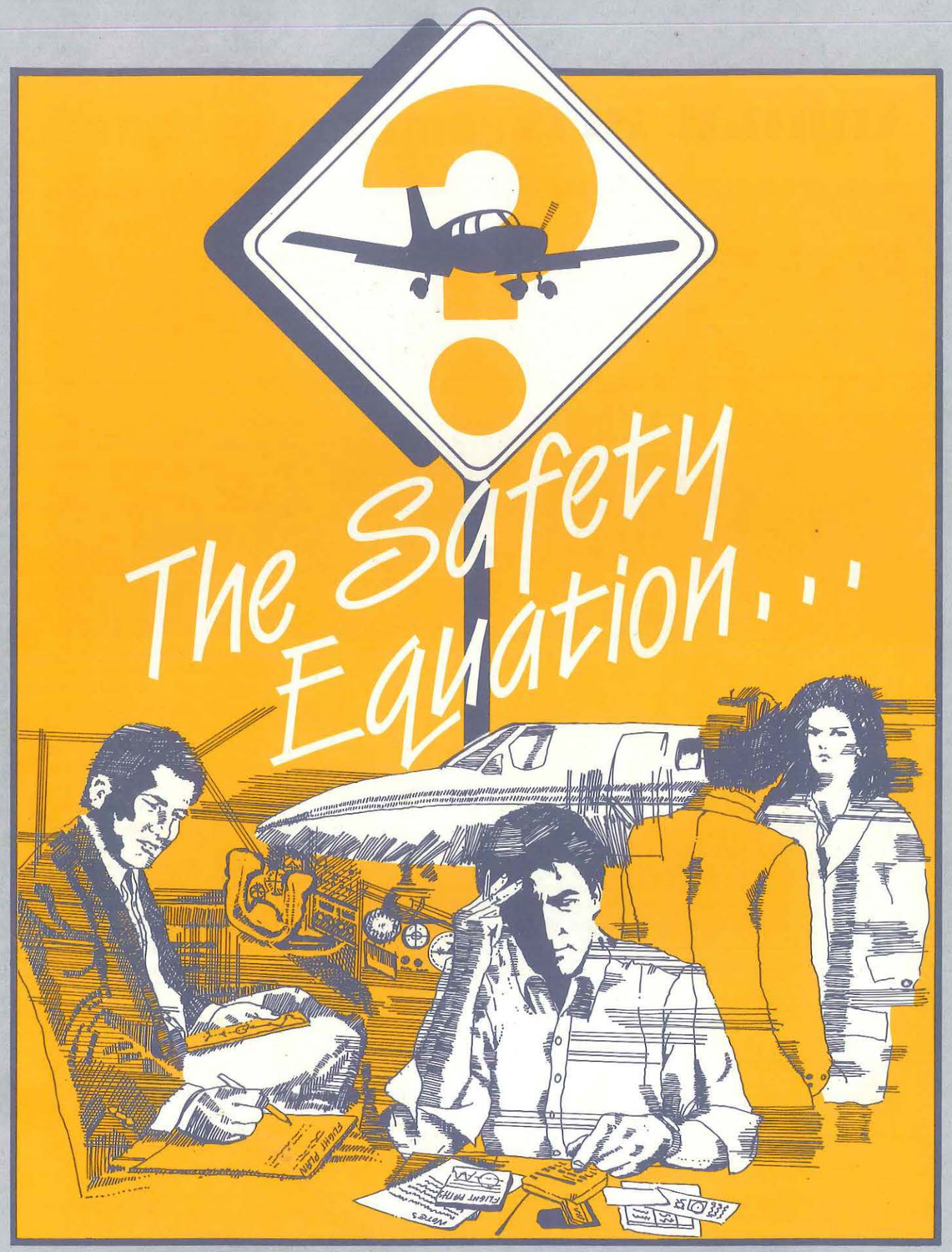

Knowledge + Preparation + Recency

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AUSTRALIA

Aviation Safety Digest

DEPARTMENT OF Aviation

ASD 130
SPRING 1986

Contents

The human factor
The single most important factor in aviation safety is the human one. To highlight its significance we have adopted a logo which will be used to link all items within this category. Logo design by David Robson.

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COVERS

Front. The cockpit environment is subjected to many stresses — as are the humans inside. Our cover design represents the disruption caused by physical, physiological and psychological stresses — stresses that can cause 'the human factor' to perform at less than optimum levels.
Back. Safety starts with the pilot. This poster identifies some of the important stepping stones which lead to safe flight.

Editorial

There has been much debate recently concerning situations where pilots call for assistance. It has even been suggested that pilots should not seek assistance in case they risk some form of disciplinary action. The concern of the GA community is understandable and at a joint AOPA/D.ofA. Pilot Safety Awareness Seminar at Coff's Harbour recently, it was evident that the subject was prominent in pilots' minds. As a consequence, I have asked the First Assistant Secretary, Flight Standards Division of the Department of Aviation, Mr Jerry O'Day, to respond formally on this important matter. Mr O'Day's statement follows this editorial.

It is encouraging to see the initiatives and responses taken by all sectors of the aviation community towards improved safety standards in General Aviation. The Pilot Awareness Seminars, the video 'Pilot — the human factor' and articles in the aeronautical press are generating discussion, argument and ideas. This is a positive effort which will benefit all of us.

To further promote the increasing awareness of the roles and limitations of the pilot-in-the-loop, a special issue of the *Digest*, to be published next year, will focus on 'The human factor'. Your contributions would be welcome.

The photographic competition run by the *Digest* during 1985 was such a success that many have asked for a re-run. I am happy to announce the competition is to be held again early in 1987 along similar lines to the previous one.

I hope that with your assistance, the *Digest* can continue to play an important role in accident prevention.

David Robson
(David Robson)
Editor

The policy on pilot immunity

I mentioned in the editorial for the July issue of the *Digest* that I would clarify the situation regarding immunity for pilots in circumstances where they call for assistance.

I am particularly concerned about suggestions that pilots should not seek assistance, because to do so could result in punitive action.

This is simply not true. The standing policy is that pilots are granted immunity from disciplinary action in situations where, because of navigational or other difficulties, they seek assistance from Air Traffic Services. This immunity applies regardless of whether or not the outcome involves entry into controlled airspace without a clearance.

You have my assurance that punitive measures will not follow an event of this nature provided those involved acted in good faith. In other words, provided they did not flagrantly ignore the rules or act without regard for the safety of others and that they were properly prepared for the flight.

There will be occasions when, despite proper planning and correct procedures, a pilot will get caught out. It may be that a contributory factor such as poor navigation, lack of familiarity with the aircraft or area, or even deficient flying techniques is discovered. In such circumstances the Department may propose remedial training or a flight check with the pilot's own CFI or with an Examiner. This action is not punitive. It is designed to assist the pilot in particular and the aviation community in general to maintain the required degree of operational safety. The Department would be remiss if it did not take such action. It is not a slur on the pilot concerned. It is a constructive procedure, aimed at restoring a safe level of competence and it is in this spirit that any such training or check will be conducted.

The policy exists to encourage pilots in serious difficulties to use whatever assistance is necessary to ensure safe flight and to do so without hesitation. It is important that such calls for assistance are made at the earliest possible time while adequate fuel and daylight remain, so that other traffic can be diverted to assist and so that adequate terrain clearance and weather avoidance can be arranged.

I urge you to take advantage of the Air Traffic Services without a second thought. Air Traffic Controllers and Flight Service Officers are there to assist you to complete your flight safely. They are keen to help.

However, as was highlighted at the Coff's Harbour Seminar, there can be a psychological barrier that sometimes exists which deters private pilots from calling for help or even from submitting a flight plan, for fear of making a mistake and feeling a fool or being rebuked by a Departmental officer. We must overcome this barrier. The way to do so is for pilots and Flight Service Officers to discuss their problems, ideas and procedures with each other on a regular and informal basis.

I am assured by my colleagues in Airways Division that approaches of this kind will be welcomed.

We all have the same aim: to enjoy a high degree of safety in our flying. To achieve this we must work together. If you need help, call for it.

I hope these comments will clear up any misconceptions that may have existed regarding the 'immunity' policy.

(Jerry O'Day)
First Assistant Secretary
Flight Standards Division

The pilot — cause or victim of the accident?

Professionalism in aviation requires that the pilot recognise and allow for his or her own capabilities and limitations and those of the aircraft as well as the influences of the environment. This professional attitude is a combination of knowledge, anticipation, skill and self-discipline. It begins in the student pilot as a combination of motivation and talent. It is developed by observation, by example, by training and by experience.

The pilot with this attitude becomes the fail-safe pilot. However, two influences remain which can threaten the predictable and safe conduct of his flying:

- the unexpected occurrence such as mechanical failure or extreme weather; and
- the relaxation of self-discipline and lowering of standards by factors such as lack of sleep, over-indulgence or the subtle influence of other humans.

