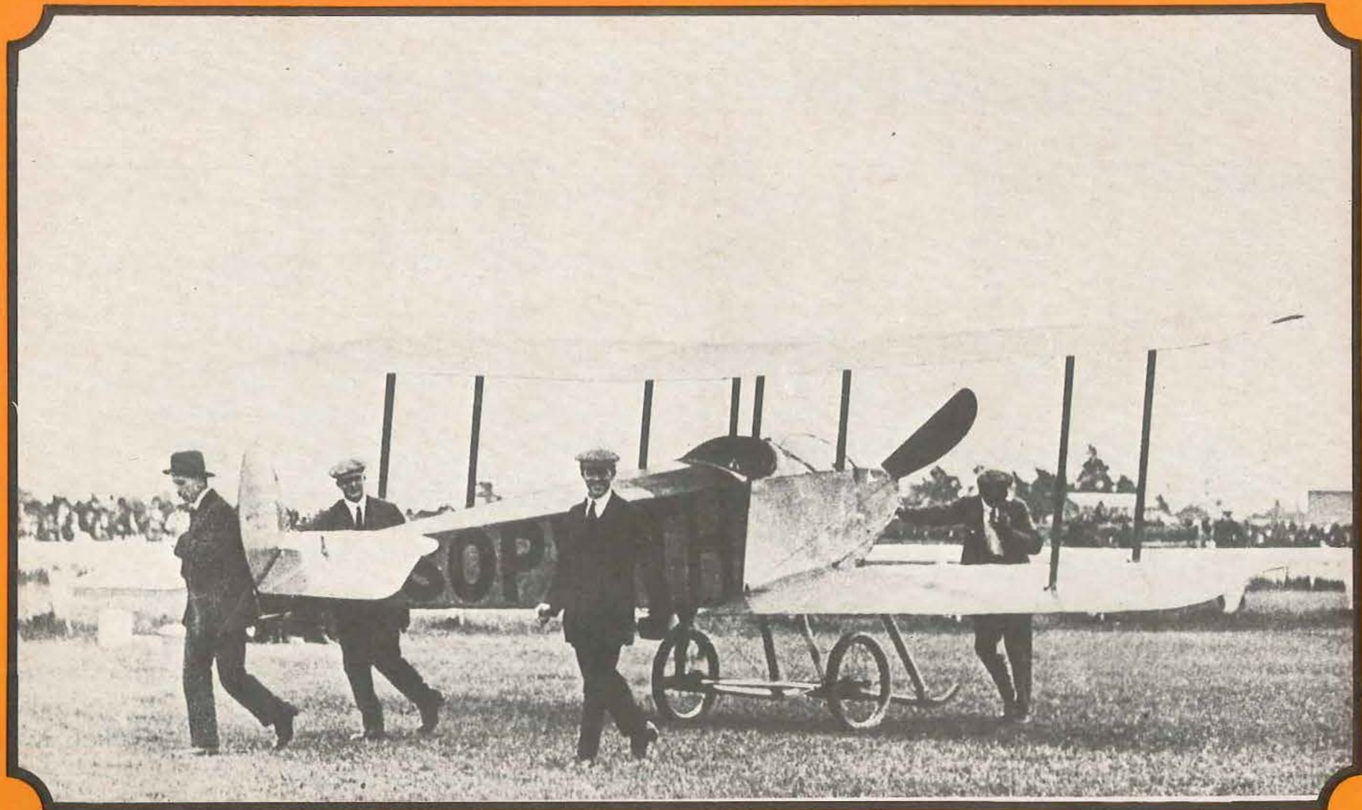

Aviation Safety Digest

BUREAU OF AIR SAFETY INVESTIGATION

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Contents

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Covers
Changing styles in tail-draggers: our covers feature a Citabria, the Saro 'Cutty Sark' and the Sopwith 'Tabloid'.

Tail-draggers and crosswind landings

Despite the proliferation of tricycle undercarriage light aircraft, tail wheel aircraft remain popular, especially for short or rough field operations. Many pilots are unfamiliar with the idiosyncracies of the tail-dragger and find a conversion on to type difficult. In particular, crosswind landings can initially prove challenging. This article reviews a typical tail-dragger landing accident and then discusses the techniques a pilot should know and use to avoid groundloops. Note that the information given is intended specifically for single-engine tail wheel aircraft, although some of the sections have general applicability.

The accident

A Cessna 180 pilot was flying an approach with a crosswind of 10–12 knots from the left. He crossed the fence at his planned speed of 60 knots, then touched down in the three-point attitude. The aircraft bounced once before settling on the ground at 40–45 knots. The pilot felt that he had landed successfully and was allowing the speed to reduce without braking when the left wing began to rise. He said that he had full left-wing down aileron and full back stick applied before this happened and so was unable to prevent the wing from rising; the introduction of engine power to assist in retrieving the situation apparently was not considered.

The aircraft began to weathercock into wind and the right wingtip scraped the runway. Friction from the right tyre became sufficient to force the propeller and spinner into the runway and the aircraft nosed over. It came to rest inverted in a direction reciprocal to that in which it had landed. The pilot completed the shutdown checks and vacated the aircraft.

Inspection of tyremarks on the runway showed that the Cessna touched down initially with the wings level and drifting to the right. After the bounce, the touchdown and roll had been on the right wheel.

The pilot had undergone 8 hours endorsement flying prior to this flight but the maximum crosswind he had encountered had been about 6 knots.

The forces

Tail wheel aircraft are generally more prone to groundloop accidents than are nose wheel types primarily because the centre of gravity is located aft of the main wheels. Figure 1 (page 4) depicts the forces which would apply if, for example, an aircraft began to swing during a takeoff or landing ground roll.

In this situation, the tendency for the aircraft to move sideways is opposed by another sideways-acting force at the main wheels which is generated by friction between the tyres and the runway surface. The fact that the centre of gravity is behind the main wheels gives rise to a yawing moment which tends to pivot the aircraft about the main wheels.

Given the distribution of forces shown in the diagram, instability exists, and so the tighter the turn the more powerful the yawing moment causing the turn becomes. Similarly, as the distance between the main wheels and the centre of gravity increases, the effect of

this adverse yawing moment will also increase, further adding to the severity of the swing in some aircraft. If the runway surface is slippery, the tyres will rapidly lose their grip and the aircraft may slide backwards; if it is dry, the spiral may continue to tighten until eventually the inside main wheel lifts and the propeller and outer wingtip strike the ground.

Flying the circuit

Before discussing the specific landing method, some comment on general circuit, approach and touchdown techniques should be made, for all of the circuit is important — not merely the landing. A badly flown circuit makes the landing that much more difficult.

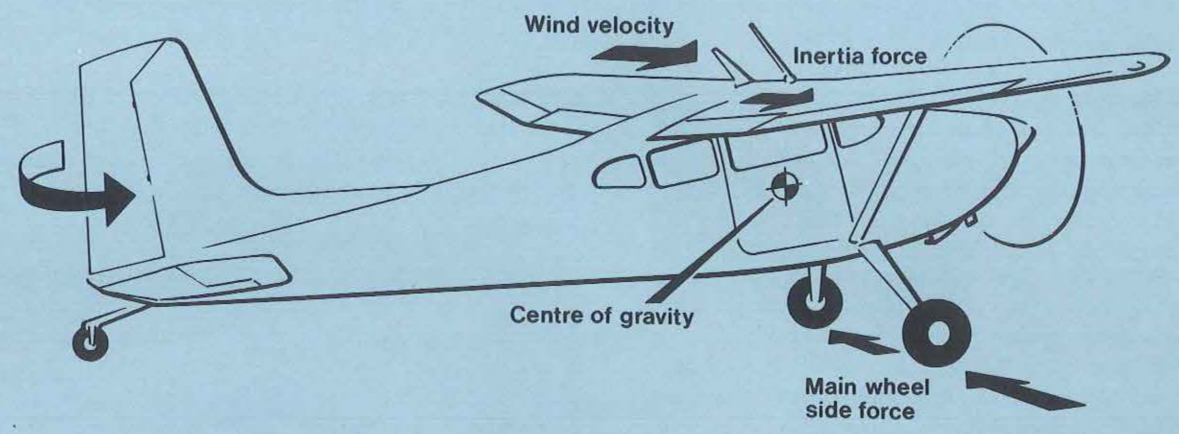
These particular comments are applicable to any aircraft, regardless of its undercarriage configuration.

Circuits. Corrections must be made for a crosswind during circuits to avoid flying an irregular circuit pattern. Heading must be adjusted on downwind to ensure that the aircraft flies parallel to the intended landing path while maintaining the correct distance out. Pilots must also appreciate that their groundspeed on the crosswind leg will be different from that on the base leg. They must be ready to turn on to the base leg either earlier or later than normal, depending on the direction of the crosswind. Any miscalculation here will make it difficult for the pilot to assess the effect of the crosswind during the final approach, which may result in a misjudged landing.

The approach. Having allowed for the wind during the base leg turn, it is then necessary to track accurately on the final approach. There are two basic methods of compensating for drift during an approach to land out of wind:

- by heading the aircraft sufficiently into wind to counteract the drift and, with the wings level, tracking or crabbing along the intended landing path; and
- by lowering the upwind wing and, holding on opposite rudder to stop the turn, side-slipping the aircraft sufficiently to descend in line with the landing direction.

Of these two techniques, the crabbed approach is the more straightforward method of compensating for drift.



The forces shown tend to cause ground loop in tail wheel aircraft.

Figure 1

Once a crab angle sufficient to cope with the conditions has been established, aircraft handling, at least up to the point of touchdown, is quite straightforward and similar in all other respects to a normal approach.

In the case of the side-slipping technique, however, there are several important considerations to be taken into account. In many aircraft types, flight manual requirements prohibit extended side-slips with low fuel quantities because of the danger of uncovering the tank outlets and causing engine failure from fuel starvation, a situation which could be extremely embarrassing at low height. In some aircraft, too, side-slipping with flaps extended beyond a particular setting is not recommended because of the possibility of shielding the tail surfaces from the airflow and producing a sudden nosedown pitch which could be difficult to correct close to the ground.

Yet another and perhaps not quite so obvious shortcoming of this type of approach is the possibility of running out of control. In a very strong crosswind, considerable into-wind aileron and a correspondingly large rudder deflection may be necessary. In these circumstances, there may be insufficient control travel remaining for the pilot to right the aircraft should an exceptionally strong gust or unexpected turbulence cause an upset near the ground.

Touchdown. During a crosswind landing, the wind force acts over the entire side area of the aircraft and tends to push it towards the downwind side of the runway. This force is proportional to the square of the crosswind velocity; thus, in a 10 knot crosswind, the side force on the aircraft would be quadruple that produced by a 5 knot component. Generally, the centre of pressure of this crosswind force acts aft of the centre of rotation (the main undercarriage) so that a yawing moment which tends to make the aircraft weathercock into wind is usually produced.

Undercarriages are not designed to withstand heavy side loads. It is imperative, therefore, that the aircraft is not permitted to contact the ground while drifting and that at the moment of touchdown it is aligned with the direction of flight or travel.

As in the case of the crosswind approach, there are two basic methods of counteracting drift at the point of touchdown. Both are simply extensions of the techniques already described. If the crabbed approach is used, the touchdown technique consists of flaring the aircraft in the normal way, with the drift correction still applied, and then, as speed diminishes and the aircraft begins to settle towards the runway, smoothly but firmly applying rudder to yaw the aircraft into line with the direction of flight just before it touches down. As the aircraft is straightened in this way, opposite aileron should be used if necessary to keep the wings level.

Despite the obvious advantages of the crabbed approach, this exercise of 'decrabbing' immediately before touchdown calls for a very high degree of skill and judgment. The pilot must resist the temptation to align the aircraft with the runway too soon or, though still pointing in the landing direction, it will quickly commence drifting towards the downwind edge of the runway. Any attempt at this stage to realign the aircraft by making a co-ordinated turn into wind will almost certainly result in it striking the ground whilst drifting downwind. Conversely, if the pilot waits too long to straighten up, the aircraft will touch down at an angle to the runway, subjecting the undercarriage to the very loads which the exercise is intended to avoid. And even if the pilot has correctly judged his height above the runway and starts to reduce the crab angle at what he estimates to be the right moment, he may still find himself in difficulties. Decaying airspeed during the hold-off might well have reduced rudder effectiveness to the point that, even with full pedal deflection, there may be insufficient control available to yaw the aircraft into line before the wheels touch the ground.

By contrast with these difficulties, landing off a side-slipping approach does not require such precise judgment or timing. The aircraft is already aligned with the runway and after what is virtually a normal flare and hold-off the aircraft touches down without drift on the upwind main wheel. The fact that the upwind wing remains lowered also provides some measure of protection against strong sideways gusts.

The combination method. The crosswind landing technique which probably gives the greatest degree of control without making unnecessarily high demands on pilot skill is the combination crab-slip method. In this type of approach and landing, the pilot compensates for drift on the approach by crabbing the aircraft into wind and holding the drift correction until after the aircraft is flared for landing. But as the speed begins to diminish and before the aircraft starts to settle towards the ground, the pilot transitions to the slip method by yawing the aircraft into line with the runway while the speed is still sufficient to maintain rudder effectiveness. Then, when the aircraft is tracking straight down the runway, the upwind wing is lowered smoothly to prevent further drift and the hold-off continued until the upwind wheel touches the ground. After touchdown, the aircraft is kept straight by using a combination of rudder and upwind aileron.

Three-pointer or wheeler?

To reiterate, the techniques discussed under the main heading of 'Flying the circuit' are generally applicable to all aircraft types. For the pilot of a tail-dragger, the particular problem is that of maintaining directional control after touchdown. Here, he must decide whether to carry out a three-point landing or a wheel landing.

Generally, in crosswind conditions a wheel landing is preferable. Note that for some tail-draggers this may not be the case and reference to the Pilot's Handbook and experienced operators should always be made. For most types, however, a wheel landing produces the following benefits:

- The change of attitude when landing is less and there is no hold-off, so judgment is easier.
- It enables the aircraft to be flown on to the ground at a higher than normal speed, which can be an advantage in adverse wind conditions.
- It is a safer way of landing a heavily laden aircraft.

The main disadvantage of a wheel landing is that it will entail a longer landing run.

Three-point. If the three-point technique is used, the pilot must be ready to quickly counter any weathercocking tendency on the ground by rapid, and coarse if necessary, use of rudder and judicious application of brakes. After the aircraft has settled on the ground, holding into-wind aileron will help prevent the upwind wing from rising in strong gusts.

An important point to make here is that if the aircraft bounces excessively on touchdown, it is almost always preferable to go around and start again rather than try to recover from the bounce.

Wheel landing. Again, once the aircraft has settled on the ground, the pilot must be prepared for rapid, and perhaps coarse, use of rudder to keep the aircraft straight; while into-wind aileron will again be necessary. Brakes should be used judiciously as the tail wheel is lowered to the runway. Note that the tail wheel should not be forced on to the ground, as premature backward movement of the control column may cause the aircraft to become airborne or may reduce the airflow over the rudder at a speed too high for the brakes to be used effectively, i.e. directional control would be seriously restricted.

General technique

As a general rule it is preferable to carry out powered approaches in crosswind conditions. The use of power helps to regulate the rate of descent over a very wide range to compensate for varying wind strengths. It also results in a smaller change in attitude during the landing flare compared with that for a full-glide approach. Slipstream, and hence rudder effectiveness, is enhanced by the use of power; however, the throttle should be closed smoothly to prevent any sudden yawing as power is reduced. As speed decreases, so too will aileron and rudder effectiveness.