Unexpected occurrences can be countered, or their effect minimised, by mental and physical rehearsal of emergency situations. (Simulators can play a significant part in these rehearsals.)

However, the relaxation of self-discipline and lowering of standards is an insidious process. The pilot may not even realise the effect on his or her skill or judgment though he or she will quite likely feel one symptom — stress — caused by a conflict of interests.

* * *

Stress one

The Cherokee was to be the second of three aircraft in an island-hopping shuttle flight. After loading, it was discovered that the aircraft had a flat battery. With some delay a battery-cart was borrowed and the aircraft was started using this external power source. Soon after takeoff, the first aircraft experienced radio problems and turned back to the mainland. Our pilot was now leading the shuttle (stress beginning).

At Prince of Wales Island, a group of Islanders was awaiting the arrival of the three aircraft to take them to Mer Island. Included in the group was a coffin containing the body of a recently deceased female Islander whose funeral was to take place on that island. The group was originally to have been transported to Mer Island on the preceding Wednesday but had been frustrated in their endeavours by the unserviceability of the scheduled aircraft. This delay had caused considerable annoyance to the funeral party and it had meant being ferried part of the way in a small boat — not a happy congregation.

Not surprisingly, the late-arriving Cherokee was greeted with less-than-open arms. The pilot was criticised for the delay and harassed by all and sundry. Uncontrolled efforts then began to pile as many of the group as possible, plus the coffin, into the Cherokee. These efforts were stopped by the pilot who informed the agents that, being in command of the aircraft, she would load it as she considered fit and proper. This attitude received a cool reception (more stress).

The two rear seats were removed and the coffin was loaded and secured. Then there was an uncontrolled rush to board the aircraft. Once again, the pilot had to exert her authority and inform the group that she would select the passengers to accompany the coffin. She therefore picked three children and three of the smallest adults and loaded them into the aircraft.

However, these problems had caused further delays and valuable time was passing (more stress).

After entering the aircraft and attempting to start the engine, the pilot discovered to her dismay that, once again, the battery was unable to perform its task. The passengers were disembarked and various attempts made to start the engine. These further delays caused more aggravation and discontent to the funeral party (more stress).

The engine was eventually started and the pilot had to remain in the aircraft while the passengers re-embarked. This caused the pilot further anxiety because of the manner in which all and sundry were milling around under no direct control by the agents and there was a consequent risk of someone walking into the spinning propeller. The pilot was also starting to feel the effect of the midday heat and she had not had any food or drink since the night before.

Eventually the flight departed for Mer Island. On the flight across the pilot had several things on her mind:

- There was sufficient fuel for the flight to Mer Island but she would have to return via Horn Island for fuel — this would further delay the remaining Islanders and hence cause more antagonism.
- She was undecided whether she should keep the engine running while unloading at Mer Island or shut down and risk a no-start. If the engine was kept running, the pilot would be faced with the problem of an excited party of Islanders unloading the aircraft, not under the control of any responsible person and with the consequent risk of injuries through a prop-strike.
- The aircraft was required back at Cairns that night to carry out a charter on the following day, which she was scheduled to fly.
- She was already tired, frustrated by the delays and feeling the psychological effects of the aggressive attitude of the passengers.

Under these conditions the pilot set up the aircraft for a final approach to land on Mer Island.

During the approach she found the aircraft's flight path descending below the level of the runway (the threshold was elevated above the surrounding terrain). Power was applied and while correcting the flight path, it also led to an excessive threshold speed. The aircraft touched down some 10 metres in from the threshold and bounced. The next touchdown was about 140 metres farther in. Full braking was applied but it became obvious the aircraft could not be stopped in the remaining runway distance. The pilot tried to ground loop but the aircraft slid sideways off the end of the strip, down a 40 degree embankment and came to rest against the trees some 8 metres below.

There were no injuries.

So we have an apparently misjudged and over-corrected landing approach. Under the circumstances, the pilot deserves an award for diplomacy and for resolve in controlling the events as well as she did. However, it would have been valuable to 'switch off' all extraneous thoughts when the 'downwind' checks were carried out. In this way the pilot could have devoted her undivided attention to the final approach — the most critical phase of flight.

With hindsight and with experience, it is possible to mentally condition ourselves in this way. You may have heard of 'load-shedding', which simply means putting aside non-relevant or lower-priority thoughts and concentrating on the task at hand. It is a form of mental self-discipline.

* * *

Stress two

Three passengers were to be flown from a rural property to Geraldton and return. At the last minute, the aircraft owner was not available and the pilot was asked to conduct the flight. She agreed and arranged to meet the passengers at the farm. She inspected the 'strip' (which was the road into the farm) but was concerned about the length and the width. The grass had recently been cut and baled and the bales were alongside the strip (stress beginning).

To ease her concern, the owner of the aircraft took off and completed a circuit to demonstrate the acceptability of the strip. Our pilot agreed to do the flight, but with some reservations.

The flight to Geraldton was uneventful. But after landing, the pilot felt unhappy about the weather and the strip she was to return to and tried to make arrangements to stay overnight in Geraldton. Unfortunately, one of the passengers had to return that night. Her car was at the strip and she didn't want to be late home.

The flight back was also uneventful but the pilot had many things on her mind:

- She was not happy about the forthcoming landing and considered diverting to a nearby airfield which was used regularly by the aero club and with which she was familiar and confident.
- The passengers' cars were parked at the strip.
- There was no telephone at the airfield to make alternative transport arrangements.
- Any delay caused by such a diversion was unacceptable to at least one of the passengers.

She elected to continue to the strip but she was hardly relaxed about it. On arrival, she carried out an airborne inspection. The windsock indicated a southerly at 5-10 knots. She would land into the wind but was concerned that the aircraft was heavy (half fuel plus four pax) and that the available strip length was marginal. Although the road that made up the strip was marked with tyres, the gravel road extended beyond the tyres for some distance at the approach end. She decided to land on the road short of the marked threshold to increase the landing run available (more stress).

The approach was normal, using full flaps. After touchdown on the gravel road, the aircraft moved to the left side and stayed there despite all efforts by the pilot to control it. This was the final straw in her decision to reject the strip. She decided to go around and divert to the nearby airfield.

The pilot applied full power. Almost immediately, the aircraft turned sharply left and headed towards a fence. To avoid impact, she pulled hard back on the control column and the aircraft staggered into the air, over the fence and touched down, left-wing first, in the paddock beyond. The aircraft swerved violently and the nosewheel snapped off.

There were no injuries.

(The cause of the pull to the left was a gully which trapped the left wheel. The cause of the sudden turn was the wheel hitting one of the tyres which marked the threshold.)

Again the pilot was pressured into a situation where an accident was almost inevitable.

The latter pilot had allowed the indecision to linger to the point where she was highly stressed. If at any point the sequence had been interrupted — by staying overnight, by diverting to the airfield or even by deciding to land at the strip and consequently preparing herself and the aircraft to ensure the best chance of a successful landing (i.e. minimum all-up-weight, practice approaches to explore the conditions, mental rehearsal of short-field techniques and finally trust in her own judgment and skill), then the stress would have been contained so that it could not interfere with flying the aircraft.

* * *

Remember all these stress factors are additive but only if they are allowed to be.

These pilots did not cause the accidents. But they did allow themselves to become victims of their circumstances. The first pilot was rightly assertive but allowed mental distractions to affect her concentration on the final approach. A landing can never be routine to the extent that your mind can be on other things. The latter pilot was not assertive enough despite her continuing concern about the landing.

A pilot-in-command must *take* command:

- of himself or herself (thoughts as well as actions);
- of the aircraft; and
- of the passengers and crew ●

Microbursts and Australian aviation

Based on a paper prepared and contributed by W. J. Grace and M. J. Hancy, Bureau of Meteorology, Adelaide, South Australia

Description of a downburst

As water from a kitchen tap spreads out horizontally when it hits the bottom of the kitchen sink, so a downward draught of air in the middle levels of the atmosphere will eventually become an outflow of horizontal winds if and when it reaches the ground. Such a downdraught is classified as a 'downburst' if these horizontal winds exceed 35 knots. The air spreading horizontally is known as the outward burst.

Near the ground the outward burst often has a violent lifting effect at the outer perimeter. Swirls of dust and leaves, and even roll-type clouds may be associated with the phenomenon. Frequently there is a loud roaring noise, similar to that of a tornado. In the worst cases, trees may be blown down and buildings destroyed. However, a downburst not strong enough to damage buildings may still present a significant danger to aircraft operations.

An idealised downburst in otherwise still air will produce a uniform, or radial outburst (Figure 1). If this downburst is moving horizontally, embedded in the overall wind flow, then the area affected by the outward burst will approximate an ellipse with the major diameter, or path length, being aligned with the overall wind flow (Figure 2). The lateral diameter is called the path width and would typically be about half to one-third of the path length, although occasionally the downdraught rotates as it descends causing the path width to be greater than the path length. As awareness of the phenomenon has increased, the number of observations have risen and surface damage patterns may also be studied. A downburst is now classified as a 'microburst' or a 'macroburst' according to the horizontal dimensions of the damaging winds.

Fig. 1

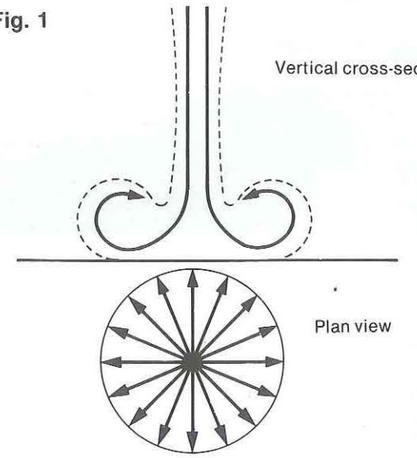
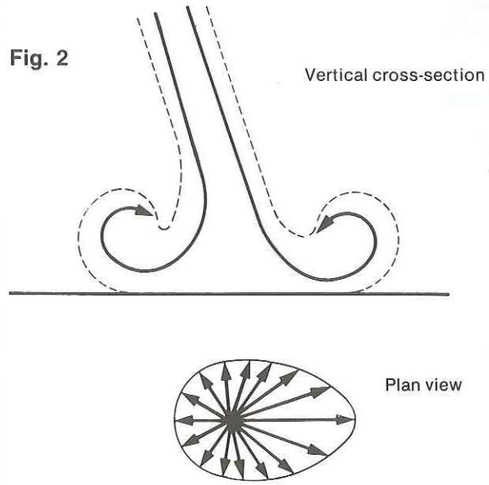


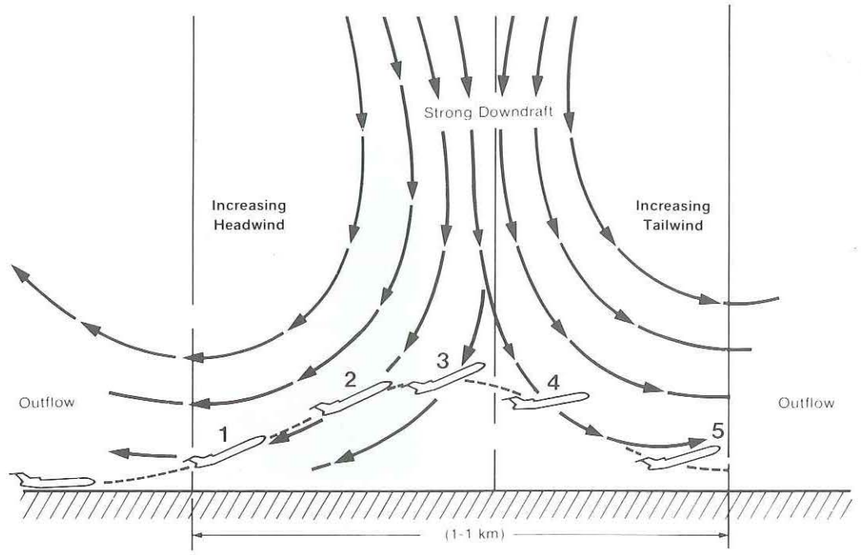
Fig. 2



Microburst

The terminology of microbursts was introduced in 1976 by Professor T. Fujita of the University of Chicago. A microburst is a downburst with horizontal dimensions less than 4 km, while the dimensions of a macroburst exceed 4 km. A typical microburst would have horizontal dimensions of 3 km, a lifetime of 10 minutes, and a horizontal wind differential or shear of approximately 50 knots. The vertical depth of the outflow is ordinarily between 300 m and 1200 m, or 1000–4000 feet. Since 1964 nearly 500 people have been killed throughout the world in accidents known to have involved microbursts. If an idealised microburst were centred over an aerodrome while an aircraft was making an approach to land, the pilot(s) would first encounter a rapidly increasing headwind which could raise the indicated airspeed substantially, encouraging the pilot to make a large power reduction. With reduced power, the aircraft would then quickly enter the huge downburst at the centre of the microburst, before passing into a tailwind of the same magnitude as the previous headwind (Figure 3). In these circumstances a go-around might not be successful, particularly if the downburst was encountered in heavy rain at the minima of say an ILS approach. Depending upon the particular circumstances, the performance of the aircraft could prove unequal to the demands of the situation and lead to an accident. An aircraft taking off into a microburst could be in even greater danger than in the landing case.

Fig. 3



A microburst situation: a heavy jet aircraft departing into a microburst experiences (1) improved performance (2) decreasing headwind (3) a strong downdraught and then (4) a strong tailwind. Position (5) could be reached prior to impact in a strong microburst. Since 1970 the U.S. National Transportation Safety Board has identified 15 airline accidents where windshear was a cause or contributing factor. In 12 of the cases the aircraft encountered a downdraught or microburst.

An Australian microburst and aircraft accident

A classic case involving this phenomenon occurred at Bathurst, New South Wales, in May 1974. An F27 engaged on a Regular Public Transport service entered the circuit area in generally fine conditions, with the surface wind reported as 5 knots from the north-east. Some rain was evident over the eastern sector of the aerodrome associated with a nearby active cumulus cell, and after descending through 300 feet above terrain the aircraft encountered heavy rain. A headwind component of 30 knots rapidly developed, the aircraft drifted well off the centreline, and with a wheel height of 50 feet a go-around was initiated. By this time the F27 had left the headwind and entered an area of rapidly increasing tailwind. Coincident with the change in wind direction the aircraft was also probably affected by a downdraught of at least 2.5 metres per second, and the F27 crashed 48 metres from the runway centreline (see photograph).

The BASI Inspector (Air Safety) in charge of the accident investigation was the first person in the world to perceive that this largely unknown phenomenon could be an accident cause, and it was later that the terms downburst and microburst became more widely known. The unpredicted behaviour of the air during the go-around at Bathurst had adversely affected the climb performance of the aircraft at a height too low to effect recovery, and the accident report gives this as the cause.

The investigation report on this accident aroused considerable interest overseas, particularly in the United States where scientific research into microbursts was being initiated. Professor Fujita of the University of Chicago researched the phenomenon at Stapleton International Airport in Denver, Colorado, in 1982–84, using high resolution Doppler radar and other equipment, and for the first time the characteristic airflow within a microburst was determined. This was known as the Joint Airport Weather Studies (JAWS)

project which, besides expanding our knowledge of microbursts, found that an average of 1.4 microbursts per day occurred in the study area.

Visual appearance of microbursts

Many microbursts observed during the JAWS program were not associated with thunderstorm activity, and were frequently seen in what appeared to be quite harmless conditions. Many microbursts were associated with light precipitation which evaporated before reaching the ground, a phenomenon known as 'virga'. Others were embedded in heavy rain and had an appearance closer to a pilot's traditional view of a thunderstorm. Another visual characteristic was the appearance of localised blowing dust at the surface as the downburst reached the ground. In dry and dusty environments this characteristic could provide valuable clues to pilots and enable them to stay well clear of a microburst. A rarer but more severe form of microburst is associated with intense or well-developed convective storms. Research into the development of microbursts in these situations is continuing.

Causes of microbursts

Amongst the mechanisms which may cause or contribute to the formation of a microburst downdraught the following have been proposed by researchers:

— cooling of air by the evaporation of falling rain
— cooling from melting snow or hail
— frictional drag from falling precipitation
— a highly localised alteration to the air pressure gradient within and adjacent to the developing microburst due to upper level wind effects
— deflection of air already in horizontal motion adjacent to the developing shaft of the microburst into the shaft itself

In addition it is possible that if the downdraught rotates as it descends, then its overall dimensions will be reduced and the outflow of air on the ground will be confined to a smaller area. Of the mechanisms which may initiate a microburst probably the most common is evaporative cooling. Since microbursts may or may not be associated with precipitation, they are termed either 'wet' or 'dry' microbursts.

Observation of a dry microburst in South Australia

In the late afternoon of 12 December 1982, members of the Murray Bridge Gliding Club observed and photographed a huge expanding ring of dust. The initial core of the downdraught was dust-free and estimated to be 600–700 metres in diameter, with the outer ring of dust estimated to 200–250 metres or 650–800 feet in both height and width. After a few minutes the dust-free core had expanded to about 10 km in diameter, while the outer ring of dust became higher, wider and more diffuse. The visual impression to the glider pilots was that of a huge explosion. Glider pilots flying in the area reported sink rates as high as 2000 feet per minute. No showers were reported in the area although some streaks of virga are evident beneath the mammatus cloud in the photograph.

Using Adelaide Airport upper air temperature soundings, the surface temperature at Murray Bridge and other data, meteorologists calculated that the cloudbase was 10 500 feet, the speed of the surface outflow was 35 knots, and the downward velocity achieved was 3000 feet per minute. It was also estimated that the time taken from initial formation of the downdraught at cloudbase, through the microburst stage to decay required 10–12 minutes.