Often there is discussion on the merits of attempting to offset the crosswind effect by aiming to land near the downwind side of the runway in anticipation of weathercocking; or conversely, aiming for the upwind side in anticipation of drift.

Careful thought should lead to the conclusion that both of these practices are questionable. All things considered, it is far better to adhere to established techniques and to aim to touch down about the normal distance in from the threshold as near as possible to the centreline.

For instructors and supervisors

The accident reviewed at the start of this article was one of several instances in a short period of tail wheel aircraft groundlooping. Accordingly, data on these occurrences over a 6 year period were researched from the Bureau of Air Safety Investigation's computer records.

In particular, pilot hours on type were related to their total experience.

It was found that over one-third of the accidents involved pilots with less than 12 hours on type while half of the accidents involved pilots with less than 600 hours total experience. The experience area of up to 12 hours on type and 600 hours total therefore contains a disproportionate share of accidents.

This does *not* mean that pilots who fall outside those parameters are immune from groundlooping occurrences. What it does mean for instructors and supervisors alike is that pilots who do not meet those experience criteria and who wish to fly tail wheel aircraft should be given:

- close supervision; and
- a large proportion of dual instruction during their first 12 hours on type.

Practice

Precise judgment is required to estimate height and drift angle in crosswind conditions and a high degree of co-ordination is necessary to correctly align the aircraft with the touchdown direction. These skills can be maintained only by regular practice.

Maximum crosswind components are normally specified in the aircraft flight manual. These values are generally based on tests carried out by the manufacturer and represent the maximum crosswind values at which the aircraft has been demonstrated, in dry conditions, to possess satisfactory handling qualities. Such demonstrations are usually conducted by test pilots and the results may well be regarded as being a limitation for the type. Pilots should therefore exercise discretion in strong crosswind conditions to ensure that operations are confined to crosswinds within their own capabilities and to accept that this may be significantly less than the crosswind component referred to in the flight manual ●

Slung load and poor visibility

The accident described below occurred overseas and involved a Bell 206 helicopter carrying a slung load. Although the occurrence specifically relates to a fire fighting operation, the safety lesson it contains is relevant to any pilot manipulating a slung load in conditions of restricted visibility. Also of great significance are the comments on the value of the protective clothing worn by the pilot.

* * *

The helicopter was engaged in dropping foam during a forest fire fighting operation. The fire was well established with a circular 600 metre fire front advancing up a valley, the end of which was increasingly steep. Because of the profusion of smoke and the nature of the terrain, the fire fighters were dealing with the upwind side of the fire, leaving the downwind and rising-terrain section burning fiercely with heavy smoke up to 200 feet AGL. This was the first occasion on which the helicopter's foam fire fighting system (which was slung beneath the aircraft) had been used operationally, and the first time that the pilot had witnessed the full effect of smoke. As the smoke was drifting forward of the flames, the pilot decided to drop the foam immediately on the fire front, over which the air was clean. Two drops were made uneventfully, at low altitude and at a speed of up to 85 knots, as per the approved procedure. However, while climbing away after the third drop, the Bell 206 passed through the smoke from the flanks of the fire. This smoke was obscuring higher ground. The bucket, still attached to the helicopter, struck the mountain slope at speed, causing the aircraft to fly into the trees. Although substantially damaged, the helicopter 'glanced' back into the air with what appeared to be a jammed yaw control and an unresponsive cyclic stick. The pilot immediately attempted a landing onto a relatively even area. However, on touchdown the aircraft rolled heavily onto its starboard side, and further damage occurred before the pilot shut down the engine. Both front doors had jammed but, aided by the fact that he was wearing gloves, the pilot was able to punch a door window out without hurting himself, and vacate the aircraft. Gloves were not the only important protective clothing the pilot was wearing: to quote the accident report, 'His life was saved, without doubt, due to the wearing of a "Bone Dome" flying helmet which took one blow to the right side of the head from the door pillar on impact'.

* * *

In the event the pilot escaped injury-free. His experience should be a salutary one for all those involved in high-risk operations ●

Less haste more speed

We are rarely in as much of a hurry as we think. Ask yourself the question: 'How often have the few minutes I saved by cutting a corner here, or short-circuiting a system there, been really important?' The odds are that in the overwhelming majority of cases an honest answer will be that those minutes were not at all important. Yet aircraft accidents continue to occur because of needless haste.

* * *

An agricultural pilot had been operating all day from a strip which was aligned north-west/south-east. Because there was a power line across the SE end, the pilot had been using the strip one way only, taking off to the NW and landing into the SE.

At the conclusion of spraying the aircraft was refuelled for the ferry flight back to its home base. The aircraft was now relatively light and, as home base was away to the SE, the pilot decided to takeoff for the first time that day in that direction: apparently he determined his aircraft would have sufficient performance to clear the wire.

Almost immediately after becoming airborne the pilot diverted his attention to wave to one of the ground party and forgot about the power line. The aircraft struck the wire with its left wing, just inboard of the wing strut. Realising he still had some control remaining, the pilot attempted to put the aircraft back on the ground. He did so successfully but the aeroplane was substantially damaged.

Comment

Clearly the fact that the pilot allowed himself to be distracted and forgot about the power line contributed to this accident. No doubt fatigue — he had been on duty for 11½ hours — and complacency at the end of a long day's work were also factors in his forgetting about the power line. The problem really started, though, when he decided to save one or two minutes by taking off on the heading of his track instead of continuing to use the safer takeoff direction away from the wire.

Human nature often seems disposed towards unnecessary haste. Unfortunately, far too often it just creates problems as important checks are overlooked, safety procedures ignored, standards compromised . . .

For aviators in particular, needless haste can be a catalyst for disaster. As was said at the start of this article, we are rarely in as much of a hurry as we think — certainly not at the possible expense of our lives ●

Say again

Warning systems are placed in aircraft for a very good reason — to alert us to the danger that something is happening, or may be about to happen, that we don't want to happen! In most instances the warning acts as a trigger to remedial action. For example, if a stall warning horn sounds we lower the aircraft's nose, level and unload the wings, apply power, etc.; if an over-voltage warning light illuminates we follow checklist actions in an attempt to restore generator/alternator power; if an OFF flag appears on an instrument we again follow the recommended procedures to find out why; and so on.

It follows, then, that when a warning system is activated, the pilot needs to know about it.

A serious accident in which a Cessna 152 stalled on final approach brought to notice an operational problem involving warning horns and pilots wearing headsets.

The accident

A student pilot was authorised for a solo period of circuits. During the fourth approach, he assessed that he was too high and attempted to regain the correct flight path.

At 65 knots indicated airspeed, and with full flap (30 degrees) selected, he raised the nose to slow the aircraft and attempted to set up a higher rate of descent using the extra induced drag. He held this nose-high attitude without monitoring the airspeed indicator. The aircraft began to buffet and, at an altitude between 200 to 400 feet AGL, the left wing dropped and the Cessna entered an incipient spin. Recovery was effected at about 10 feet AGL on a heading 180 degrees off the runway direction.

However, the aircraft 'reared up' to a nose-high attitude again with full power applied. It was levelled at the approximate height of the first stall when another stall occurred. Again, the left wing dropped, but this time the aircraft rotated through some 360 degrees and then struck the ground in a nose-low attitude. The right wing and undercarriage absorbed the main impact. When the wreckage came to rest, the pilot — who sustained only minor injuries — undid his full harness and exited rapidly. The aircraft was destroyed.

Discussion

Clearly, certain aspects of the pilot's flying technique were deficient at this early stage of his training and this matter was addressed during the investigation. What is of interest here, however, is the fact that at no stage during the occurrence did the pilot hear the stall warning horn blowing. If he had, then doubtless corrective action would have been initiated before the stall was allowed to develop.

It transpired that the pilot was wearing a headset over both ears. This headset was particularly effective in reducing unwanted cabin noises. Unfortunately, it also suppressed the sound of the stall warning horn.

The use of headsets in GA aircraft is recommended by the Department of Aviation. Not only does a headset usually make radio/navaid reception clearer and easier but, if fitted with a boom microphone, also removes the necessity to divert one hand to operating a hand microphone.

However, if a headset suppresses external sounds that need to be heard, then something needs to be done about it.

Some headsets currently available are claimed to mute unwanted noises while still allowing normal conversation with both ears covered. Other sets, however, seem to block all external noises with both ears covered. Thus, over the years, many pilots have, as a matter of routine, flown with one ear uncovered so that warnings will be heard.

It is interesting to note that the assessment of level for aural warning from discrete sources has always been a contentious subject. Attempts have been made to adjust levels using instrumentation but this has been generally unsuccessful, and even aircraft as recent as the Boeing 767 have the levels set subjectively. Accordingly, the need to react to sounds emanating from discrete sources has been addressed by wearing headphones over one ear. For example, the Specification for Ground Proximity Warning devices is stated as follows: 'The audio warning level should be assessed under conditions of . . . approach speed with one ear uncovered by the headset used in that aircraft type'.

Summary

The crucial point arising here is that if an aural warning system — stall, undercarriage, GPWS etc. — is activated, then you need to be able to hear it so that remedial action can be initiated. If you use a headset, then take a couple of minutes to check whether you can hear external warnings clearly with both ears covered. If not, then obviously you need to fly with one ear uncovered at least during those phases of flight — e.g. approaches, circuits — where the workload is high, your IAS low, you must have your wheels down, and so on.

It's a small check to make in terms of time and effort, but it could be invaluable ●

Set-up or self-inflicted?

It is the prerogative of any licensed pilot to decide that an area he wishes to use for takeoffs and landings can be classified as an Authorised Landing Area (ALA). In exercising this prerogative it is the pilot's responsibility to ensure that his planned operations and the ALA standards comply with those specified in the Visual Flight Guide (VFG). While these requirements are fairly straightforward and exist solely to try to ensure safe operations, they are unfortunately far too often overlooked or ignored, which in turn can lead to an aircraft accident when an ALA proves to be inadequate for an intended operation.

Before flying in to an ALA a pilot needs to know its physical dimensions, the condition of the landing surface and the location of any obstructions. An ALA also should have a suitable indicator of the wind velocity. Given that ALAs are sometimes used for purposes other than aircraft operations — for example, livestock grazing — it is clear that the best way for a pilot to confirm the conditions at an ALA is to contact the owner.

In the accident account that follows, some readers may feel that the pilot concerned took all reasonable steps to determine the suitability of the ALA he wished to use . . .

A tradesman was planning to fly to a property homestead to carry out some maintenance. Before departure he decided to refer to a strip register which had been compiled locally by a flying organisation. None of that organisation's pilots was available to talk to at the time, so the tradesman checked the register by himself. It advised that strip 17/35 was preferred at the particular ALA; no other comments were made.

The flight out to the homestead was made in a PA28R-200. On arrival in the circuit area the pilot saw two clearly defined strips — the second was 12/30 — marked by white painted tyres. A dirt road was visible running parallel to 12 and crossing 17. It appeared level and the pilot assessed that it would not affect the ALA. As the wind was a southerly at 5-10 knots he elected to land on 17.

The pilot landed long because of a tree near the approach end. A smooth touchdown was made on the main wheels. Shortly afterwards a ridge of dirt across the strip ahead of the aircraft was noticed, and as the Arrow ran over the ridge a loud impact noise was heard. Notwithstanding the noise, the pilot did not consider the impact severe. At the completion of the landing roll he taxied back and observed that the ridge was associated with grading on the road across the strip.

It was subsequently found on return to base that the aircraft had been substantially damaged. Bulkheads had crumpled and the right wheel had been pushed back, while the right wing had buckled ribs and wrinkled skin. There were also popped rivets in various places.

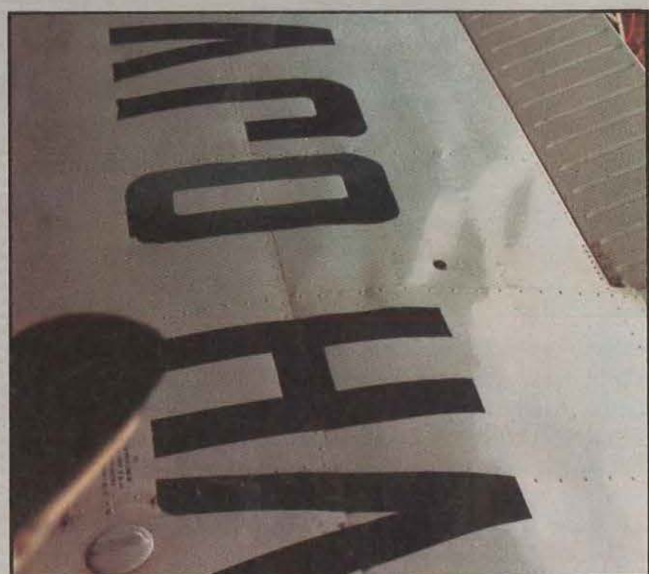
Unfortunately, the strip register the pilot had consulted prior to the flight was out-of-date. The organisation which compiled it had another, current, register of which its regular pilots were aware, and which stated that 17/35 at the ALA in question was 'NOT USED'. It was also unfortunate that the white tyres delineating 17/35 were visible from the air. Apparently they had not been so for some time previously, having been overgrown. However, because of a recent drought, the undergrowth had died and so from the air it seemed as though the strip was usable.

It could, then, perhaps be argued that this pilot was to some extent 'set-up' by the out-of-date register and the strip markings. On the other hand, the pilot had not observed the recommended practice for ALA operations of contacting the owner to determine the current status of the ALA. Further, he did not take the opportunity to speak to one of the professional pilots who operated into the ALA. Had he taken either of these actions, the accident presumably would not have happened.

Following the accident investigation, the out-of-date register was amended, and it was suggested to the property owner that he remove the tyres marking out 17/35.

* * *

There was an interesting postscript to this accident. Following the impact on landing, the pilot stated that he made an inspection of the aircraft, particularly the undercarriage. No signs of damage were noticed. After he completed his work at the homestead he carried out a 'normal walkaround', was again satisfied that everything was all right and then flew back to his original departure point. While the gear seemed to retract normally the 'in-transit' light remained on. It was only after landing at home base that the serious damage was apparently noticed.



As the photograph shows, the wrinkled skin on the right wing is quite obvious. The wrinkling is indicative that something has happened to the structure beneath the skin, and that the structural integrity of the aircraft may be at risk.

It should never be necessary to have to stress the importance of preflight inspections ●

Reader contribution

Freud, Jung and all that

'The pilot continued into weather conditions . . .' How many times have we read it in the *Digest*? As the editor once said, the story has been repeated ad nauseum. We usually read, too, that the unfortunate pilot probably was the victim of the 'it-can't-happen-to-me' syndrome. The same pilot who bought it for himself and his passengers by flying into high ground after a nice old spell in stratus trying to fly IFR may well have been experienced, conscientious, and without a desire to commit suicide. He was, of course, under the influence of an urge 'to get through'; or perhaps had a bad case of 'get-home-itis'.

Yet, have we solved the mystery? Are these the sole causes of the fatal weather-related accidents? Can we fully guarantee our own safety: (1) by realising it actually can happen to us; (2) by not trying to 'get through'; and (3) by ignoring our 'get-home-itis' symptoms? We can't. We can, but we can't.

Somebody said something about it in the *Digest* a few years ago. It was a reprint from America, and to me it hit the spot. It was all to do with programming the subconscious mind. The well-known French hypnotherapist Emille Coue wrote about it back in the 1920s in his 45 page book *Better and Better Every Day*. He described the differences between the conscious mind and subconscious mind, and laid down these rules: firstly, the conscious mind passes all information to the subconscious, which naively believes it; secondly, the more the information is stressed or repeated the more the subconscious believes it, and is likely to act on it; thirdly, the subconscious is the boss. Any attempt by the conscious to go against what the subconscious believes will cause the subconscious to rise up and overwhelm the conscious, even if it means causing its own death.