At the present time theoretical calculations indicate that the maximum speed which could occur in the surface outflow air is 49 knots. An aircraft flying through a microburst of this magnitude would therefore experience a horizontal windshear of 98 knots. Calculations also indicate that theoretically the maximum attainable downburst velocity could be 3500 feet per minute. The maximum wind differential observed in a sample of 70 microbursts from the JAWS project was 93 knots:

shear terror!

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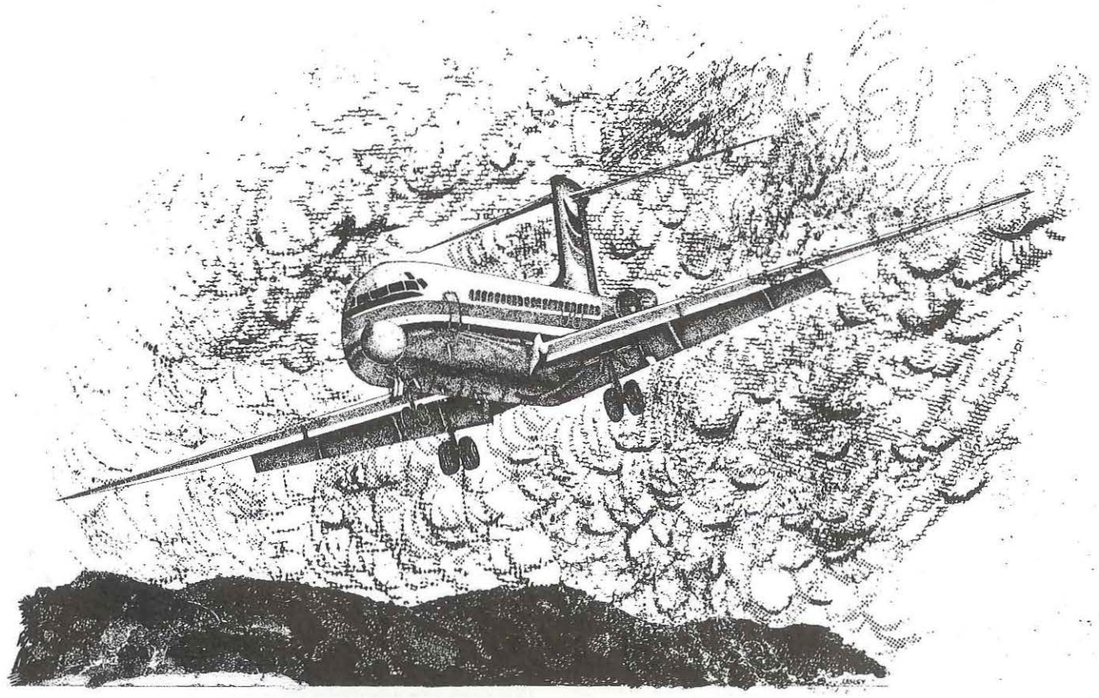
Cockpit communication breakdown



A DC-9 designated Flight 183, operated by an American company, took off in the mid-afternoon with 51 passengers, bound for the Detroit Metropolitan Airport. The weather forecast was typical for summer, including a prediction for 'quite a few scattered afternoon and evening thunderstorms, possibly severe'. En route weather verified this forecast. About 90 miles from Detroit the crew detected scattered thunderstorms, most of them west of the airport.

Tuning in the Automatic Terminal Information Service (ATIS), they received information 'Charlie', giving scattered cloud at 4500 feet, visibility 7 miles, surface wind 280/13; Instrument Landing System (ILS) approaches were being used for runways 21L and 21R. As the DC-9 approached the airport the crew observed a thunderstorm 7 miles in diameter, just to the west.

The crew began an ILS approach to 21R, and at 1650 hours Eastern Standard Time (EST) they descended first to 3000 feet, then 2600 feet. While in the descent they entered a near-solid cloud deck. The flight crew continued to observe area thunderstorms on radar, noting that a thunderstorm west of the field produced the strongest returns. As they discussed its location 10 nm away, the controller announced, 'Metro visibility is two miles'. A Learjet on an ILS approach to runway 21L at the same time asked the controller for a weather update. The controller responded with current conditions, including: '. . . thunderstorm in progress'.

The captain of Flight 183 understood the discussion related to weather at the airport, but since the Learjet was landing on runway 21L he assumed the information did not apply to runway 21R. The first officer later said he could not determine the thunderstorm's location from the discussion. Neither pilot requested additional weather information. At 1653 hours, the crew discussed missed approach procedures for runway 21R, and their concern about the thunderstorm west of the field. As they talked, the controller announced airport visibility had decreased to one mile. The first officer stated later he observed cells on their final approach path, but did not consider them an impediment to landing. The crew tuned in the local tower frequency and heard: 'Winds are 320 degrees at 26, peak gusts 36, north boundary winds 270 degrees at 16, east boundary winds 310 at eight, south boundary winds 290 degrees at 22'. The flight crew stated they recalled the transmission but did not consider it a wind shear alert. The captain said the transmission indicated rapidly shifting winds, and the first officer said he thought it was merely additional wind data. At 1655 the captain said 'It's going to get choppy. . . here in a minute . . .'

Flight 183 then broke out of the clouds momentarily, and the crew could see a low grey-white layer of clouds

along the localiser course to 21R. At 1655 hours, the first officer called, 'Runway approach lights in sight'. At this time the controller stated that she observed the airport visibility had dropped to one-quarter of a mile because of rain. Flight 183 entered the low-lying clouds about 350 feet above the ground, and simultaneously encountered heavy rain, hail and turbulence.

The captain lost sight of the runway environment and immediately started a missed approach. He called for gear up, advanced the throttles to the mechanical stops and rotated the aircraft to a 15° nose-up attitude. He noted the indicated airspeed increased to about 140 knots. After passing the middle marker, the aircraft flew out of the rain and hail shaft and the pilot saw the runway. He felt the aircraft was still descending and contact with the runway was inevitable. The captain then ordered: 'Down the gear, down the gear'. Following this command, he pushed the nose over to ensure a level touchdown, and pulled the thrust levers back to reduce power.

The DC-9 landed at 1656 hours, about 2000 feet beyond the threshold of runway 21R, with its gear partially extended. The aircraft skidded about 3800 feet on the runway before sliding into the grass on the left side of the runway. There were no fatalities or serious injuries, although three crew members and seven passengers suffered minor injuries. The DC-9 was severely damaged.

Analysis

The National Transportation Safety Board (NTSB) focused their investigation on the factors impinging on the pilots' decision-making processes and flying abilities.

Weather. The DC-9 flight crew observed a contouring cell about 5–8 miles west-south-west of Detroit. This storm was not reported via ATIS because of the rapid development of the storm cell and the ground clutter on the Detroit radar which prevented the observer from receiving a true radar picture of the airport proper. The captain of another aircraft just behind Flight 183 saw a cell of 'significant intensity' moving across the northern portion of the field via his weather radar at the time of the accident.

The Detroit National Weather Service (NWS) station visually observed a thunderstorm three miles west of the field at 1635 hours.

The Board concluded the thunderstorm which affected Flight 183 was part of an area of scattered cells which were observed as early as 1615 hours by pilots and ground observers. The thunderstorm, which was over the airport at 1656 hours, intensified rapidly as it approached the field from west to east. The Board further concluded the storm was of VIP (Video Integrator Processor equipment) level 4 and travelling at about 30 knots. The VIP level was confirmed by a 1730 hours weather radar observation and the associated heavy rain, ¾-inch hail, and wind gusts up to 42 knots. The centre of the cell passed over the approach end of runway 21R, which placed the rain and hail shaft in the path of Flight 183.

Aircraft performance. Analysis of flight data recorder information revealed conclusively the aircraft was subjected to wildly divergent winds characteristic of microbursts as it passed through the heavy rain and hail. It confirmed the captain's assessment of the airspeed increase to 143 knots followed by a rapid decrease to 119 knots. The data clearly indicated, however, that the aircraft remained in level flight, even as the airspeed decayed. Yet even with maximum power the aircraft did not achieve a positive climb rate. In fact, the airspeed decreased at a rate of two knots/second. (In no-wind conditions, the aircraft would have been accelerating at about four knots/second rate.) This revealed a severe wind shear with an actual wind change of about six knots/second. The NTSB concluded that the pilot probably averted a catastrophe by initiating the go-around. As the aircraft flew out of the rain and hail shaft, the pilot perceived a decrease in airspeed and a continued descent.

The captain was the victim of a visual illusion. As the aircraft emerged from the weather, his visual cues increased rapidly, giving him the sensation he was approaching the ground. Meanwhile, the cockpit instruments available to both pilots showed level flight. Given the captain's perception of the circumstances, his decision to lower the gear and reduce power was appropriate. The flight data recorder, however, showed that even when he reduced power, the IAS actually increased, supporting the hypothesis that the DC-9 had penetrated the severe wind shear and had achieved climb capability when it struck the runway.

The NTSB felt a well-trained, alert captain should have been aware that the aircraft would resume positive performance after exiting a microburst. They felt the captain should have continued the missed approach once he initiated one. By reducing power, however, the pilot committed the aircraft to landing before the gear was down. The Safety Board felt the pilot's knowledge that he was over the runway should have mitigated his concern about possible ground contact after the landing gear was down during the continued missed approach.

VIP levels

	Echo intensity	*Rainfall rate (in./hr)*	*Indication*
1	weak	0.2 (light)	Light to moderate turbulence is possible with lightning.
2	moderate	0.2–1.1 (moderate)	Light to moderate turbulence is possible with lightning.
3	strong	1.1–2.2 (heavy)	Severe turbulence possible, lightning.
4	very strong	2.2–4.5 (very heavy)	Severe turbulence likely, lightning.
5	intense	4.5–7.1 (intense)	Severe turbulence, lightning, organised wind gusts.
6	extreme	7.1 (extreme)	Severe turbulence, large hail, lightning, extensive wind gusts and turbulence.

Therefore, rather than reduce power and commit himself to a landing before the landing gear was fully down, the Safety Board believes that the proper decision would have been to continue the missed approach even after the landing gear was lowered and even if a 'touch-and-go' on the runway proved necessary to prevent further loss of airspeed.

The Safety Board felt, in this instance, that the overriding factor which should have affected the pilot's decision was the location of thunderstorms near the airfield. The crew was aware a thunderstorm was no more than five miles west of the field, probably closer, as they reached the outer marker. They were also aware that the thunderstorm was affecting the wind conditions at the field. Given this information, the Board felt the crew should have been aware they would enter thunderstorm-related weather conditions if they continued the ILS approach to runway 21R, and therefore the captain's decision to continue was inappropriate.

Cockpit management. A lack of preparation and anticipation characterised the flight crew's management of the final portion of the flight. While the crew accomplished all required actions, they did not discuss the special situation they were in. The crew made no requests for any of the following: weather updates (despite obvious discrepancies between reality and the ATIS), clarification of the wind data provided (despite confusion as to its significance by both pilots), clarification of the location of a known thunderstorm (despite its obvious proximity).

Further indications of the flight crew's unprepared state included flying the DC-9 into the centre of a thunderstorm; lack of anticipation of thunderstorm-related weather; and lack of recognition of these phenomena at onset. The result of this lack of preparation was confusion in the cockpit — the decision-making process broke down. The captain's belief that he was being 'pushed down' was actually a decrease in airspeed, not a loss of altitude. His perception of imminent ground contact was overwhelming and went unchallenged, despite the fact the aircraft instruments worked properly and were available to both pilots. The pilot's decision to land was based on his 'seat of the pants' interpretation of the events, not the actual situation.

The Safety Board also pointed out that the first officer failed to support the captain, save mandatory checklist items, nor did he provide any information. In fact, he did not question the information he had, even though he was unsure of its significance. The Safety Board felt the first officer should have been more aggressive in resolving his concerns about the existing conditions, and should have voiced his concerns to the pilot. His uncertainties should have led him to discussing the feasibility of abandoning the approach. In this mishap, the NTSB saw little indication of leadership from the captain, nor any crew augmentation from the co-pilot.

This mishap clearly highlights the necessity for aircrew assertiveness and co-ordination training — e.g. cockpit information management training. The NTSB feels training in crew co-ordination and decision-making should be required for all crew members as these skills are essential for the safe operation of aircraft.

Conclusions

The NTSB had 27 findings in this mishap. The following nine are the most directly related to the causal sequence:

1. A VIP level four thunderstorm passed over the northern portion of the airport and the threshold of runway 21R as Flight 183 approached decision height.
2. The flight crew had sufficient information upon which to make a decision to start a missed approach before entering the thunderstorm.
3. The aircraft was flown into the thunderstorm before a missed approach was started, and the missed approach was initiated as the aircraft passed through the centre of the rain and hail shaft.
4. The aircraft's rate of descent was stopped by the initiation of the missed approach, and the aircraft was flown at a constant altitude for about 16 seconds.
5. The aircraft was capable of maintaining level flight during the missed approach.
6. The captain's belief that the aircraft would not climb was influenced by the incorrect perception of information, and the physical consequences of entering the thunderstorm cell, i.e. the rain, hail, and effect on the aircraft's pitch attitude.
7. The captain elected to land the aircraft when he saw the runway, although the aircraft may have been capable of continued safe flight.
8. There was inadequate crew co-ordination and management during the instrument approach and missed approach.
9. The first officer failed to assist the captain to the fullest extent possible under the circumstances by not voicing his uncertainty about airport weather conditions.

Probable cause

The National Transportation Safety Board determined the probable cause of the accident was inadequate cockpit co-ordination and management, which resulted in the captain's inappropriate decision to continue the instrument approach into known thunderstorm activity where the aircraft encountered severe wind shear ●

Adapted from NTSB/AAR-85-01 by The Mac Flyer

Flexibility

Frankfurt Approach: 'Lufthansa 343 expect an ILS approach to runway 25 Left'.
Lufthansa 343: 'Oh, that's a pity!'
Frankfurt Approach: 'Why?'
Lufthansa 343: 'Well, we had actually prepared for an ILS approach to runway 25 Right, but it doesn't matter, we'll take 25 Left. We are flexible'.
Frankfurt Approach: 'So are we. Expected runway 25 Right'.

Assessing the conditions

The Terminal Aerodrome Forecast (TAF) can be a valuable indicator of what to watch out for. It is then the pilot's responsibility to judge the actual conditions.

A Piper PA-23 on a charter flight arrived at an island airstrip to find a heavy rainshower overhead the destination. The pilot orbited for about five minutes a few miles south-west of the island while the squall passed. When the airstrip became visible he began an approach to runway 32. He did not check the windsock until the Aztec was on a very wide base position, at which time he estimated the wind as coming from the north-east quarter at about five knots. The approach was continued using a planned threshold speed of 80 knots.

Touchdown was made left of centre in the first quarter of the strip. About 300 metres in from the threshold this strip has a 'hump'. Braking was commenced well before this was reached. As the PA-23 passed over the hump the pilot noticed that the more level section of the strip had extensive areas of water lying on it.

At this stage he felt the Aztec's brakes lock and thought that the deceleration was less than expected. Passing the windsock (which was about two-thirds of the distance down the strip), the pilot noticed that it was now indicating a tailwind component for runway 32. With the airspeed indicator still showing 45 knots, he began to doubt that he would be able to stop the aircraft in the distance remaining. The possibility of groundlooping the Piper was briefly considered and rejected in favour of a go-around.

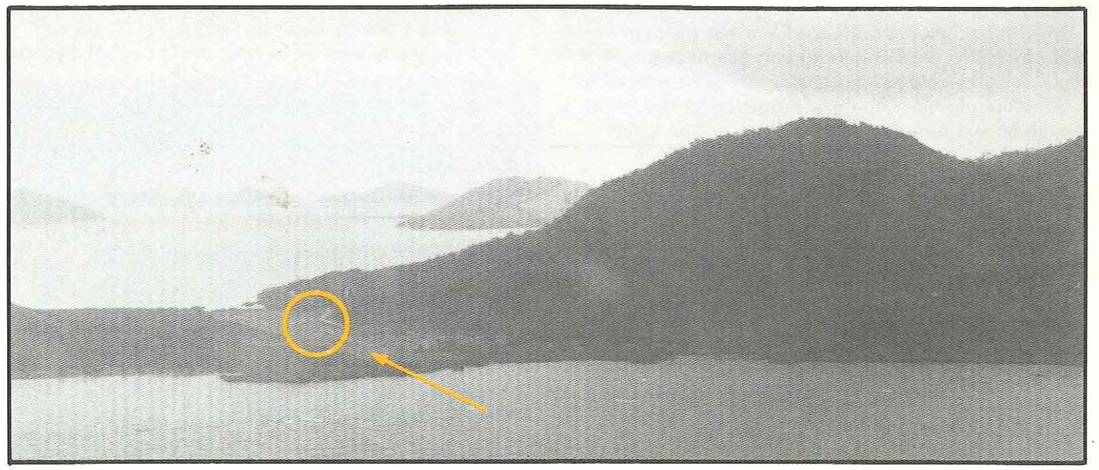
Power was applied and the aircraft eventually became airborne two metres beyond the marked end of the strip. Full flap was still selected. The nosewheel struck a glancing blow on the top of a 1.3 metre-high fencepost 45 metres past the marked end of the strip. This caused the nosewheel to be offset 90 degrees to the airflow. The pilot heard the noise of the impact and, once he had established a safe flying speed, checked the engines and confirmed that they were operating normally. He concluded that he had not hit anything with the propellers, but rather with the undercarriage. He therefore decided to leave the wheels down and complete the flight back to his home base. However, shortly afterwards, he retracted the gear to increase the rate of climb. The 'gear down' green lights extinguished but the 'gear up' light failed to illuminate. The pilot looked at the mirror on the engine cowling and observed that the nosewheel was still down but was slightly back from its normal position.