Coue cited an example. If you place two house bricks on the ground, put a long plank on them, and invite yourself to walk the plank without falling off, you should pass the test. Fit the same plank at twenty storeys across two high-rise buildings in zero wind conditions, and try walking across again. Whether or not you get halfway there and fall to your death will depend on how your subconscious is programmed. If, as a result of your experience with the plank on the ground, you have told yourself you can walk across at any altitude, and you have no fear of falling off, you will walk to the other side. If you have a fear of falling off but think you can make it anyway, you will probably walk part-way, get wobbly, drop to your knees, and finish the job by crawling across.

If, however, you have a strong fear of falling off, have told yourself 'I'll fall off that plank if I try to cross it', but nevertheless force yourself to do it, your subconscious will cause one of your knees to buckle, your hand to go numb as you try to grab the plank, and your body to fall to its death.

The more you try to go against what your subconscious believes, the stronger the subconscious makes that belief happen, even to the extent of causing its own death. Such is the power of the subconscious, says Coue.

When most of us plan a flight from A to B, we program our subconscious to get to point B. We usually have no doubt about getting to B. All our thoughts and expectations are of a positive nature; we think only about getting there, and work out how to do it. We rarely plan to get part-way there and turn back.

This, therefore, is the reason why so many of us push our way through marginal or sometimes even quite lethal conditions, and on miraculously arriving at our destination tell ourselves we were stupid to have done it and there was no real need for us to have tried. We were lucky this time. Yet, zingo, what happens but next time we do exactly the same thing again! In my 1200 hours of private flying I've done it at least four times, though these days it's never again.

When we reach marginal conditions, to the point where we should be turning back, our subconscious tells us to keep going. We are programmed to get to B, and that is where we must try to get. We can't help ourselves.

A friend of mine described a similar experience when driving his car into the city centre. Before he started the motor he got out his street directory and worked out what inner city streets, including one-way streets, he had to negotiate; and how to turn eventually to the right down a laneway. When he got to the laneway after following his 'flight plan', he found a policeman at the laneway intersection directing all traffic to go straight ahead. My friend couldn't help himself; he had a powerful urge to turn down the laneway, and he turned. When the policeman came over to him, he said: 'Just book me, officer; I know you didn't want me to turn in here, but I couldn't help myself. I had to turn because this is where I planned to go.' The policeman must have read his share of Freud or Carl Jung because he let him off.

All right, what do we do to stop our own subconscious minds from wiping us out one day in bad weather conditions? The answer is: we program ourselves to turn back. Before we submit our flight plan, we look it over for likely turn-back points and tell ourselves: 'If I run into marginal conditions about there, I'll turn back.' Before we start the engine, we tell ourselves: 'If I run into marginal conditions anywhere on this flight, I'll turn back.' That's all we have to do.

Any pre-flight planning that programs the pilot's subconscious mind to make a timely diversion when things get rough may well save his life, the lives of his passengers, and a good aircraft to boot ●

Report heavy landings

After an uneventful transit flight to a holiday resort, a pilot entered downwind for landing in his Cessna 182. Conditions were clear with a 15–20 knot wind gusting slightly across the strip. Just as the Cessna was turning on to final approach the pilot's wife, who was in the front right-hand seat, drew his attention to one of their children in the rear who was about to vomit. The pilot attempted to locate a sick bag to pass to the child. This was eventually accomplished when the aircraft was on short final.

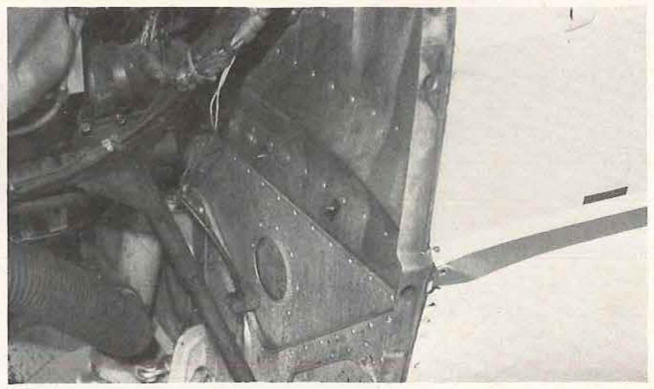
At this stage the pilot noticed that the airspeed was about 75 knots. As he was intending to fly a short-field approach and landing, this was about 10 knots faster than the ideal. Full flap had already been extended, so he closed the throttle to idle power to reduce the speed. Shortly after power was reduced the aircraft sank rapidly and contacted the ground nosewheel first. The aircraft bounced two or three times and was brought to a stop about two-thirds of the way down the 815-metre-long sealed runway and then taxied to the parking area.

The pilot helped his family out of the aircraft and to their overnight accommodation. By the time he was able to return to the Cessna to tie it down it was after dark. Thus, the external condition of the aircraft was not readily apparent to him. In any case, he later stated that he had not considered the landing exceptionally heavy and had no reason to suspect that there would have been any damage.

The aircraft remained tied down for a couple of days until the family arrived for the return flight. During his daily inspection, the pilot noticed that the fuselage was buckled on the lower left-hand side behind the engine cowling. He assessed this as being only minor damage and flew the aircraft back home.

It was subsequently discovered that during the landing at the resort the Cessna had sustained serious damage:

- The firewall was compressed and buckled.
- The nose wheel outer left-hand rim had a flat spot.
- Both propeller blades were bent back and abraded.
- There was buckling on the left-hand side of the forward fuselage.
- The nose wheel strut seals had ruptured, allowing the strut to gradually deflate.



Compression deformation of firewall.

Propeller blade damage not noticed by pilot.

All of those occurrences are consistent with a heavy landing.

Following the discovery of the damage, the strip at the resort was examined and three propeller slashmarks were found 147 metres from the threshold.

Comment

Clearly, the daily inspection prior to the return flight was inadequate, for the only abnormality the pilot noticed was the buckled fuselage. Equally clear is the fact that in the light of the total damage the landing must have been heavy; indeed, to the extent that the pilot should have been seriously concerned.

There have been several instances in the past where Australian GA aircraft have had their flight control systems adversely affected by heavy landings. In this instance, the buckling of the firewall could well have deprived the pilot of elevator control by displacing elevator control pulleys. The propeller damage also may have led to a catastrophic failure.

In short, the pilot's assessment that the damage was minor, and his decision to fly the aircraft home, could have had tragic consequences.

It is vital that pilots report any heavy landing so that the aircraft concerned can be inspected for possible hidden damage before it is flown again. The consequences of a heavy landing can be far reaching.

Assessment

Assessing whether or not a landing has been heavy can be difficult; as there are no exact criteria by which the factors involved can be measured, the decision will be partly subjective. However, consideration of the following factors should serve as a guide:

- Was the rate of descent before touchdown substantially greater than normal?
- Was the aircraft allowed to 'drop' on to the runway from a greater height than is normal?
- Was the touchdown made on one undercarriage leg with a high sink rate or with drift on?
- Were there significant g-forces developed on touchdown?

Conclusion

No pilot likes being associated with a heavy landing. However, the possible embarrassment notwithstanding, it is essential to report any such occurrence, in fairness both to yourself and any other pilot who may subsequently fly the aircraft.

Because the damage can sometimes be difficult to detect, making a formal report will ensure that the aircraft is inspected by a LAME before it flies again.

If you are not sure whether or not a landing was heavy, report it. To do so is good airmanship and in everyone's best interests ●

Air pollution

A Bell Jet Ranger was tracking towards a power station at 600 feet AGL and 60 knots while carrying out aerial photography. It was 100 feet above the top of the station's twin chimneys.

As the aircraft approached the most northerly of the chimneys and reached the edge of their visible emissions, the pilot noticed a smell of acrid gas. At the same instant the helicopter's engine lost power. Because of the height, an air restart was not attempted. A successful auto-rotation was completed.

Analysis

Research revealed that the emissions from the power station contained plenty of carbon dioxide, nitrogen and water vapour, varying amounts of sulphur and nitrous oxides — and precious little oxygen. There was nothing mechanically wrong with the engine: it had simply been starved of the all-important O_2.

Comment

Most readers will recall the engine power loss suffered by a B747 some time ago when it flew through a volcanic cloud over Indonesia. As the Jet Ranger's experience showed, it is not only volcano clouds that can cause engine respiratory problems.

Pilots are well advised to give emissions from power stations and the like a wide berth. The comment of a specialist who reviewed this incident summed up the problem succinctly: 'Oxygen-breathing engines will not operate without oxygen' ●

Don't knock the 225

The fundamental objective of air safety investigation is the prevention of accidents and incidents. Investigations aim to determine all the factors involved and to use this information as the basis for enhancing safety in aviation.

One important medium through which air safety investigators receive safety-related information is the Department of Aviation's Air Safety Incident Report (Form 225). These forms offer all individuals associated with the aviation industry the opportunity to bring to attention information which, when analysed and acted upon, could conceivably save lives and aircraft.

Yet it is an unfortunate fact that, within some sections of the industry, the '225' is looked upon as a means by which one 'dobs', or is 'dobbed', in to officialdom.

This is not the case: the sole purpose of the 225 is to serve as a constructive aid to flight safety. An example of the positive use to which the form can be put was illustrated by a Boeing 727 pilot, following an incident during a takeoff from Coolangatta.

When the 727 was about one-third of the way down the runway on the takeoff roll, a 'severe thump' was felt through the aircraft. Concerned by the force of the impact the pilot made inquiries and found that it had been caused when the aircraft's undercarriage had run over a temporary ramp at the end of a new overlay on the runway. This ramp was associated with works in progress on the runway.

The 727 captain found out that the ramping was within the standards laid down for such works. He also discovered that another RPT pilot had experienced the 'thump' but considered it 'not too bad'. Nevertheless, the 727 captain remained unsatisfied and so submitted a Form 225 to the Department of Aviation, strongly urging a review of the existing ramping standards.

An investigation of temporary ramping standards had been going on in the Department for some time. Information from the 225 report was just the sort of feedback the Department needed. An analyis of the B727's Flight Data Recorder showed that the aircraft had sustained vertical accelerations of −0.5 g to +1.4 g within 0.6 of a second when traversing the ramp.

DEPARTMENT OF TRANSPORT

AIR SAFETY INCIDENT REPORT

Folio No.
Station
No.
Reg. Off. No.
Central Off. No.

Normally this report should be mailed to the Director of the Region in which the incident occurred. If more convenient it may be lodged with the OIC of any Air Traffic Control or Flight Service Unit.

LOCATION OR ROUTE SECTION ... Date ... Local Time

AIRCRAFT: Type and Marking ... PILOT: Name and Initials

OWNER/OPERATOR ... FLIGHT CATEGORY: (underline) VFR IFR

TYPE OF OPERATION (underline applicable type):
Regular Public Transport / Charter / Agriculture / Aerial Work
Private / Aircraft Test Flight / Training Dual / Training Solo

FLIGHT: Last departure point ... First point of intended landing ... Flt. No.

When this report is submitted by a Departmental officer, enter Fault Report No. (if applicable)

DESCRIBE INCIDENT AND RELEVANT CIRCUMSTANCES, with comment and suggestions:

NOTE—If you desire an acknowledgement of this report, please place your name and address hereunder. If these details are not given, no acknowledgement of receipt will necessarily be made.

Name
Address

DOT 225 P

Region
Dear Sir/Madam,
Thank you for your Air Safety Incident Report concerning
on / /
For future reference it has been allocated No.
Yours faithfully
Date / /
For Director

This information contributed to the decision to revise the standard and an Airports Instruction was issued, improving the requirements for temporary ramping during resurfacing works.

As the closing minute on the Bureau of Air Safety Investigation's file on this incident stated, '. . . the results arising from the investigation of the pilot's report graphically illustrate the worth of the incident reporting system' ●

Pilot knowledge should be shared

A recent accident which resulted in an agricultural aircraft having its right-hand landing gear ripped off in a hole has highlighted the need for pilots and their companies to share knowledge of strip conditions.

It appears that some weeks after the accident, the pilot asked the agent who had organised the job on which he had been engaged whether the owners had repaired the strip. To his amazement, he was advised that a pilot from his company had previously condemned the strip and refused to use it because of its substandard condition. The agent had then organised another pilot from the same company to undertake that task.

In the event, three pilots' lives were put at risk, one narrowly avoiding injury, despite the fact that the owner, the agent and the company apparently knew of the hazard ●

Aircraft accident reports

SECOND QUARTER 1984

The following information has been extracted from accident data files maintained by the Bureau of Air Safety Investigation. The intent of publishing these reports is to make available information on Australian aircraft accidents from which the reader can gain an awareness of the circumstances and conditions which led to the occurrence.

At the time of publication many of the accidents are still under investigation and the information contained in those reports must be considered as preliminary in nature and possibly subject to amendment when the investigation is finalised.

Readers should note that the information is provided to promote aviation safety — in no case is it intended to imply blame or liability.

Note 1: All dates and times are local

Note 2: Injury classification abbreviations

C = Crew	P = Passengers	O = Others	N = Nil
F = Fatal	S = Serious	M = Minor	

e.g. C1S, P2M means 1 crew member received serious injury and 2 passengers received minor injuries.

PRELIMINARY REPORTS (The following accidents are still under investigation)

Date / Time	Aircraft type & registration / Location	Kind of flying / Departure point/Destination	Injuries / Record number
05 Apr 0643	Cessna A185-F VH-SFS Cairns, Qld. 26NNW	Non-commercial—business Cairns, Qld./Stanley Island, Qld.	C1N, P1F, P2N 8411019

About 12 minutes after takeoff, the pilot reported that the engine was malfunctioning. It subsequently lost power completely and the pilot was committed to a forced landing. The sea conditions were unsuitable for the aircraft type, with strong wind and a 1.5 metre swell. The aircraft sank almost immediately after touchdown and no trace has since been found of the aircraft or one of the occupants.

Date / Time	Aircraft type & registration / Location	Kind of flying / Departure point/Destination	Injuries / Record number
05 Apr 0640	Piper 25-235 VH-EHR Pittsworth, Qld. 8SSW	Aerial agriculture Pittsworth, Qld./Pittsworth, Qld.	C1N 8411018

In company with a member of the property owner's family, the pilot had conducted a ground survey of the area to be treated. He was not made aware of the presence of a reinforcing mesh grain silo, about 2 metres high and camouflaged by the colour and height of the surrounding grasses. On a subsequent spraying run the aircraft collided with the silo, the right gear was dislodged during the ensuing ground impact and the aircraft slid to a halt 102 metres from the silo.

Date / Time	Aircraft type & registration / Location	Kind of flying / Departure point/Destination	Injuries / Record number
06 Apr 1810	Thorp T18 VH-RWT Berwick, Vic.	Non-commercial—pleasure Mangalore, Vic./Berwick, Vic.	C1M, C1N 8431012

The aircraft owner was flying the aircraft under the supervision of the pilot-in-command. A landing was made on the grass to the south of the gravel strip. After a small bounce on initial touchdown, the aircraft landed firmly and the right wheel penetrated the ground to a depth of about 5 cm. The aircraft tipped forward, the propeller struck the ground and the aircraft overturned.

Date / Time	Aircraft type & registration / Location	Kind of flying / Departure point/Destination	Injuries / Record number
07 Apr 1610	Cessna 180J VH-SHX Mt Barnett, WA	Non-commercial—pleasure Derby, WA/Mt Elizabeth, WA	C1N, P1N 8451009

After a flight time of 70 minutes, with a planned fuel endurance of 140 minutes, the engine failed and the pilot was committed to a forced landing on rock covered terrain. Evidence of a faulty fuel cap and fuel leakage past the cap was found.