On arrival at home base he carried out a flypast for visual inspection. It was confirmed that the mainwheels were fully retracted but the nosewheel was down and cocked about 90 degrees. The undercarriage was selected 'down' and extended normally and three greens were obtained. However, during the landing the nosewheel collapsed on contact with the runway.

Investigation

A TAF was not obtained by the pilot before the flight. The forecast wind for the strip in fact was 110/16, which would predict a tailwind component of 14 knots on runway 32. Of course, a forecast can be one thing and actual conditions another; nevertheless, a knowledge of the overall pattern is helpful in making assessments of the weather and trends. In this case, the rainshowers in the area were expected to influence landing conditions. Not only was there a forecast possibility of water on the grass strip but also substantial variations in wind speed and direction were likely to be associated with the squalls.

The forecast was an accurate warning of the expected conditions and in light of this warning, the pilot's inspection of the runway and assessment of the wind seems a little cursory ●



Airstrip from position at which pilot checked windsock (circled). Landing direction is arrowed.

AIRFLOW

Feeling a little query?

The AIRFLOW column is intended to promote discussion on topics relating to aviation safety. Input from student pilots and flying instructors is particularly welcome.

Anonymity will be respected if requested. 'Immunity' applies with respect to any self-confessed infringements that are highlighted for the benefit of others.

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Aircraft accident reports

Second quarter 1986

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.

Preliminary data indicate aircraft type, location of accident, month and year, category of flying, pilot licence and rating, and total hours.

Preliminary reports

The following accidents are still under investigation

Cessna A188B-A1, Chinchilla Qld, Apr. 86, Aerial agriculture.
The pilot reported that during a crosswind spray run along a fence line the left wing struck a tree. Despite extensive damage to the wing, the aircraft remained airborne and the pilot was able to land the aircraft at the departure strip, some 3 kilometres away.

Beech 95-C55, Coolangatta Qld, Apr. 86, Instructional — dual.
Prior to landing, the gear was selected down and a normal gear down indication obtained. The touchdown was normal but when the airspeed was reduced to about 65 knots, a vibration similar to a wheel shimmy developed. Attempts were made to keep the aircraft straight with brake and rudder but when it was realised that the right maingear was not supporting the aircraft, the right engine was shut down. Investigation revealed that the uplock bracket spring had become detached from the uplock bracket. This, along with some corrosion and stiffness in the bracket attachment bolt, caused the bracket and uplock not to be withdrawn during the extension sequence. As a result the extension rod was bent during the extension cycle and the right gear did not extend.

Victa 100, Michelton Vic., Apr. 86, Non-commercial — pleasure.
The pilot reported that the aircraft brakes were serviceable prior to departure. However, during the landing roll the brakes did not operate and aircraft overran the strip and ran through a fence.

Cessna 180K, Caramut Vic., Apr. 86, Non-commercial — pleasure.
On arrival at his destination, the pilot overflew the homestead to indicate that transport from the nearby strip was required. The aircraft was then seen apparently following a gully containing a sunflower crop in which the pilot and passenger were partners. Shortly afterwards the sounds of an impact were heard. The aircraft was found to have struck the side of the gully while in a steep nosedown attitude and probably rotating to the right.

Transavia PL12, Seymour, Vic., Apr. 86, Aerial agriculture.
The pilot had been spreading in the general area of the strip for most of the afternoon. When he commenced operations on a paddock to the south of the strip an area of sink was experienced on approach. To allow for this on following flights, he reduced the weight of the load to be carried and another six flights were completed successfully. As the pilot was turning the aircraft to align it for the next run, he encountered an area of sink and turbulence. Realising that the aircraft would not clear a line of trees, the pilot continued the turn to the left but the angle of bank suddenly increased and the nose pitched down. The pilot dumped the load and applied right rudder but the aircraft struck the ground heavily.

Cessna 210L, Mt Hotham Vic., May 86, Non-commercial — pleasure.
At about 200 feet above ground level on final approach the pilot noticed kangaroos near the threshold. He adjusted the approach to fly over the animals but the aircraft was subsequently landed heavily about four metres to the right of the centre of the strip. The aircraft slewed to the right and struck a windrow. The right maingear and nosegear folded and the aircraft slid to a halt 105 metres after the point of touchdown.

Cessna 210N, Wingelinna W.A., May 86, Non-commercial — business.
The aircraft arrived in the circuit area in the late afternoon. The pilot assessed that the prevailing wind would make it necessary to land into the sun on strip 29. The aircraft touched down on the left side of the strip and the pilot looked out of the left window in an attempt to keep the aircraft aligned with the strip. However, he did not see three half 200-litre steel drums that were located 14 metres off the left side of the strip and the left mainwheel struck one of these drums. The left maingear folded and the aircraft slewed to the left and became entangled in the perimeter fence before coming to rest.

De Havilland DHC-2, Cooma N.S.W., May 86, Aerial agriculture.
During the takeoff roll, the left mainwheel struck a tyre which was being used as a strip marker. The tyre deflected into the tailplane; however, the pilot did not feel the impact and discovered the damage at the conclusion of the flight. An inspection indicated that the tyre had been moved from its normal position prior to the impact, and was hidden from the pilot's view by the long grass on the strip.

Beech E33, Bandana Qld, May 86, Non-commercial — pleasure.
Prior to the flight the pilot ascertained that the strip was serviceable, although rain had fallen in the area. The previous aircraft had landed without difficulty. However, as the pilot of VH-ENU applied braking after touchdown, the aircraft began to slide. The pilot considered carrying out a go-around but elected to continue with the landing. The aircraft overran the strip and travelled 67 metres before stopping.

Avions Pierre Robin R-2160, Camden N.S.W., May 86, Instructional — solo (supervised).
The pilot had been briefed to carry out her first period of solo aerobatic manoeuvres. The period was to include spins, loops, rolls, stall turns etc. About 30 minutes after departure for the aerobatic training area, the aircraft was observed at a relatively low altitude, spinning or spiralling towards the ground. The rotation continued until the aircraft collided with a group of large trees and fell to the ground.

Cessna 182, Durham Downs Qld, May 86, Non-commercial — aerial mustering.
The pilot had only recently arrived in the area and had not operated from this strip previously. On his first takeoff from the strip he decided to conduct a short-field takeoff. The aircraft became airborne after a ground roll of about 250 metres but after travelling a further 110 metres, the wingtip struck the ground. The aircraft landed heavily and ran off the side of the strip. The pilot continued with the attempted takeoff and the aircraft travelled a further 325 metres before the takeoff was abandoned when the aircraft struck trees.

Piper PA23-250, Essendon Vic., May 86, Instructional — check.
The pilot was carrying out a preflight inspection of the aircraft in preparation for an instrument rating flight test. He had selected the flaps down, and began operating the hydraulic hand pump to extend the flaps. After a few pump cycles, the right maingear collapsed and the pilot then noted that the gear selector was in the up position. Initial investigation revealed that the anti-retraction valve, which is designed to prevent gear retraction on the ground, was unserviceable.

Beech 58, Crooble N.S.W., May 86, Charter — passenger operations.
At the completion of one leg of the flight, the passengers disembarked and the pilot prepared to ferry the aircraft to another aerodrome in preparation for the next day's flying. The strip in use was constructed of crushed limestone laid on black soil. The pilot taxied onto the black soil at one end of the strip as he prepared to carry out a 180 degree turn to line up for takeoff. The nosegear entered a hole about 150 millimetres deep, and collapsed.

Transavia PL12, Bunbury W.A., June 86, Aerial agriculture.
The pilot was engaged in spreading fertilizer on a forest. The airstrip being used was in a valley and to fly to the area of operation the aircraft had to cross a ridge line. As the aircraft approached the ridge the pilot stated that he noticed that the aircraft was descending; he applied full power and jettisoned the load. However, the stub wing of the aircraft struck some tall trees below the top of the ridge and a short distance later the forward flight of the aircraft was arrested when it collided with a large tree. The aircraft slid down the tree and became wedged between it and two other trees. The pilot was able to evacuate himself from the wreckage and walk to the airstrip.

Cessna 172M, Mt Surprise Qld, June 86, Aerial mustering.
The aircraft was being flown at about 900 feet above ground level while the pilot spotted horses for a programmed muster. When the pilot attempted to increase engine power he found that there was no response to throttle movement other than a decrease in power to idle. The pilot was unable to correct the situation and selected the best available area for landing. This area was covered with small basalt boulders. On touchdown, the left wing struck a small dead tree and the propeller struck the ground before the aircraft came to rest.

An inspection of the aircraft revealed that the outer throttle cable had come loose from the clamp at the engine. This allowed power to be reduced but not increased.

Beech C23, Echuca Vic., June 86, Instructional — solo (supervised).
The pilot was conducting a series of circuits and landings following a period of dual instruction. During one of these landings the aircraft landed heavily and bounced several times. The nosegear and propeller were damaged before the aircraft was brought to a halt.

Cessna A152, Parafield S.A., June 86, Non-commercial — practice.
The pilot had intended to carry out aerobatic practice in the Dry Creek Aerobatic Training Area. After departure, the pilot requested, and was cleared, to operate in the Dry Creek area up to an altitude of 3500 feet. The aircraft was then observed to be spinning and crashed into a salt-evaporation pan.

Piper PA-32-RT300, Fraser Is. Vic., June 86, Non-commercial — pleasure.
The pilot was approaching to land into the south. The wind at the time was from the south-west and gusting to about 30 knots. The first half of the strip was sheltered from the wind by a solid line of tall scrub and trees. The aircraft did not touch down when the pilot flared for landing and a go-around was initiated. At a height of about 10 feet and passing abeam of the sheltered area, the aircraft suddenly moved violently to the left. The nose dropped sharply and the nosewheel dragged on the ground for some 10 metres before the pilot was able to continue the go-around. A diversion to a more suitable aerodrome was made, where a post-landing inspection revealed that the nosegear had been bent sideways by the previous ground contact.

Cessna 210L, Ascot Vic., June 86, Non-commercial — pleasure.
The pilot's flight plan indicated that he would reach his destination 20 minutes before last light. During the flight this estimate was amended to 7 minutes before last light. As the en route weather was satisfactory, the pilot proceeded as planned. However, about 10 kilometres from the aerodrome, rain showers and deteriorating visibility were encountered and the pilot did not consider it safe to continue. There was insufficient daylight remaining to reach the planned alternate aerodrome, and the pilot elected to carry out a precautionary landing on a sealed stretch of road. The aircraft touched down normally, but then began to drift to the right. A go-around was initiated, but the tailplane struck a fence post. The force of this impact almost tore the tail section from the aircraft. The pilot felt the impact but was unaware of the extent of the damage until after he landed the aircraft in the adjoining paddock.

Piper PA-24-250, Barraba N.S.W., June 86, Non-commercial — pleasure.
The aircraft arrived at the destination strip about 40 minutes after last light. Weather conditions in the area were good, with light winds and clear skies; however, the night was very dark and there was no visible horizon. Witnesses on the ground reported that the aircraft seemed to be at a normal height on the crosswind leg and as it turned into downwind. However, it was then seen to enter a gradual but steady descent. About half-way along the downwind leg, the lights of the aircraft were lost to sight. The aircraft impacted the ground in a stright-and-level attitude, bounced 118 metres, and then bounced and skidded for a further 216 metres before coming to rest.

Piper PA-60-600, Bankstown N.S.W., June 86, Charter — cargo operations.
As the pilot approached his destination he was advised that he was number three in the landing sequence. A visual, straight-in approach was made in clear, dark conditions. After receiving a landing clearance a normal flare was made, and it was not until the aircraft settled onto the runway surface that the pilot realised that the gear was retracted.

Cessna U206G, Mabuig Is. Qld, June 86, Charter — passenger operations.
The pilot reported that the aircraft encountered turbulence late on the final approach. This resulted in a heavy landing, during which the left maingear and nosegear were deformed.

Piper PA-32-300, Broken Hill N.S.W., June 86, Non-commercial — pleasure.
The pilot was conducting a flight under Night VMC from his property to Broken Hill. About 30 minutes after departure, the pilot reported that the aircraft engine was running roughly. Shortly afterwards, he reported that the engine cowling had become detached and then that the aircraft was on fire. No further transmissions were received from the aircraft which was destroyed as a result of impact forces and fire.

Cessna 150K, Wondagee Stn W.A., June 86, Aerial mustering.
The aircraft was being flown at about 200 feet agl in a left turn while the pilot was attempting to locate some sheep. The pilot reported that the aircraft stalled and that during the recovery it struck a bush. This resulted in damage to the right mainplane, right wing strut, right horizontal stabiliser and the brake lines on both mainwheels. The pilot was able to maintain control of the aircraft and land at a nearby airstrip.

De Havilland DH-82, Shute Harbour Qld, June 86, Charter — passenger operations.
The pilot reported that as he applied full power for takeoff, the aircraft began to swing to the left. He was unable to correct the situation and the aircraft ran off the strip and collided with trees.

Beech 95-B55, Ballina N.S.W., June 86, Non-commercial, business.
During the takeoff roll the aircraft had reached a speed of about 85 knots when the left engine suddenly lost power. The pilot immediately closed both throttles and applied braking, but was unable to prevent the aircraft over-running the 730-metre strip. The landing gear was torn out before the aircraft came to rest. Initial investigation revealed that the takeoff attempt had been made with the fuel tanks selected to the auxiliary positions, and these tanks were about one-quarter full. It is probable that the fuel ports became uncovered as a result of the takeoff acceleration, allowing the ingestion of air to the fuel system.

Cessna 210L, Ballina N.S.W., June 86, Non-commercial — pleasure.
The aircraft crossed the threshold higher than the pilot desired, and touchdown occurred well into the 730-metre strip. After initially running normally along the ground, the aircraft bounced twice before coming to rest in a nosedown attitude. Investigation revealed that the aircraft had landed on the left side of the strip, where the surface was very rough, and the aircraft had suffered a broken nosegear fork. The nosewheel had become detached and the nose strut was pulled away from the firewall.

Hughes 269C, Moorabbin Vic., Apr. 86, Instructional — dual.
Following a period of general training, a practice autorotational landing was made. A moderately firm touchdown occurred and a repeat of the exercise was requested by the instructor. Touchdown on this occasion was normal; however, during the ground slide, the right landing gear collapsed.

Hughes 269C, Ormiston Gorge N.T., Apr. 86, Aerial mapping/photography/survey.
As the pilot was overflying the Ranger's cottage, he noticed two rangers run out, waving frantically. Believing they required assistance he landed the helicopter in the nearby car park. The rangers approached the helicopter and urged the pilot to move the helicopter as they were about to commence blasting. In his haste to clear the area the pilot overpitched the rotor blades. He attempted to land the helicopter on an access road but the main rotor blade struck tall scrub, the aircraft yawed to the left and the tailrotor collided with the base of the bush before the helicopter landed.

Hughes 269C, Theda Stn W.A., May 86, Aerial mustering.
The helicopter was hovering at 50 feet agl when there was a partial loss of engine power. An autorotational descent was commenced but the aircraft struck trees and landed heavily. Inspection of the engine indicated that the exhaust valve guide and spring cap on number 2 cylinder failed allowing the exhaust valve to drop into the cylinder thus causing the loss of power.

Bell 47G-2, Camden N.S.W., May 86, Non-commercial — practice.
The aircraft had recently been sold, and had been ferried from Moorabbin to Camden by the previous owner. The Chief Flying Instructor for the company which had purchased the aircraft arranged to be taken for a re-familiarisation flight, as he had not flown the type for almost one year. During a practice autorotative landing, the helicopter fell heavily to the ground from a height of about 6 feet. The tail boom was severed and the bubble canopy was shattered. The matter of which pilot was in command and which was manipulating the controls has not yet been resolved.

Bell 47G-3B-1, Killarney N.T., June 86, Aerial mustering.
Three helicopters were engaged in the mustering of cattle on the property. One became unserviceable during the afternoon but returned to the muster after rectification. By 1830 hours the herd of 4000 cattle were near the homestead and one of the pilots was instructed to return to the homestead and land. The other two helicopters continued the muster using the landing lights of the aircraft for lighting. Last light in the area was 1842 hours.

At about 1910 hours the muster was nearing completion and the pilot of VH-HMX was instructed by the property overseer to move his aircraft away from the herd. Shortly afterwards the pilot of the other aircraft observed a fire, and upon investigation found the wreckage of VH-HMX. The aircraft had struck the ground in a steep nose-down attitude while banked at about 90 degrees to the left.

Bell 206B, Cunnamulla Qld, June 86, Power and pipeline control.
The helicopter was engaged in an inspection of the oil pipeline between Jackson and St George. The inspection involved landing at various points along the pipeline to allow the technicians to check the pipeline. As the aircraft took off after an inspection stop, the front seat passenger warned the pilot about the position of a power line. The pilot attempted to take avoiding action but the aircraft struck the power

by a grass tussock. The severed section of the leg punctured the right wing and the tailplane as the aircraft slid to a halt. Initial investigation indicated that the failure of the leg was caused by fatigue.

A subsequent metallurgical examination confirmed that the leg fractured because of the growth to critical size of a fatigue crack. The fatigue had originated in small surface imperfections caused by corrosion pitting.