Date / Time	Aircraft type & registration / Location	Kind of flying / Departure point/Destination	Injuries / Record number
11 Apr 1555	Romainian IS-28B2 VH-GVZ Benalla, Vic.	Instructional—dual Benalla, Vic./Benalla, Vic.	C2N 8431013

Thermal activity was reducing rapidly following the development of a high cloud layer. When the glider had descended to 1150 feet agl, the student was asked to return for landing. The instructor later took control and planned a short circuit in the poor conditions. When the strip could not be reached, a landing was made in a paddock outside the aerodrome and the glider's left wing struck a fence.

Date / Time	Aircraft type & registration / Location	Kind of flying / Departure point/Destination	Injuries / Record number
21 Apr 1340	Cessna 210 VH-RHK Port Macquarie, NSW	Non-commercial—pleasure Bankstown, NSW/Port Macquarie, NSW	C1N, P3N 8421019

When the landing gear was selected down it failed to extend. The pilot attempted unsuccessfully to extend the gear using the emergency system and by the application of g-forces. Touchdown was made with the main gear up and the nose gear partially extended. The filter in the landing gear hydraulic system was found to have a cracked housing and all the oil in the system had been lost.

Date / Time	Aircraft type & registration / Location	Kind of flying / Departure point/Destination	Injuries / Record number
22 Apr 1050	Bell 206B VH-UTS Nunawading, Vic.	Non-commercial—corporate/executive Channel 10 Helipad/Heyfield, Vic.	C1N, P3N 8431014

During the takeoff, the engine instruments were checked while the helicopter was in a hover and no abnormalities were noted. Just as forward movement was commenced a loud noise was heard and all engine power was lost. A significant drop in rotor rpm occurred before landing. Inspection revealed a total mechanical failure of the engine compressor.

PRELIMINARY REPORTS (The following accidents are still under investigation)

Date / Time	Aircraft type & registration / Location	Kind of flying / Departure point/Destination	Injuries / Record number
27 Apr 1630	Piper PA32-300 VH-JGH Bingara, NSW 9SW	Non-commercial—pleasure Wee Waa, NSW/Bingara, NSW 9SW	C1N, P2N 8421020

The strip had been recently graded by heavy earth moving equipment which the passengers were to inspect. Before landing, the pilot carried out a strip inspection from 50 feet. After touchdown, the pilot was allowing the aircraft to decelerate without the use of brakes when a soft, graded area containing numerous hidden boulders was encountered. The right main gear leg became detached from the wing and the aircraft came to a halt resting on the right wingtip.

05 May 1230	Piper 28-180 VH-DWV Coonabarabran, NSW	Non-commercial—pleasure Lismore, NSW/Coonabarabran, NSW	C1N, P4N 8421028

The weather conditions were deteriorating as the pilot approached to land. On final approach the aircraft was too high and a go-around was conducted. During the subsequent circuit, the plot inadvertently entered cloud and shortly afterwards control of the aircraft was lost. The pilot ultimately recovered control; however, both wings were later found to be bent upwards as a result of applied aerodynamic loads.

09 May 1645	Bell 47-G3B1 VH-CSE Mable Downs, WA 12N	Activities associated with aerial agriculture Packsaddle Plains, WA/Mable Downs, WA	C1N 8451011

The fuel gauge was unserviceable and a dip stick was not available. The pilot estimated that there was two hours fuel remaining by inspection of the contents of the left hand tank only. Seventy minutes after takeoff the engine stopped and an autorotational landing attempted. The terrain was very rough and during the landing the tail rotor struck the ground and the main rotor blades cut off the tail boom.

10 May 1400	Cessna T188C VH-HAM Walgett, NSW 25S	Aerial agriculture Walgett, NSW 25S/Walgett, NSW 25S	C1M 8421021

The pilot was landing at the conclusion of the second spraying operation for the day. She aimed to touch down about half-way along the 700 metre strip to allow a following aircraft to land behind her. During the latter stages of the landing roll the tail rose and the aircraft overturned.

11 May 1200	Hiller UH12-E VH-FFX Pretty Plains HS, Qld.	Commerical—aerial mustering P. Plains HS, Qld./P. Plains HS, Qld. 9NW	C1N, P1N 8411021

While returning to refuel at a mustering yard, the pilot attempted to move a bull from some trees. When this proved unsuccessful, the pilot climbed to continue the flight to the yard. The engine began to run roughly and an approach to a clearing was made. Rotor rpm decayed as some trees were cleared and the pilot was unable to prevent a heavy landing. The helicopter bounced about two metres, the right skid collapsed and the main rotor struck the ground.

12 May 1247	Cessna 402 VH-CJA Archerfield, Qld.	Aerial mapping/photography/survey Brisbane, Qld./Archerfield, Qld.	C2N 8411022

After landing, a 180 degree turn to the right to backtrack along the runway was planned. As the aircraft was being slowed to taxi speed, a gentle left turn to position the aircraft near the left side of the runway was commenced, but the right main gear collapsed. A gear down indication remained on after the aircraft came to a halt.

12 May 1236	Cessna 210N VH-TFC East Mereenie, NT	Charter—passenger operations Alice Springs, NT/East Mereenie, NT	C1N, P4N 8441016

The pilot reported that brake pedal pressure was available on both brakes before landing. During the landing roll, no pressure could be produced in either brake but, after the aircraft had overrun the strip, pressure could be developed in the right hand pedal. The nosewheel area was damaged when the aircraft struck a ditch.

13 May 1509	Beech 36 VH-TYZ Beaudesert, Qld. 8SW	Charter—passenger operations Kooralbyn, Qld/Brisbane, Qld.	C1N, P5N 8411023

Soon after settling in the cruise at 2000 feet, the pilot noticed that the fuel flow was lower than expected. He selected rich mixture but the fuel flow began to fluctuate markedly and the MAP reduced. A short time later the engine began to run roughly, accompanied by a rise in oil pressure and a further reduction in MAP. The pilot elected to return to the departure point. Engine power became inadequate for level flight and the pilot selected an emergency landing area. The aircraft came to rest after running through two barbed wire fences.

15 May 2345	Cessna 340A VH-BYB Goulburn, NSW	Non-commercial—pleasure Sydney, NSW/Goulburn, NSW	C1F, P2F, O1F, O1M 8421022

On arrival in the circuit area, the pilot reported his intention was to conduct an NDB approach. The aircraft was subsequently observed as it circled the adjacent township several times at a low height above the ground. It was then seen to roll and descend steeply before striking two houses. A fierce fire broke out which engulfed the aircraft and gutted both houses. Initial investigation revealed a pre-impact failure of the left engine camshaft.

16 May 0919	Cessna 172M VH-DYM Corkwood Bore, NT	Non-commercial—pleasure Oodnadatta, SA/Bond Springs, NT	C1N 8441015

As no one had arrived to meet the aircraft at the planned destination, the pilot flew to a strip on another property. The strip appeared suitable to the pilot but during the landing roll the right wing struck mulga trees on the side of the strip. The width of the strip was subsequently determined to be 16 metres and the trees on the side of the strip were up to 5 metres in height.

16 May 1500	Partenavia P68B VH-FAO Horn Island, Qld.	Charter—passenger operations Murray Island, Qld./Horn Island, Qld.	C1N, P4N 8411024

Severe turbulence had been encountered on final approach but smooth air was entered on short finals. After flaring to land, the aircraft rolled left rapidly and the landing was made on the left main wheel, followed by the nose and right wheels. The pilot subsequently inspected the aircraft but did not detect any damage. After two further flights, the pilot noticed that the left wing appeared to be low. Distortion of the left main gear support frame was found.

PRELIMINARY REPORTS (The following accidents are still under investigation)

Date / Time	Aircraft type & registration / Location	Kind of flying / Departure point/Destination	Injuries / Record number
19 May 1630	Evans VP1 NOT REG St Arnaud, Vic.	Non-commercial—pleasure St Arnaud, Vic./St Arnaud, Vic.	C1S 8431015

The pilot had been briefed to familiarise himself with the cockpit prior to practising ground handling. He was advised that the fuel cock was turned off. Subsequently, the engine was started and a takeoff carried out. When the aircraft was about 25 feet agl, the owners heard the engine cut. The aircraft nose dropped and a heavy landing ensued. When the owners arrived at the wreckage, they found that the fuel cock was in the off position.

21 May Unknown	Cessna 182G VH-DJN Townsville, Qld.	Non-commercial—pleasure Unknown/Unknown	C1N 8411027

During a routine 100 hourly servicing, both wings were found to be bent upwards slightly. On further inspection, both rear spars were found buckled just inboard of the inboard aileron hinges. None of the pilots who had flown the aircraft since the last periodic inspection could recall any unusual stresses being placed on the aircraft by turbulence or manoeuvring.

22 May 1640	Cessna 182Q VH-FRV Longreach, Qld. 145W	Non-commercial—aerial mustering Vergemont Stn., Qld./Vergemont Stn., Qld.	C1N 8411026

The pilot reported that his approach to land towards the north-west was good; however, the aircraft floated for some distance before touching down. As the aircraft landed the sun appeared from behind a cloud and the pilot lost all forward vision. Braking was applied, but as the pilot considered that the aircraft was not slowing down and he was aware that the strip end was near, he applied power to go-around. The aircraft failed to become airborne and collided with a bush and a fence beyond the end of the strip.

22 May 0852	Cessna 182Q VH-WMF Trentham, Vic. 5NE	Non-commercial—pleasure Quambatook, Vic./Moorabbin, Vic.	C1F, P2F 8431016

During the flight the pilot encountered gradually deteriorating weather conditions, forcing him to reduce his cruising altitude from 5500 feet initially to below 3500 feet. Cloud covered the tops of the adjacent ranges and there were showers and associated low cloud in the accident area. The aircraft struck the ground at 2140 feet amsl while flying level, banked 20 degrees right under control and on a heading 55 degrees to the right of the flight planned track.

23 May 1340	Cessna 150L VH-DNE Pinnacles Stn., WA 8NW	Non-commercial—pleasure Pinnacles Stn., WA/Pinnacles Stn., WA	C1N 8451012

The aircraft was being used for sheep spotting. Three hours had been flown since the last refuelling and the pilot noted that the fuel gauge was indicating close to empty. He considered that enough fuel remained for a further 40 minutes; however, 5 minutes later the engine stopped. During the ensuing forced landing, two trees were struck and the aircraft sustained substantial damage to both wings and the tail section. Less than 3 litres of fuel was subsequently drained from the fuel system.

27 May 1600	Quickie Q2 NOT REG Warnervale, NSW	Test Warnervale, NSW/Warnervale, NSW	C1N 8421026

The pilot had finished construction of the aircraft and was conducting ground handling trials. He reported that on the final taxiing test the aircraft suddenly became airborne. There was insufficient strip length remaining to safely land again and the pilot climbed the aircraft to 2000 feet and carried out handling manoeuvres before returning to land. The aircraft landed heavily and the right canard was fractured.

31 May 1945	Piper 24-400 VH-BOO Adelaide, SA	Non-commercial—pleasure Essendon, Vic./Strathalbyn, SA	C1M, P3M 8441017

Due to weather conditions at the planned destination, the aircraft was diverted to Adelaide. About 135 kilometres from Adelaide the engine began to run roughly but cruising altitude could be maintained. The aircraft was positioned over Adelaide airport at 2500 feet and a right circuit commenced. During the approach, the aircraft began to undershoot and when the pilot applied power the engine did not respond. The right wing was torn off by impact with a power pole and the aircraft struck the ground inverted near the airport boundary.

31 May 2152	Cessna U206G VH-AZC Goulburn, NSW	Instructional—dual Bankstown, NSW/Goulburn, NSW	C2N, P2N 8421025

The pilot under instruction was training for the issue of a Night VMC rating. At about 250 feet agl on approach, considerable sink was experienced and the aircraft descended below the desired approach path. Power was applied and the nose was raised but the sink continued. The instructor took control and initiated a go-around; however, the left main gear wheel collided with a fence and was dislodged. Control was maintained and a safe landing was subsequently carried out on return to Bankstown.

07 June 1320	Pilatus B4 VH-UIP Central Mangrove, NSW	Non-commercial—pleasure Cent. Mangrove, NSW/Cent. Mangrove, NSW	C1S 8421027

The pilot was carrying out his third flight for the day when heavy sink was encountered near a small bushfire and an outlanding became necessary. During the approach, the pilot flew below a set of power lines and then attempted to climb over trees at the edge of the selected paddock. After passing over the trees, the aircraft was seen to descend steeply and strike the ground, crumpling the fuselage and damaging the wing attachment structure.

10 Jun 1200	Burkhart Astir CS VH-WUK Kimba, SA 30S	Non-commercial—pleasure Darke Peak, SA/Darke Peak, SA	C1N 8441019

While ridge soaring at a low height and 50 knots, the pilot noticed a dead tree a short distance ahead. The glider mushed during the attempted pull-up, the left wing hit another tree and the glider turned through 90 degrees before colliding with the upward sloping ground.

10 Jun 1540	Fuji 200-180 VH-FJI Strathalbyn, SA	Non-commercial—pleasure Strathalbyn, SA/Strathalbyn, SA	C1F, P1F 8441018

After performing aerobatics near the strip, the pilot joined the circuit for a landing to the south-east. He overflow the field at a low height, apparently with cruise power set. As the aircraft passed the north-western end of the strip, it was seen to roll left until it was inverted and nose low. A "pull-through" manoeuvre was then initiated but the aircraft collided with the ground at high speed and at about 30 degrees nose down.

PRELIMINARY REPORTS (The following accidents are still under investigation)

Date / Time	Aircraft type & registration / Location	Kind of flying / Departure point/Destination	Injuries / Record number
14 Jun	Hiller UH12E VH-FBQ	Instructional—dual	C2N
1430	Aurukun, Qld. 56SE	'Bamboo' Outstation/'Bamboo' Outstation	8411029

Cattle were being mustered from open country with the helicopter operating at 15 to 20 feet agl in wind gusting to 25 knots. At the completion of one downwind run the trainee flared instead of turning into wind. The main rotor blades overpitched and the helicopter struck the ground heavily, tail down, before the instructor could recover control of the situation.

15 Jun	Hughes 269-C VH-KZR	Commercial—aerial mustering	C1N
0805	Mt Anderson, WA	Mt Anderson, WA/Mt Anderson, WA	8451013

After a normal landing the helicopter began to bounce sideways. The pilot suspected the onset of ground resonance and attempted to lift off. The helicopter slewed left and a main rotor blade struck a large drum.

22 Jun	Cessna A188B-A1 VH-MXH	Aerial agriculture	C1N
1400	Wongan Hills, WA 16E	Glen Var Station, WA/Glen Var Station, WA	8451015

Prior to commencing spraying operations for the day, the pilot had taken samples from three of the five fuel drain points fitted to the aircraft. Water was detected at each point and further samples were taken until no trace of water remained. Further samples of clean fuel were obtained after two subsequent refuellings. On takeoff after the second refuelling the aircraft failed to accelerate normally and collided with a fence after overrunning the strip. Water was later found in the fuel system.

24 Jun	Cessna 210M VH-PKR	Non-commercial—pleasure	C1S, P2M, P3N
1515	Birchip, Vic. 24NW	Birchip, Vic./Birchip, Vic. 24NW	8431017

The aircraft touched down about 150 metres past the threshold of the 600 metre strip and bounced. The pilot applied power to go-around and gradually raised the flap, but the aircraft then began to sink and he was unable to prevent the left wing striking the ground. The aircraft cartwheeled and rapidly came to a halt.

24 Jun	Mooney M20F VH-ERY	Non-commercial—business	C1N, P1N
1600	Mundabullangana, WA	Belele Homestd., WA/Mundabullangana, WA	8451016

A go-around was made from the first approach as the aircraft was overshooting the pilot's aiming point. On the second approach the aircraft began to porpoise after touchdown. Braking was commenced with 200 metres of the 750 metre strip remaining. After a further 100 metres the pilot attempted to go-around. The aircraft came to rest some distance beyond the strip end after colliding with a number of mounds of earth.

28 Jun	Cessna 210L VH-KWW	Non-commercial—pleasure	C1N, P1N
1410	Kalgoorlie, WA	Orleans Farms, WA/Esperance, WA	8451017

When the pilot selected the gear up after takeoff, the retraction cycle took longer than normal. The gear was selected down prior to the next landing and although the gear up light extinguished, the gear motor did not operate and the gear down light did not illuminate. Attempts to lower the gear, using the manual system, were unsuccessful and the aircraft was diverted to a more suitable airfield. During the subsequent landing roll the main gear, which was partially extended, collapsed.

29 Jun	Piper 25-235/A1 VH-MYE	Instructional—dual	C2N
0930	Leongatha, Vic. 8SE	Leongatha, Vic./Leongatha, Vic.	8431018

A spray run was being flown along the boundary of a paddock. One tree infringed the run and the trainee elected to apply rudder to direct the aircraft past the tree. Incorrect rudder was applied and the instructor took over but the left wing struck the tree. The instructor was able to maintain control, although one metre of wing and the aileron had been torn off. He landed the aircraft in the adjoining paddock without further damage.

FINAL REPORTS (The investigation of the following accidents has been completed)

Date / Time / Pilot licence	Aircraft type & registration / Location	Age	Kind of flying / Departure/Destination / Hours Total	Hours on Type	Rating	Injuries / Record number
05 Apr	Beech A36 VH-WHH		Non-commercial—pleasure			C1N, P3N
1000	Cobham HS, NSW		Tibooburra, NSW/Cobham Homestead, NSW			8421016
Private		37	297	78	Instrument rating class 4	

The pilot was aware that a rough area existed adjacent to the threshold of the strip. He elected to land long and clear of the rough section, as sufficient strip length remained for a safe landing. He stated that he was concentrating on achieving a precise point of touchdown and did not realise until after landing that he had omitted to extend the landing gear.

The landing gear warning horn was subsequently found to be unserviceable.

05 Apr	Bell 47-G2 VH-RFE		Non-commercial—practice			C1N
1400	Amata, SA		Amata, SA/Amata, SA			8441012
Commercial — helicopter		37	8743	7395	None	

After completing an autorotation with power termination, the pilot decided to carry out a full autorotative landing. During the approach all collective control was used prior to touchdown. The helicopter landed heavily and the main rotor blades severed the tail boom.

The pilot misjudged the height of the helicopter above the ground when commencing the flare prior to landing.

FINAL REPORTS (The investigation of the following accidents has been completed)

Date / Time / Pilot licence	Aircraft type & registration / Location	Age	Kind of flying / Departure/Destination / Hours Total	Hours on Type	Rating	Injuries / Record number
14 Apr	Piper 28-180 VH-PPB		Non-commercial—practice			C1N
1045	Warialda, NSW		Warialda, NSW/Warialda, NSW			8421017
Private restricted		29	40	40	None	

During a landing in light crosswind conditions, the aircraft began to veer left. Right rudder was applied but the swing continued until the aircraft was travelling sideways. The nose wheel broke off when it contacted an area of soft ground.

The approach and touchdown were made at a speed in excess of that recommended for the aircraft type. The pilot was relatively inexperienced and had probably not applied sufficient back pressure to the elevator controls in order to reduce the effective weight on the nose wheel. A 'wheel-barrowing' situation had developed, leading to a loss of directional control.

18 Apr	Beech 95-B55 VH-FEM		Charter—passenger operations			C1N, P1N
1530	Brewarrina, NSW 40W		Lila Springs Stn., NSW/Beemery Stn., NSW			8421018
Commercial		21	1050	190	Instrument rating 1st class or class 1	

The pilot was making his first landing at the strip. He had been advised to bring the aircraft to a halt before passing the windsock because of a soft surface beyond this point. Initial touchdown was about 400 metres past the threshold but all wheels were not firmly on the ground until the aircraft was 39 metres beyond the windsock. The wheels progressively sank into the surface and after a ground roll of 160 metres the nose gear fork sheared off and the aircraft pitched onto its nose.

The approach had been flown at a speed about 10 knots in excess of that recommended for the prevailing conditions and had been made with a tailwind component of about 5 knots. Although the aircraft had floated for a considerable distance beyond the target touchdown point, a go-around had not been initiated.

21 Apr	Partenavia P68B VH-PNZ		Charter—passenger operations			C1S, P5N
1302	Bankstown, NSW		Bankstown, NSW/Bendigo, Vic.			8421024
Commercial		24	1400	50	Instrument rating 1st class or class 1 with instrument rating	

After passenger loading had been completed, but before the engines were started, the pilot remembered that a nose wheel chock was still in place. She disembarked and removed the chock; however, the aircraft commenced to roll down the slightly sloping tarmac area. The chock was replaced but the aircraft rolled over the chock and the left main wheel passed over the pilot's right leg. The aircraft came to a halt at the bottom of the slope.

The pilot was subsequently unable to recall whether the parking brake had been fully applied or whether she had inadvertently released the brake when pushing her seat back with her feet on the rudder/brake pedals prior to disembarking to remove the chock.

24 Apr	Mooney M20F VH-ERD		Non-commercial—pleasure			C1N, P3N
1725	Mildura, Vic. 67NW		Cobar, NSW/Renmark, SA			8441013
Private		58	1367	450	None	

The pilot intended refuelling at the previous landing point but he found that fuel was not available. After re-checking his fuel requirements, he was satisfied that the flight could be accomplished with almost full reserves. The weather deteriorated and groundspeed reduced during the flight, causing the pilot to become concerned about flight visibility and fuel endurance. He elected to make a precautionary landing near a homestead but during the landing roll the aircraft ran through a fence and collided with a ditch.

Although the pilot had lost time on earlier legs of the flight, he made no similar allowance for the subject leg, nor did he divert to a suitable refuelling point. Having decided to carry out a precautionary landing, the pilot did not make a low-level inspection of the area. The approach to land was made downwind and the aircraft did not touch down until it was less than 220 metres from the end of the 2000 metre paddock selected.

28 Apr	Piper 18-150 VH-FPI		Activities associated with fire control			C1N
1340	Manjimup, WA		Manjimup, WA/Manjimup, WA			8451010
Commercial		20	601	394	Instrument rating class 4	

Because of strong crosswind conditions at his planned destination, the pilot diverted to a nearby strip which was aligned into the prevailing wind. Although the groundspeed was low during the approach, the pilot elected to use full flap for landing. Shortly after touchdown the left wing lifted and the pilot was unable to apply full corrective aileron because his knee became jammed between the control column and the flap lever. The aircraft ran off the side of the strip and struck a fence.

The fence was only 28 metres from the centre-line of the strip. In his efforts to apply full aileron, the pilot had lifted his left foot from the appropriate rudder pedal, which probably increased the tendency of the aircraft to diverge to the right of the strip.

13 May	Cessna 337G VH-KUX		Charter—passenger operations			C1N, P1N
1326	Gove, NT		Elcho Island, NT/Gove, NT			8441014
Commercial		24	899	440	Instrument rating 1st class or class 1 with instrument rating	

Prior to commencing a 60 minute flight the pilot estimated that the aircraft held fuel for 120 minutes. The front engine failed when the aircraft was 25 km from the destination. The rear engine subsequently failed and a glide approach from 9 km and 3000 feet commenced. A 15 knot headwind was present and the aircraft landed 7 metres short of the aerodrome boundary fence. The right main gear was torn off in a ditch during the 135 metre ground roll.

When the aircraft was last refuelled, it was not filled to capacity and the pilot probably inaccurately estimated the amount of fuel onboard. Fuel usage rates did not vary significantly from those used by the pilot for flight planning. The fuel gauges were found to overread in the lower quantity range.

FINAL REPORTS (The investigation of the following accidents has been completed)

Date / Time / Pilot licence	*Aircraft type & registration / Location*	*Age*	*Kind of flying / Departure/Destination / Hours Total*	*Hours on Type*	*Rating*	*Injuries / Record number*
26 May 1515 Private	Piper 28-140 VH-MTU Hoxton Park, NSW	19	Non-commercial—pleasure Bankstown, NSW/Bankstown, NSW 46	6	None	C1N, P3N 8421023

The aircraft bounced after the initial touchdown and subsequently porpoised a number of times before the pilot was able to regain control of the landing. He later inspected the aircraft but did not notice any damage which might have occurred during the landing. On the subsequent takeoff, pitch attitude control difficulties were encountered and the pilot carried out a low level circuit and landing. Damage to the rear bulkhead and stabilator trim support brace was discovered.

The damage had been sustained during the initial touchdown, which had been on the main wheels and the tail skid, and had probably accounted for the pilot's difficulty in controlling the subsequent porpoises along the runway.

13 Jun 1000 Private	Maule M5-235C VH-MSM Nanango, Qld.	44	Non-commercial—business Tara, Qld./Nanango, Qld. 515	265	None	C1N 8411028

The pilot assessed the crosswind to be in excess of the aircraft limits on the two prepared strips and elected to land on a disused strip aligned into-wind. During the approach, he noticed a horse being exercised adjacent to the landing area and steepened his glide path in order to land closer to the strip threshold and thereby avoid frightening the horse. On touchdown the right main wheel struck an anthill, the gear collapsed and the aircraft groundlooped.

The anthill was hidden by the long grass on the strip, which had not been maintained for some time. The pilot had used the strip on previous occasions but had not attempted to land close to the threshold.

17 Jun 1340 Private	Avnspier Robin-R2160 VH-XXY Wedderburn, NSW	36	Non-commercial—practice Wedderburn, NSW/Wedderburn, NSW 379	33	Instrument rating class 4	C1N, P1N 8421029

The pilots were practising precision flying circuits and landings in preparation for a forthcoming competition. Weather conditions were fine but with variable and gusty winds. As the pilot flared the aircraft following a normal approach, substantial windshear was encountered and the aircraft landed heavily. A subsequent inspection revealed structural damage had occurred in the fuselage adjacent to the rudder pedal area.

Both pilots had operated from the strip on previous occasions and were aware that windshear conditions were frequently encountered under the prevailing wind conditions. On this occasion, the pilot reported that the onset of shear was so sudden that there was no time to take corrective action before the aircraft struck the ground.

18 Jun 0705 Commercial — helicopter	Hughes 269C VH-SMT Moola Bulla Stn., WA	34	M. Bulla Stn., WA/M. Bulla Stn., WA 37 WSW 882	785	None	C1S 8451014

The pilot had planned to carry out a cattle muster in conjunction with another aircraft. He had been late in departing his base, but when he found the other aircraft had not yet arrived at the rendezvous point, he decided to make a quick comfort stop. The helicopter was landed on a spinifex covered area and the pilot disembarked, leaving the engine running. Shortly afterwards he noticed a fire underneath the helicopter and reboarded in an attempt to fly it away from the fire. The engine did not respond. The pilot disembarked and attempted unsuccessfully to extinguish the fire. He received burns to his hands and legs while unloading equipment and the helicopter was destroyed.

FINAL UPDATES (The investigation of the following accidents has been completed. The information is additional to that previously printed in the preliminary report)

Date / Pilot licence	*Record number / Age*	*Aircraft type / Hours total*	*Hours on type*	*Rating*
19 Mar 83 Private	8321030 49	Piper 23-160 540	350	None

The aircraft was crossing the threshold, about 300 metres behind an Iroquois helicopter, when the right wing dropped. The nose also dropped and the nose wheel contacted the runway heavily and was broken off. The aircraft slid along the runway for some 200 metres on its nose before coming to rest.

The aircraft evidently encountered the wake turbulence created by the helicopter.

19 Mar 83 Private	8321031 36	Rutan Vari Eze 500	100	None

Just before touchdown the aircraft encountered wake turbulence from a preceding landing aircraft. The pilot applied full power and attempted a go-around, but the aircraft contacted the runway heavily and the nose gear collapsed.

17 May 83 Commercial — helicopter	8321041 24	Hiller UH12-E 1900	1600	Instrument rating class 4

While on cruise at 1000 feet agl, the aircraft experienced a sudden loss of height. The pilot carried out an autorotative landing on river mud flats. During the landing the tail rotor struck the water.

The transmission of the helicopter failed after the disintegration of the planetary gears which was caused by fatigue cracking. Fatigue cracks were found in several sections of the remaining gear fragments and it was not possible to determine the exact origin of the final failure.

FINAL UPDATES (The investigation of the following accidents has been completed. The information is additional to that previously printed in the preliminary report)

Date / Pilot licence	*Record number / Age*	*Aircraft type / Hours total*	*Hours on type*	*Rating*
10 Sep 83 Commercial	8321071 39	Cessna A188B-A1 7400	600	Agricultural class 1

The aircraft was descending over a line of trees prior to commencing a spray run when the left wing collided with the branch of a tree. The pilot was able to maintain control of the aircraft and land at a nearby strip.

25 Sep 83 Private	8311061 31	Piper 32-260 700	300	Instrument rating class 4

The pilot was conducting a short field approach into a 525 metre strip. He reported that thermal activity was encountered and the aircraft touched down a short distance beyond the target point. As soon as full brakes were applied, the aircraft commenced to veer to the left and despite appropriate corrective action the pilot was unable to prevent the aircraft running off the side of the strip.

A defect in the master cylinder caused the left brake to lock and the left main gear struck a tyre used as a strip marker. Collision with the tyre fractured the torque link allowing the left main gear to separate from the oleo leg. The strip width between the tyre markers was only 25 metres, which was below ALA standards.

02 Oct 83 Private	8351024 32	Cessna 172M 90	10	None

While conducting a series of practice circuits, the pilot noted that a crosswind from the right was evident down to 50 feet on the approach, but the wind at ground level was blowing down the strip in use. On the last circuit a normal approach was made; however, shortly after touchdown the aircraft began to drift despite the application of corrective rudder. A go-around was made but the drift to the right continued. Flap was raised but control was then lost and the aircraft struck trees.

No fault was found with the aircraft that could have contributed to the accident. There was no method by which the pilot could continuously monitor the wind velocity at the strip. It is probable that the aircraft was affected by a crosswind that caused it to drift to the right after touchdown. During the attempted go-around, adequate airspeed was not maintained and the aircraft stalled.

04 Oct 83 Student	8321077 47	Victa 115 58	32	None

The student pilot was briefed to conduct a period of solo consolidation training. After several circuits and landings had been completed, the pilot flew the aircraft to a strip at a nearby military installation. A passenger boarded the aircraft and the pilot then conducted a takeoff with the intention of making a local flight. A partial loss of engine power occurred and the aircraft subsequently struck the ground with a high rate of descent and came to rest inverted.

The cause of the engine failure could not be positively determined.

24 Oct 83 None	8351026 36	Cessna 182P 10		None

After unsuccessful attempts were made by two prison escapees to steal three other aircraft, the engine of the subject aircraft was started. Shortly after commencing to taxi the aircraft collided with a parked Beech Bonanza; however, taxiing to the runway was continued. Shortly after becoming airborne the aircraft turned to the left and collided with the ground.

The man acting as pilot had held a student pilot licence some nine years previously. He had obtained about 10 hours dual training and had since been permitted to fly various aircraft while a passenger but had not received any instrument flight training. Although the moon had risen, the night was dark and smoke haze obliterated the horizon.

03 Nov 83 Commercial	8321085 29	Piper 25-235 1250	20	None

Shortly after becoming airborne, the pilot observed that the temporary fabric covering on the left wing was ballooning and advised the tower that he was returning. The aircraft turned left until lined up with strip 18 and the pilot advised that he would recheck the condition of the left wing and may land downwind. He stated that the nose and left wing dropped suddenly and that despite corrective flight control action, he was unable to prevent the aircraft striking the ground.

The pilot had not flown the aircraft type for about 3 years. During the approach to land, the aircraft had stalled and the pilot had employed an incorrect recovery technique.

18 Nov 83 Student	8331035 32	Piper 24-400 33	Not known	None

At about 0200 hours, the owner and a passenger boarded the aircraft for a local flight. A resident heard it take off and saw the aircraft lights in the circuit area. He also noted that the runway lights were illuminated. A go-around was made on the first approach and the aircraft was landed after another circuit. A takeoff was carried out in the opposite direction and shortly after becoming airborne the aircraft struck the ground. Fire broke out and engulfed the wreckage.

It was not possible to determine who of the occupants was manipulating the controls at the time of the accident. Neither person was qualified to operate the aircraft. Post mortem examinations revealed that both persons had high blood alcohol levels.

05 Feb 84 Private	8431004 36	Piper 32-300 214	23	None

After takeoff, the pilot noticed that the engine cowl had lifted slightly. He decided to complete the circuit and land. During the crosswind leg of the circuit, the cowl lifted completely from the left attachment points and obscured, to a large extent, the pilot's forward vision. An approach was then made to a cross strip and on short final the pilot lost sight of the runway and the aircraft landed heavily.

The top engine cowl had not been correctly secured before flight. Inspection of the aircraft revealed that the lug holes that accept the cowl locating pins were not fitted with the required nylon inserts. It was possible for the cowl side latches to appear to be fastened when in fact they were not properly engaged.

FINAL UPDATES (The investigation of the following accidents has been completed. The information is additional to that previously printed in the preliminary report)

Date / *Pilot licence*	*Record number* / *Age*	*Aircraft type* / *Hours total*	*Hours on type*	*Rating*
03 Mar 84	8441006	Britnor BN2-A21		
Senior commercial	30	4995	24	Instrument rating 1st class or class 1

The east-west strip at the destination had been rendered unserviceable by recent rain. The pilot was advised that another strip which ran parallel to this strip was serviceable, as was a third north-south strip a short distance away. When the aircraft arrived in the circuit area, the wind was southerly at 30 knots and the pilot decided to land on the north-south strip. However, since the inspection 38 millimetres of rain had fallen and water about 20 centimetres deep lay across a section of the strip when the aircraft landed. As the main wheels entered the water, the nose wheel was pulled into hard contact with the strip and collapsed rearward.

12 Mar 84	8441008	Cessna U206-G		
Commercial	22	282	19	Instrument rating class 4

During the landing flare the aircraft ballooned and assumed a nose-high attitude. The pilot attempted to take corrective action but the tail contacted the ground before the main wheels. The aircraft bounced and on the subsequent touchdown the tail again struck the ground.

The pilot was inexperienced on the aircraft type and had used an approach speed below that recommended in the Aircraft Flight Manual. The aircraft was flared too high and incorrect recovery action was taken by the pilot after the aircraft ballooned.

15 Mar 84	8451006	Cessna 182-D/A1		
Commercial	26	615	32	Instrument rating class 4

The model specification for this aircraft indicates that it has been converted to tail-wheel configuration. The pilot reported that the windsock was indicating a wind of 270 degrees 10 to 13 knots. He elected to land on runway 13 and after a three-point touchdown the aircraft began to turn right. The pilot was unable to regain directional control and the aircraft groundlooped, bending the left wing and tailplane.

18 Mar 84	8441009	Cessna 182K		
Private	34	187	72	None

While airborne for parachute dropping operations, the pilot noted that the weather at his destination had deteriorated. He elected to divert to a clear area and carry out a precautionary landing. The area selected was soft and during the landing roll the nose gear strut collapsed.

The pilot was in receipt of weather forecasts that indicated the probability of rainstroms and low cloud in his area of operation. Insufficient fuel was carried in the aircraft to allow the pilot to hold until the weather cleared or divert to a more suitable landing area.

19 Mar 84	8441010	Piper 28-140		
Student	38	38	37	None

After a number of dual circuits, the pilot was authorised to carry out solo circuits with touch and go landings. After the first touchdown the pilot applied full power, then selected the flap to 10 degrees. The aircraft entered a rapid turn to the left and the pilot abandoned the takeoff. The aircraft slid sideways off the strip and the nose wheel was broken off.

The pilot was carrying out her first solo period of touch and go landings. After applying full power she noticed that the aircraft was accelerating more quickly than when she had been under dual instruction. The pilot had previously required forward pressure on the control column while retrimming the aircraft. On this occasion, she had not had time to retrim and the investigation revealed that the aircraft had been 'wheelbarrowing' on the nose wheel when directional control was lost.

20 Mar 84	8421012	Beech E55		
Commercial	40	1230	409	Flight instructor grade 3

During the course of the flight, the pilot learned that the passenger in the right hand front seat held an American pilot licence and was experienced on the type. He allowed the passenger to manipulate the controls until the aircraft was on final approach and allowed him to keep his hands lightly on the controls during the flare and touchdown. During the landing roll the passenger, unnoticed by the pilot, inadvertently selected the landing gear up. The aircraft slid to a halt with the gear partially retracted.

24 Mar 84	8451007	Cessna 172N		
Private	29	142	36	None

The pilot was landing into the east with a 10 to 12 knot southerly wind. On short final approach at a speed of 60 knots the aircraft encountered sink. Touchdown was heavy and resulted in damage to the propeller, nose gear and engine firewall.

To the south and parallel to the runway are a line of sandhills approximately 100 feet high. With the prevailing wind, it is probable that mechanical turbulence would have been present during the later stages of the approach. The pilot lacked both recent and general flying experience.

24 Mar 84	8421014	Bell 47-G4		
Commercial — helicopter	27	960	90	None

The pilot was inspecting areas of noxious weeds to check on the results of recent spraying. The helicopter struck a power line which severed the bubble windscreen. The wire then contacted the pilot's throat before being cut by the main rotor. The helicopter struck the ground tail rotor first from the wreckage, the pilot swam across a river, walked 3 km to a homestead, and drove 15 km for help. He was later admitted to intensive care in hospital.

The pilot had been unaware of the location of the power lines until immediately before the collision. An aerial survey of the area had been planned but had not been undertaken. There was evidence to indicate that the pilot had flown beneath the wires on at least one occasion while spraying. The poles supporting the span struck by the helicopter were 253 metres apart and were probably outside the pilot's normal field of vision at the time of the strike.

27 Mar 84	8411016	Piper 23-250		
Commercial	19	290	93	Instrument rating class 4

Prior to the departure for the planned 50 minute flight the pilot had added fuel to give an endurance of 100 minutes. Adverse weather was encountered en route and the pilot became uncertain of his position. In fading daylight he recognised the Burketown area and requested Flight Service to organise strip lighting. Before this could be arranged, the left engine failed and the pilot attempted to land on an old road. Touchdown occurred in a rough area adjacent to the road and the landing gear collapsed. The left engine had failed from fuel exhaustion. When refuelling the aircraft the pilot had not added sufficient fuel to allow for 60 minutes holding at the destination, as required, because of the forecast adverse weather.

Helicopter Vne: what's it all about?

Helicopter Vne speeds are not always well understood by rotary-wing pilots.

In a recent discussion on the subject, a pilot who once flew Hueys in Vietnam remarked:

> We were in this valley in the Central Highlands and started taking automatic weapons fire from both ridgelines. I pulled in collective and pushed the nose over — must have gone about 15 knots past the red line getting out of there. The machine shook a little more than normal but continued to fly okay.

The pilot implied that nothing serious will happen if from time to time Vne is exceeded by some reasonable amount because, based on his experiences, the Huey didn't exhibit any unusual characteristics, such as a violent pitch up and roll which one would expect from blade stall, nor did it shake so violently that rivets were loosened and the instruments became unreadable. His feeling was that there must be some margin built into Vne limits to prevent sudden catastrophic failure and to protect pilots from their own excesses in handling aircraft.

Well, to be sure, there are margins, but as a test pilot and aerodynamicist for a major helicopter manufacturer said recently: 'Lots of considerations go into deriving a helicopter's Vne envelope. It could be blade stall margins, controllability, or vibration and stress levels which limit the service life of critical components'. In short, if Vne is exceeded, it could be bad news right then and there or sometime later.

Take, for example, the matter of controllability. On some models of the SH-3 helicopter (the military version of the S-61), Vne is limited by controllability. As Vne is approached in level flight, the cyclic has to be positioned increasingly forward, to the extent that if airspeed was not limited, all forward cyclic travel would be used up and the stick would strike its mechanical stop, even though sufficient blade stall and component stress margins remained. At that point, if a gust were to suddenly pitch the nose up, there would be no forward cyclic control remaining to return the aircraft to level flight, and in effect the helicopter would be out of control.

Figure 1

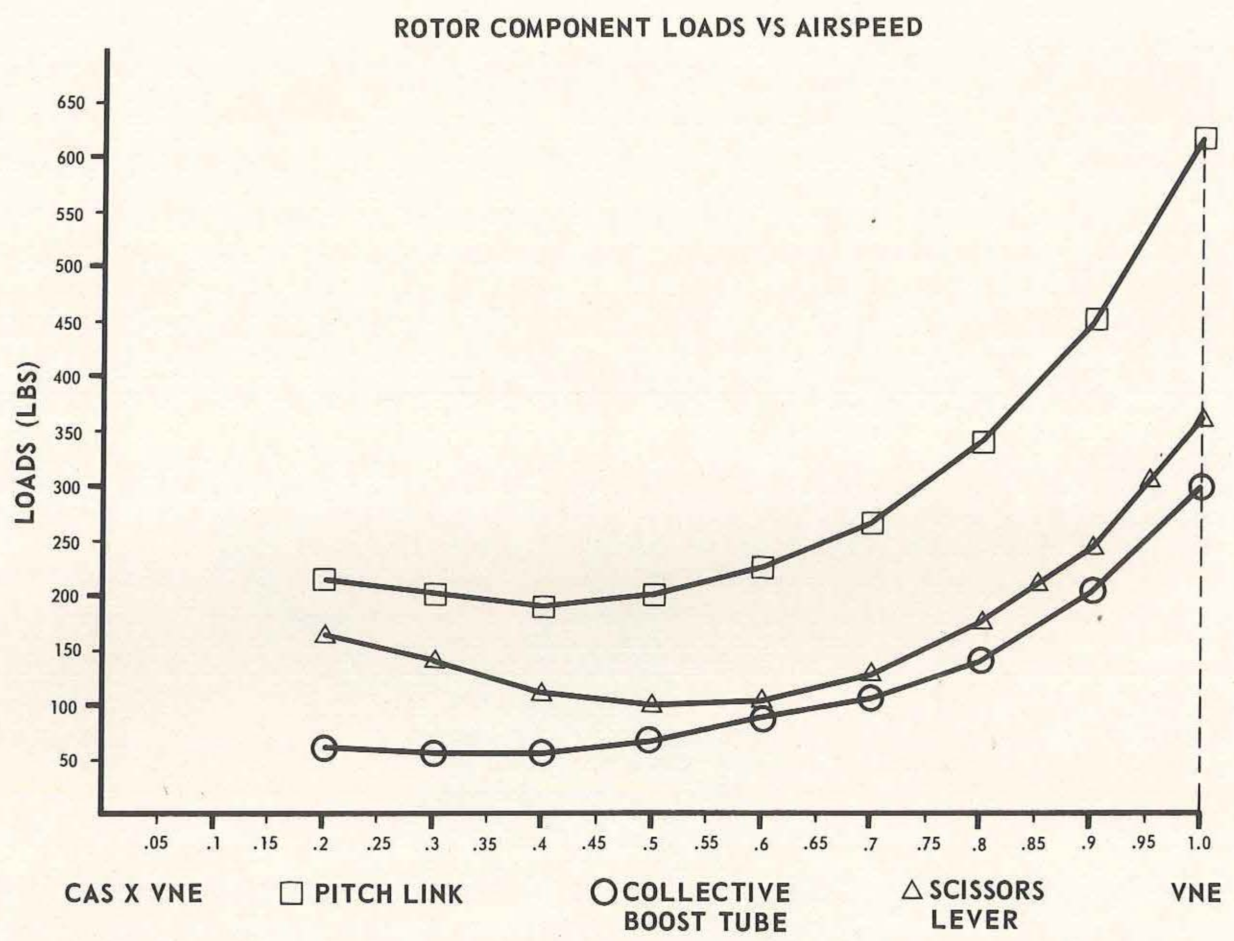
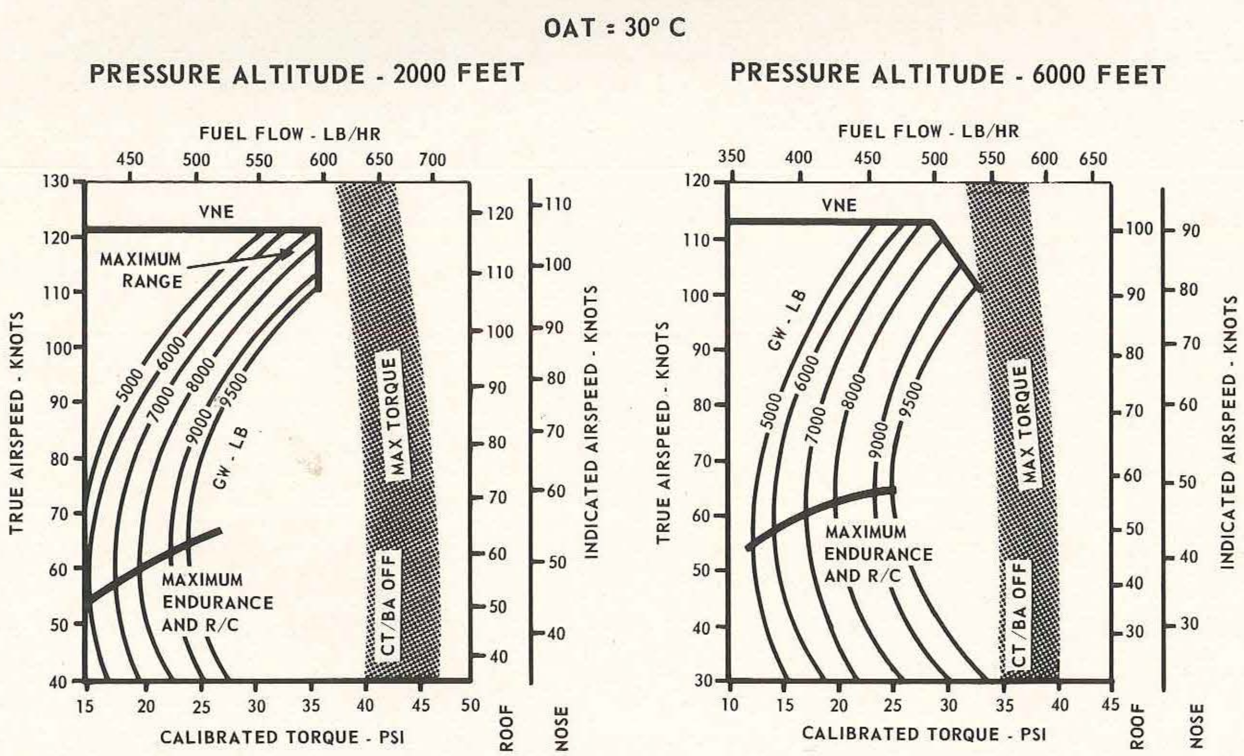


Figure 2



What about blade stall? Most modern helicopters are not limited by blade stall, but blade stall certainly is a limit. One day some years ago a Navy pilot flying an H-2 found himself falling behind on his flight plan due to unforecast south-westerly winds. The pilot must have forgotten his basic helicopter aerodynamics, or perhaps never really learned the subject, because his response to the low groundspeed was to 'beep' the cyclic forward with the altitude hold engaged to increase indicated airspeed. He said: 'The next thing I knew the vibrations increased and we pitched up and rolled left' Whether or not the H-2 was limited by blade stall on that flight I don't know, but the pilot learned an aerodynamic fact of life that day.

Stress levels of critical rotor head and rotor blade components are the main reason for limiting Vne in modern helicopters. In the UH-lH, for example, the loads on rotor head components rise dramatically as Vne is approached. Figure 1 shows how a small increase in indicated airspeed (near Vne) results in a very steep rise in pitch link, scissors lever and collective boost tube loads. Even exceeding the Vne by a small amount in such stress-limited aircraft (as you can see by extrapolating the curves upward) results in sharply higher loads which will almost certainly reduce nominal component life. A system safety engineer for a major helicopter manufacturer put it this way: 'This damage may not be evident until a crack or other defect develops considerably below the retirement or overhaul flight hour level'. It is important to remember that each revolution of the critical part, whatever it is, constitutes one overstress cycle. In the extreme, the engineer said, the service life of a component designed for many hundreds of hours could be reduced to the point where only a few hours of safe operation remain. For this reason, whenever Vne is exceeded, it should be regarded very seriously and pilots should take pains to record the duration of such events, along with indicated airspeed, gross weight, rotor RPM, engine power settings, pressure altitude and even outside air temperature. From this data, the maintenance department will determine (sometimes with the help of the manufacturer) to what degree component life was reduced and if further checks are required before the helicopter can be flown again.

Computing component service life is a highly complex process and Vne is just one of the end products of this work. When making a helicopter, designers look at the machine's mission and then tailor the strength of components to meet the specifications. Of course, as we well know, the true test of their work comes when the machine enters service. Charter and aerial work operators who routinely fly at high speed very often operate near Vne limits which will vary appreciably with changes in gross weight and cruising altitude.

For example, in high, warm places such as the Atherton Tablelands, the Blue Mountains and the Southern Tablelands in the summer, a helicopter cruising at maximum range speed just a thousand feet above the ground could be just a few knots below Vne and with some aircraft Vne might actually be cruise-speed limiting. This could also be true in the very high temperatures which occur regularly at sea level throughout Australia, especially in the summer. Figure 2, which shows the speed envelope of a UH-lH at an outside air temperature of +30°C at 2000 feet and 6000 feet pressure altitude, illustrates this point. Note how at 2000 feet a 7000 pound Huey has a maximum range indicated airspeed of 112 knots (roof-mounted pitot) and Vne is 117 knots. At 6000 feet, Vne is limiting, so it becomes the maximum range indicated airspeed at 101 knots. Also note how Vne indicates airspeed drops off sharply as gross weight increases. The red line painted on the airspeed indicator (which is valid only at sea level on a standard day) may be doing more harm than good by luring some pilots into faster speeds than they should be operating at. As a matter of professionalism and flight safety, pilots flying at high speed should make it their business to check Vne each time they change altitude. Perhaps someday Vne limits will be displayed on the airspeed indicator by a moving 'barberpole' pointer, much like it is on today's jet transports.

In summary, helicopter Vne speeds have to be understood and appreciated for what they are: critical aircraft limitation, which often is not depicted correctly on airspeed indicators. Also, on modern high-speed helicopters, Vne can be exceeded with no perceptible increase in vibration level or control feel and, if exceeded, could ultimately have catastrophic consequences ●

Adapted from Flight Crew

Who is flying the aircraft?

The pilot of a Cessna 182 fitted with an autopilot almost came to grief recently by accidentally hitting the ON/OFF switch during the takeoff roll.

He opened the throttle and unbeknown to him one of his knuckles came into contact with the autopilot switch, pushing it into the ON position. As it happened, the 'bug' on the heading indicator associated with the autopilot was set in a position 80 degrees to the right of the runway heading. Much to the pilot's surprise, the aircraft immediately started to try to 'fly' the heading indicated, but before it left the ground he was able to regain directional control and abandon the takeoff.

This particular pilot has developed his own solution — he has reversed the switch so that it cannot be inadvertently pushed to ON and he also now aligns the heading indicator 'bug' on the runway heading prior to takeoff ●

Pressing on regardless

The Flight Information Service provided to pilots operating outside controlled airspace in Australia is widely regarded as very effective and well suited to the flexible nature of GA operations. Relevant preflight, traffic and operational information is available to all aircraft on request. A fundamental characteristic of this system is the operational freedom it affords pilots who, within certain guidelines, can choose the amount of information they receive and the way in which they use such facilities as airspace, aerodromes and SAR services.

Inherent in the flexibility of this system is the devolution to pilots of the responsibility, first, to obtain all the information applicable to their operations, both before and during a flight; second, to assess the information themselves; and finally, to take action in response to that information. This is a continuum of processes, which therefore makes it essential that pilots recognise their responsibility to take full advantage of inflight information services and to update, if necessary, planned courses of action. That responsibility was not accepted in the accident examined below.

Preflight

Before planning a flight from central New South Wales to Essendon the pilot of a Cherokee Six telephoned a meteorological office for a flight forecast. He was advised that the predicted en route weather generally was good. A cold front, accompanied by strong wind gusts, sharply decreasing visibility and moderate to severe turbulence, was expected to pass through the southern section of the PA 32's route later in the day, after the Cherokee's ETA Essendon. In view of the generally favourable forecast, the pilot was confidently able to submit a VFR flight plan.

Inflight

Departure was made on time and the flight initially proceeded smoothly at an altitude above 5000 feet. However, as the Cherokee (shown as Aircraft A on the map) approached about 20 nm north of Bathurst, AIREPs from other aircraft on the same FIS frequency began to indicate that actual weather conditions were different from those predicted.

Reports from two other aircraft were passed to Sydney FIS that the leading edge of the cloud which was associated with the front was lying some 12 nm east of Orange, aligned south-east to north-west. From these reports it was clear that frontal passage had occurred earlier than expected.

Aircraft A's track took it over Bathurst towards Cootamundra. When it was 12 nm south-west of Bathurst, another significant AIREP was passed to Sydney. This was from Aircraft B, which was tracking from Cowra to Young, and which advised that there were substantial dust storms in the area up to 5000 feet, and that he was IMC in dust at 3700 feet (which was the lowest safe altitude). As can be seen from the map, Aircraft B's track was adjacent to Aircraft A's intended track.

Sydney Flight Service contacted Aircraft A as it approached Wyangala Reservoir and repeated Aircraft B's AIREP. At about the same time, other aircraft reported severe turbulence in the Cowra/Young/Yass/Goulburn area generally, and intense dust storms up to 6000 feet around Rugby.

By this stage Aircraft A had descended to 4000 feet to remain VMC because of a lowering cloud base, and had also begun to experience considerable turbulence. The pilot later confirmed that he had been able to see the dust storms for some time as he approached the general Cowra area.

There were, then, clear indications that Aircraft A was entering a region of rapidly deteriorating weather in which VFR flight was most improbable and severe turbulence existed. The pilot, in fact, had considered diverting and had examined the charts for Bathurst and Cootamundra. However, against all the evidence with which he had been presented in flight, he decided to press on to check the dust storms for himself.

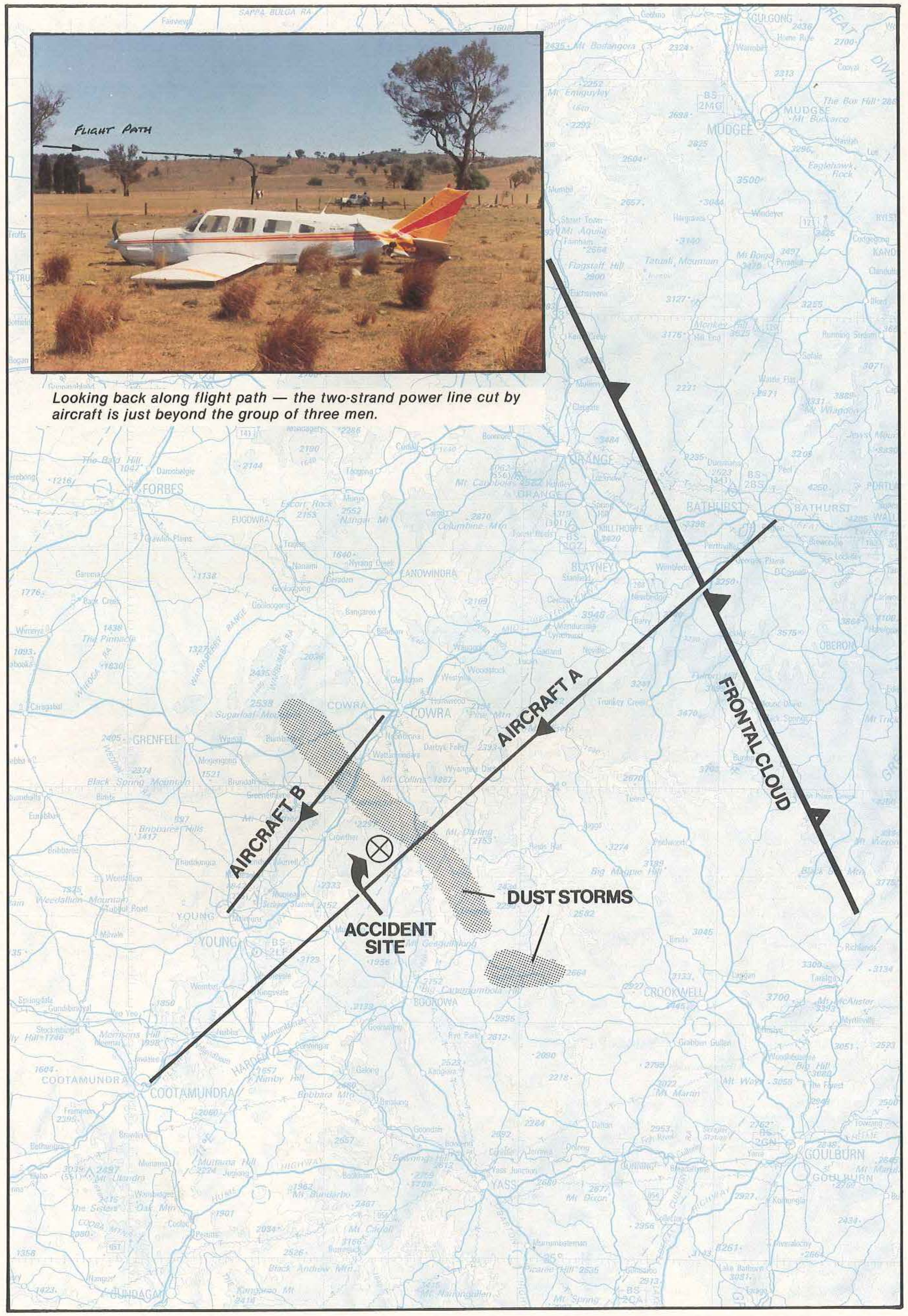
Very shortly afterwards, he found that conditions in the dust were precisely as reported, and he had to descend further to retain visual contact with the ground. Extreme turbulence made controlled flight difficult. As usually happens in weather-related accidents, the pilot suddenly realised that he was rapidly losing control of the situation. He found himself below 1000 feet AGL still descending and with the aircraft pitching and rolling violently.

Full power was applied, but it was too late: the pilot no longer had the capability of extricating himself from his frightening situation. With the stall warning horn blowing and 85 knots indicated on the ASI, the pilot called out to his passengers 'I've lost it!'. Shortly afterwards the aircraft sliced through a two-strand power line, hit the ground, bounced over a ditch and a road and slid through a fence before finally coming to rest on its belly. Remarkably, all six occupants escaped unscathed.

* * *

There is no need to labour the most important safety message here: the details of the accident graphically illustrate the folly of pressing on regardless of conditions. It does need to be said that, by and large, meteorological forecasts in Australia are very good; but this in no way absolves any pilot from reacting to actual rather than predicted conditions.

Two other safety-related points are worth mentioning. It was fortunate that nobody was injured, and even more so for one of the passengers who did not have his seat belt fastened and who was thrown out of the aircraft as the back door flew open on impact. Further, it was later established that the Cherokee had been 187.7 kg overweight on takeoff — a 12 per cent increase over the maximum allowable weight. The aircraft was still 88 kg overweight at the time of the accident, and this would have degraded the aircraft's climb performance when, with full power applied, the pilot was unable to gain altitude when he needed to do so to recover from the dangerous situation in which he had placed himself, his passengers and his aircraft ●



Looking back along flight path — the two-strand power line cut by aircraft is just beyond the group of three men.

Look closely, and spot the defect

Articles in the *Digest* often highlight the importance of conducting a thorough pre-flight inspection and the dire consequences of overlooking this critical part of flight preparation.

Despite appalling weather at Canberra and marginal weather at Mangalore, almost 100 pilots participated in pre-flight competitions conducted by the Bureau of Air Safety Investigation at the Canberra Aero Club Open Day in March and the Sport Aircraft Association's fly-in at Mangalore over Easter.

The competitions, which were sponsored by *Australian Flying,* challenged pilots to locate ten defects specially built into an aircraft. The pre-competition briefing for each participant explained that the aircraft had been daily and pre-flight inspected by the pilot-in-command and that the pilot was about to board the aircraft, start the engine and commence taxiing. However, each competitor was then advised that there were ten 'defects' which either made the aircraft unserviceable or unsuitable for flight and competitors were challenged to locate the items.

The aircraft used were a PA32-300 provided by Vee-H Aviation in Canberra and a PA28-140 provided by Mr Ian Dickson, a member of the SAAA, at Mangalore. The prize for the most correct entry for each competition was 2 years free subscription to *Australian Flying,* donated by the publishers of the magazine.

With two exceptions, the defects which were rigged into the two aircraft were the same, namely:

- tow handle left attached to the nose wheel;
- screwdriver in the engine compartment;
- port main wheel oleo flat;
- split pins missing from main cabin door hinge bolts;
- two screws missing from propeller spinner;
- nut and bolt securing anti-collision beacon lens missing;
- hydraulic leak starboard brake;
- loose HF antenna;
- wheel chocks left in place (corrosion starboard wing at Mangalore); and
- self-locking nut missing on starboard inboard flap hinge bolt (aileron hinge bolt at Mangalore).

The Bureau believes that the exercise was well worthwhile and nearly all participants, including those who decided against handing in their entries because they could not locate what they believed to be sufficient items, said that they would scrutinise aircraft a good deal more carefully in the future. Some participants in fact spent in excess of an hour checking the aircraft for the chance to win the prize. This raises the question as to whether they would spend the same amount of time undertaking a pre-flight to save their lives.

No one spotted all ten defects, but three at Canberra and one at Mangalore successfully identified nine. However, because the Canberra competition was plagued by intermittent thunderstorms, entrants who participated after about 1300 hours only had to locate nine items because the hydraulic leak was finally washed away! The Bureau passes on its congratulations to the winners: Mr Dave Johnson of Yarralumla, A.C.T., and Mr Michael Winton of Para Hills, S.A.

Participants have already been advised of the results and their own scores, but readers may be interested in the overall detection rates, which were as follows:

- tow handle 52%
- screwdriver 34%
- flat oleo 51%
- split pins 42%
- propeller spinner 72%
- anti-collision beacon 74%
- hydraulic leak 40%
- HF antenna 51%
- wheel chocks (Canberra) 33%
- corrosion (Mangalore) 5%
- self-locking nut aileron/flap 64%

The flying experience of the participating pilots varied from 1 hour to, in one case, 11 000 hours, although the average was in the range 130–200 hours. Individual results ranged from poor to excellent. Two 1 hour pilots successfully identified five defects while a 500 hour pilot located only one item.

While the defects were entirely detectable by an external visual inspection, participants needed to get down on their hands and knees to locate some of them. Those who failed to bend their backs missed the screwdriver (which was partly obscured by the propeller), hydraulic leak and self-locking nut.

Of the 51 per cent who spotted the oleo problem, many said that the starboard oleo was over-inflated rather than the port oleo being deflated. While the detection of an oleo problem was considered sufficient, how many pilots would have correctly identified the deficiency if both oleos were equally deflated?

Many pilots quite rightly identified other items which had not been rigged on the aircraft, such as dirty windscreens and nicked propellers. One intrepid aviator even suggested that he was concerned about the serviceability of the aircraft due to a small cobweb in the tailcone!

The Bureau believes the exercise was both rewarding and educational for those pilots who took part, but also wonders how many of the defects would have been located if the pilots were not advised of the number to locate and were advised to complete the pre-flight in the usual time spent on checking an aircraft — 5–10 minutes ●

Churchill Fellowships

The Winston Churchill Memorial Trust was established in Australia in 1965, the year in which Sir Winston Churchill died. The principal object of the Trust is to perpetuate and honour the memory of Sir Winston Churchill by the award of Memorial Fellowships known as 'Churchill Fellowships'.

The aim of the Churchill Trust is to give opportunity, by the provision of financial support, to enable Australians from all walks of life to undertake overseas study, or an investigative project, of a kind that is not fully available in Australia. This opportunity is provided in furtherance of Sir Winston Churchill's maxim that: 'with opportunity comes responsibility'.

There are no prescribed qualifications, academic or otherwise, for the award of a Churchill Fellowship. Merit is the primary test, whether based on past achievements or demonstrated ability for future achievement in any walk of life. The value of an applicant's work to the community and the extent to which it will be enhanced by the applicant's overseas study project are important criteria taken into account in selecting Churchill Fellows. However, Fellowships will not be awarded in cases where the primary purpose of the application is to enable the applicant to obtain higher academic or formal qualifications nor to those in a vocation which offers special opportunity for overseas study.

Churchill Fellows are provided with a return economy-class overseas air-ticket and an Overseas Living Allowance to enable them to undertake their approved overseas study project. In special cases they may also be awarded supplementary allowances including Dependants' Allowance. Fifty-one Churchill Fellowships were awarded for 1984.

All Churchill Fellows are presented, at an appropriate ceremony, with a certificate and badge identifying them as such. The certificate bestows upon the recipient the prestige of being a Churchill Fellow and, while a Fellow is overseas, serves to open many doors that would not otherwise be opened to a private individual. This could provide an opportunity for a member of the aviation industry to help others in aviation as a result of their endeavour and the assistance provided by a Churchill Fellowship.

Applications

The Churchill Trust is now calling for applications from Australians, of 18 years and over, from all walks of life, who wish to be considered for Churchill Fellowships tenable in 1986.

Completed application forms and reports from three referees must reach the Churchill Trust by 29 February 1985.

People wishing to be considered for a Churchill Fellowship should send their name and address now with the request for a copy of the Churchill Trust's information brochure and application forms to: The Winston Churchill Memorial Trust (M), PO Box 478, Canberra City, A.C.T. 2601 ●

Heat stress

As all Australian pilots would be well aware, Australia is a country of climatic extremes with temperature zones ranging from tropical to alpine environments. Associated with these zones are extremes of temperature, humidity and high solar (radiant) heat loads.

Everyone has experienced the discomfort of getting into a closed car which has been standing in the sun on a hot day. Driving in hot weather is unpleasant, tiring and generally leads to short tempers. Most importantly, it can degrade your driving performance. A burst of hot weather is usually associated with a spate of road accidents.

Have you ever considered that the same situation exists in your aircraft on a hot day? A combination of high ambient temperatures, clear cloudless skies, large expanses of perspex and the 'heat soaking' of the aircraft all lead to extremely high cockpit temperatures. 'Heat soaking' occurs when the aircraft structure approaches the ambient temperature. Under such circumstances surface temperatures in the aircraft may reach extremely high levels and the cockpit air temperatures may approach the radiant temperature.

One practical approach to this problem has been to specify that conditions in cockpits should be such as to maintain the skin temperature of the pilot as close to 33 °C as possible. This skin temperature is that which most people consider 'comfortable' or at which a sensation of comfort is reported. Unfortunately, given the limited capacity of current aircraft air-conditioning units and the extremely high temperatures reached in heat soaked aircraft, such specifications become for all practical purposes meaningless. Additionally, some aircraft were never designed to operate under such extremes of temperature, and a requirement that the cockpit temperature be maintained at 28 °C may be interpreted as (for example, under European design conditions) a requirement for an efficient heating as opposed to cooling system! Where efficient cooling units have been installed their power consumption may be such as to limit their use during the hotter regimes of flight, e.g. takeoff and landing.

These factors raise the obvious question of just how hot does it get in aircraft cockpits and what is the effect on the pilot? A recently conducted series of trials measured temperatures in aircraft cockpits and the body temperatures of pilots in Western Australia during hot, summer operations. While this study was aimed primarily at the problems of military flying under these conditions, the cockpit temperatures were the same as, or very similar to, those found in GA aircraft that have been standing on the ground or airfield heat soaking before use and those involved in low level, hot weather operations such as aerial application, aerial mustering or glider towing.

The rises in pilot body temperature which accompany high cockpit temperatures are of concern to all pilots flying under these conditions because increased body temperature can affect both the physiological well-being and the flying ability of the pilot.

The Western Australian research showed that the temperatures in the heat soaked aircraft cockpits were around 15-25 degrees higher than the outside air temperatures. This means that even on a relatively mild day, cockpit temperatures may be extremely high. For example, if the outside temperature was 25 °C, then the cockpit temperature of a heat soaked aircraft was anything up to 50 °C. Temperatures out on the tarmac were generally around 5 °C hotter than the temperatures reported by the meteorology people. (This results from the absorption of heat by the grey asphalt surface and the reflection of heat back from the tarmac.) Additionally, surface temperatures in the aircraft cockpits were very high. In some cases they were hot enough to cause burns if touched.

The hottest parts of all flights in the experiment were identified as ground standby prior to takeoff and within the circuit area before landing. Generally, cockpit temperatures peaked prior to takeoff and rose again as the aircraft re-entered the circuit area prior to landing. The highest cockpit temperatures were recorded at takeoff or landing.

The hottest phases of the flights therefore corresponded to high workload sections of flights, where the pilot had to pay maximum attention to the task in hand.

On all long, hot, low flights the body temperature of the pilots rose. The magnitude of this rise was 1-2 °C and was dependent on the average inflight temperature, duration of the flight and, to some extent, the mass of the pilot. One or 2° may not sound like much; however, your body is designed to operate within a very narrow temperature range and once the temperature goes outside this range, even by a small amount in either direction, the effects can be severe.

The most easily observable physiological response to the high temperatures was the degree of sweating by pilots. If pilots had completed several low, hot flights of around 1 hour duration each, then mass losses of the order of 5 pounds were common, despite the fact that they were encouraged to drink between sorties. This dehydration, caused by sweating, is important because it impairs both body temperature regulation and work capacity. If the fluid loss caused by sweating is not replaced (i.e. dehydration), less body water is subsequently available to sustain further sweating and sweat rates are accordingly reduced. Therefore, during dehydration, body temperature will be higher than normal because a reduced sweat rate lessens evaporative heat loss and the cooling capacity of the body.

The thirst mechanism is inadequate to prevent dehydration occurring. First, the mechanism only becomes operative when total dehydration exceeds 1 per cent of body mass. Second, only one-half to two-thirds of fluid loss is replaced voluntarily, e.g. a 155 pound person would need to lose 1.5 pounds before feeling thirsty and *only half this mass loss would be replaced by drinking* an amount sufficient to satisfy the feeling of thirst.

To minimise the effects of heat stress the pilot must remain fully hydrated and must therefore consciously force fluid intake past the point of feeling 'satisfied'. Additionally, fluids such as tea or coffee should be avoided as they are diuretics. (Diuretics are fluids which increase the level of water loss by increasing the urine volume and output. They merely add to the effects of any pre-existing dehydration.)

As a rule of thumb, it generally took the pilots about twice as long to cool off after a hot sortie as it did for them to heat up. This meant that if a flight lasted 50 minutes it took nearly 2 hours for body temperatures to return to resting levels. Adequate rest periods are therefore essential if sustained operations are to be undertaken during hot weather flying. Strenuous activity should also be avoided, as this also increases body temperature and the level of dehydration.

Recent overseas experience has shown that heat stress may compromise the 'hands-on' ability of the pilot to actually fly the aircraft. In a simulator study at the Royal Air Force Institute of Aviation Medicine at Farnborough, it was shown that subjects exposed to heat stress flew the simulator much less accurately and made control errors of greater magnitude than under non-heat-stressed conditions. Further, such control failures were characterised by their unpredictability.

Other simulator studies have demonstrated that increased body temperatures are associated with increased errors of speed, altitude and deviation from required flight headings. Heat stress may also cause a narrowing of attention and directly affect a student pilot's learning ability. Studies at the United States Air Force School of Aerospace Medicine have indicated that impaired pilot performance under heat stress is associated with new or emergency conditions in which previous practice would be limited.

High levels of skill may lessen the effects of heat stress on performance and affect skilled and unskilled workers to different extents. In addition, heat stress may also combine with the effects of other stressors such as fatigue, sleep deprivation, etc., to produce much more severe performance reductions than if each stressor was present in isolation. Under such circumstances the accident potential is increased and flying skills may be degraded without the pilot being aware of any changes in performance.

Pilots who are particularly vulnerable to the effects of heat stress are those operating continuously at low level in hot conditions where sustained attention and high levels of concentration are required, e.g. the agricultural pilot or the aerial mustering pilot. (Note that these kinds of operations are those which are also most susceptible to the effects of skill fatigue — see *Aviation Safety Digest* 121.) Consequently, while heat stress by itself may not be a sufficient stressor to result in an accident, if it is combined with the effects of dehydration, lack of sleep or fatigue, the accident potential may be increased.

Heat stress: the lessons for pilots

The lesson to be learned from all of this is that if you are flying in hot summer conditions, be aware of the potential for heat stress to affect your ability to fly the aircraft and do not ignore it.

- As a rule of thumb, temperatures in a heat soaked aircraft may be 15-25 °C higher than ambient temperatures.
- Remember that heat soaking may occur even on a cloudy day if your aircraft has been standing outside for a few hours.
- Even slight levels of dehydration may affect performance, and fluid intakes should be forced past the point where you feel you couldn't drink any more.

- Adequate rest periods are essential and strenuous activity should be avoided if sustained low level flying activities are to be undertaken in hot weather.

* * *

The following accident is believed to reflect the combined effects of lack of sleep, heat stress and strenuous activity levels during hot weather.

During aerial mustering operations, a helicopter pilot was flying from one mob of cattle to find another. He reported crossing a rocky ridge when he spotted cattle to his right and behind him. The pilot checked his RPM and executed a 30° bank turn to the left through 180° at 20 feet AGL and at about 60 knots.

After completing the turn, which put him downwind, the pilot felt the helicopter sinking. He applied power and collective controls but the aircraft, now flying downslope, was reported to be unresponsive and continued to sink, striking its tail rotor on the ground.

The chopper then rotated three or four times to the right and crashed heavily onto its skids.

In the absence of any detected contributory aircraft unserviceability, the following causes of the ground strike were considered:

Overpitching

The pilot reported that he did not check his rotor RPM during or after the turn (a necessity for low level operations), and especially when the sink was apparent. A decay in rotor RPM during the turn would cause a lack of collective response when attempting to counter the apparent sink and a persistence with full collective would rapidly induce an overpitch situation from which no recovery would be possible at low altitude.

Such an over-controlled response is characteristic of skill fatigue, where gross rather than fine movements are used to try to correct such situations.

On this day the pilot had been flying for 9.5 hours and 8 of these hours had been spent in aerial mustering activities. Aerial mustering requires high levels of sustained attention and flying skills, especially during low level operations in difficult terrain. It is likely, therefore, that the pilot may have been suffering, to some extent, from skill fatigue following a long period of mustering.

Judgment of ground clearance

When turning and flying downslope, the pilot would judge ground clearance from his forward view. However, the tail of the helicopter would be upslope at a much reduced ground clearance.

The previously mentioned research at RAF Farnborough demonstrated the association between heat stress and increased errors of controlling altitude, speed and flight headings. It is considered likely that heat stress may have affected the pilot's ability to accurately judge his ground clearance. Ambient temperatures during the muster were around 30°C. Under such circumstances cockpit temperatures may have been as high as 45–50°C.

On the day of the accident the pilot had drunk only one cup of sweetened tea, despite the long working day in the heat. On the day prior to the accident he had eaten only an apple and an orange. Dehydration must therefore be considered as an additional factor which may have affected his flying ability. Flying in hot conditions with the windows and doors open would have resulted in high and sustained water losses through the evaporation of sweat. It is likely, therefore, that the pilot's judgment criteria may have been altered without his being subjectively aware of any change.

While each of these factors in isolation may have been insufficient to result in an accident, the combined effects of operating long hours in hot conditions, fatigue, dehydration and the nature of the flying task contributed to the eventual accident ●

In brief

As the Boeing 727 started its approach to an airport in the U.S.A., the Tower advised that the weather had deteriorated from a visibility of about 2 miles with a cloud base of 800 feet to an RVR near 4000 metres with a cloud base of 100–300 feet. The First Officer was flying and made a good ILS approach, on centreline and on glideslope. At Decision Height the Captain called 'Approach lights in sight — continue the approach'. At about 150 feet the First Officer (still flying) looked up and although the approach lights were in view the runway was not yet in sight. Then the Ground Proximity Warning System (GPWS) glideslope warning came on and the glideslope deviation indicator started moving to a full fly-up command. With the pressure altimeter reading less than 100 feet the Captain called 'Go around'. This was initiated without further delay and with no incident. After the go-around the Tower reported that RVR had rapidly dropped below 2000 metres while vertical visibility had fallen to less than 100 feet.

The Captain later commented that the GPWS probably saved them from ploughing into the approach lights. As to the sudden increase in descent rate, this was the First Officer's first experience with rapidly deteriorating visibility during an instrument approach. He had read about the problem and seen films on the difficulties of transitioning from instrument to visual flight, but found the task of translating theory into practice a handful.

* * *

Almost immediately after takeoff, both engines of a Piper PA-23 lost power and a forced landing was made in a field. The aircraft had been refuelled from a ground fuel tank that had run dry during the process. A preliminary examination indicated that two of the drain sumps in the wings of the aircraft were clogged with foreign matter, probably from the bottom of the ground fuel tank ●