Rockwell 114, Sea Lake Vic., Jan. 86, PPL/Cl. 1, 1000 hrs.
Shortly after takeoff the pilot's door opened. The passenger became very agitated and the pilot elected to carry out a low-level circuit and landing. The passenger's condition deteriorated to the extent where the pilot was experiencing difficulty in concentrating on the approach. The aircraft touched down in a paddock 22 metres short of the aerodrome boundary fence, ran through the fence and came to rest near the strip threshold.

Atmospheric conditions at the time were conducive to the formation of downdraughts and willy-willies. It was possible that the aircraft was affected by such a disturbance at a time when the pilot was distracted by his passenger's condition.

Piper PA-28-R180, Mansfield Vic., Jan. 86, PPL, 130 hrs.
The pilot had intended to carry out a scenic flight which would include aerial photography of a property at Merrijig. An en route landing was not planned, but the pilot subsequently advised that one of his passengers became unwell and a decision was made to land at a grass strip near the property. Takeoff from this strip was commenced about 90 minutes later, and the acceleration was reported to be slower than expected. The aircraft was pulled into the air near the end of the strip, but it then descended, ran through two fences and collided with some disused farm machinery. It came to rest in a nearby riverbed.

Prior to the attempted takeoff, the pilot had made calculations from the performance charts in the aircraft. However, the strip was 100 metres shorter than estimated, and the pilot also incorrectly assessed the takeoff weight of the aircraft. Based on the corrected figures, the charts indicated that about 1030 metres would have been required for takeoff. The strip being used was only 550 metres in length and, although it had a downslope, it was covered in grass some 20 centimetres high. The long grass had slowed the rate of acceleration of the aircraft and flying speed could not be obtained under the conditions.

De Havilland DH82-A, Bond Springs N.T., Jan. 86, SCPL/Cl. 4, 3600 hrs.
About 450 metres from the start of the takeoff run the aircraft became airborne, but almost immediately sank back onto the ground. The aircraft then veered sharply to the right, and the pilot was unable to regain directional control. The aircraft ran off the side of the strip and struck an embankment before coming to rest inverted.

No defect could be found with the engine, flight controls or brake system and the aircraft weight and centre of gravity were within the required limits. Since fitment of the braking system, the aircraft's recorded time in service was 27 hours. However, examination of the brake shoes revealed an excessive rate of wear which was consistent with the brakes being applied during takeoff or landing. The left gear brake shoes were found to have suffered greater wear than the right gear brake shoes and a cable within the braking system was found to be incorrectly adjusted such that on application of the brakes, a differential braking force would be produced which favoured the left wheel. A progressive application of right rudder would be required to overcome this differential braking effect as speed increased during a takeoff run while brakes were applied.

The takeoff run was significantly longer than was normal for the prevailing conditions and this flight was to be the pilot's second in an aircraft of this type fitted with brakes.

Cessna 152, French Island Vic., Feb. 86, PPL, 52 hrs.
The pilot was carrying out various manoeuvres in the training area. After about an hour general flying, the pilot decided to conduct a practice forced landing approach to a disused strip on the island. At about 200 feet on final approach, the pilot moved the carburettor heat control to the cold position and applied full power to overshoot. The engine failed to respond normally, and produced only about 1500 rpm. The pilot exercised the throttle control without obtaining any further power increase, and he was then committed to a forced landing. Touchdown occurred in a cleared paddock and damage to the nosegear and propeller was sustained when the aircraft ran through a ditch.

No fault was subsequently found with the engine or its associated systems. Reference to the appropriate chart indicated that atmospheric conditions were conducive to the formation of moderate to severe carburettor icing. Although carburettor heat was selected at the start of the forced landing practice, it was likely that some icing had already formed and was not dispersed by the time the throttle was reopened. When the engine failed to deliver full power, the pilot had not re-applied carburettor heat in an effort to restore normal engine operation.

Piper PA-25-235, Lady Barron Tas., Feb. 86, CPL, 11000 hrs.
The pilot was using his aircraft for agricultural operations on his own land. The aircraft had been performing normally during the day; however, on this particular takeoff, the engine lost power when the aircraft had reached about 55 knots. There was insufficient strip length remaining for the pilot to stop the aircraft, which struck several fences before coming to rest in a ditch 50 metres beyond the end of the strip.

Despite an extensive examination of the engine and associated systems, the reason for the power loss could not be determined.

Transavia PL12-T300A, Nannup W.A., Feb. 86, CPL/Ag. Cl. 1, 5900 hrs.
The pilot was operating from a strip on top of a ridge line. Because of the slope of the strip, landings were being made with a quartering tailwing of about 10 to 15 knots. At the end of a landing roll, the pilot commenced to turn around prior to reloading when the wind gusted to about 25 knots. The pilot applied more power in order to assist the turn, but the nosewheel bounced into the air. The aircraft weathercocked and ran off the side of the strip. It then ran down the slope of the ridge line until the nosewheel entered a large hole and the aircraft overturned.

The pilot had attempted to turn the aircraft around for reloading while traversing an area of rough ground adjacent to a steep slope at the side of the strip. All previous turns to position for reloading had been conducted on a flat area on the opposite side of the strip. However, the pilot decided to reverse the direction of turn to assist the loader driver who was experiencing difficulty in positioning the loader close to the aircraft.

Beech 95-C55, Brampton Is. Qld, Feb. 86, CPL/Cl. 1, 1450 hrs.
The pilot reported that shortly after takeoff he positioned the fuel selector to feed fuel to the right engine from the right auxiliary fuel tank. After levelling the aircraft at the cruising altitude of 1500 feet, he noticed the right engine falter, and immediately positioned the fuel selector for that engine to 'crossfeed'. The right engine then stopped. The right engine fuel selector was then positioned to draw fuel from the right main fuel tank; however, the engine did not restart. The left engine then stopped, and attempts to restart it were unsuccessful. The pilot transmitted a 'Mayday' call and ditched the aircraft.

Only the engines of the aircraft were recovered; however, no fault was found with them that could have contributed to the accident. It is probable that the disruption of power from the right engine was due to the depletion of fuel in the right auxiliary fuel tank. The reason the left engine failed could not be determined; however, it is likely that air entered the fuel system when the pilot selected the right fuel selector to 'crossfeed'. It is probably that the left engine could not be restarted because there was insufficient time to purge the fuel system of air before the aircraft ditched.

The manufacturer's operating manual for the aircraft limits the use of 'crossfeed' to operations where fuel is used to operate only one engine. It also requires the auxiliary pump be selected on, to stabilise the fuel flow, prior to crossfeed selection.

Cessna 150H, Koonmarra Stn W.A., Feb. 86, RPPL, 189 hrs.
The pilot was engaged in sheep spotting. The aircraft had been refuelled two days prior to the flight, and before departure the pilot had checked the fuel contents gauges, which indicated full fuel. After about two hours of the planned three-hour flight, the pilot noticed that one of the fuel contents gauges indicated empty and the other almost full. As he was near one of the property airstrips, the pilot decided to land the aircraft and dip the tanks. Having apparently satisfied himself that sufficient fuel remained, he continued the flight. An hour later, as he was returning to the station airstrip, the engine stopped. The aircraft was landed on a road but during the landing roll the left wing struck a tree and the aircraft ran off the road and into the bush, sustaining further damage.

An inspection of the aircraft revealed that the engine had stopped after the usable fuel had been exhausted. The fuel gauge for the right fuel tank was found to overread by 10 litres; however, the reason the fuel had been exhausted after a flight time of only three hours could not be positively determined.

Piper PA-18-150, Katherine N.T., Feb. 86, PPL, 113 hrs.
Near the end of the landing roll the left wing rose and the aircraft lifted off the strip, then settled back onto the ground on the right mainwheel. The brakes were still applied and the aircraft turned sharply to the right and the right wing struck the ground. The aircraft rolled over and came to rest inverted.

The pilot had assessed the crosswind component affecting the main property strip as being close to the maximum for the aircraft type. He had therefore decided to use an adjacent area which was aligned into wind, but because of the position of buildings at the end of the area a go-around was not possible. It is possible that mechanical turbulence from the buildings affected the aircraft during the landing roll. The approach was conducted at a higher airspeed than that recommended in the P-charts, and heavy braking was applied on touchdown before the tailwheel had contacted the ground.

Piper PA-28-161, Alice Springs N.T., Feb. 86, Student, 10 hrs.
After a dual check, the pilot's instructor briefed the pilot to carry out two circuits, each with a full-stop landing. Following the first circuit and landing, the pilot applied power to commence the takeoff without bringing the aircraft to a stop. The aircraft veered sharply to the left and became airborne momentarily before settling back onto the ground outside the flight strip. Flaps were selected fully down and the aircraft continued under full power across a stormwater drain for another 38 metres before coming to rest.

This was the pilot's second solo exercise. Following the loss of directional control, it appears that the pilot became confused and did not apply the correct control inputs to bring the aircraft to a stop.

Partenavia P-68C-TC, Orbost Vic., Mar. 86, SCPL/Cl. 1, 2450 hrs.
The pilot was preparing to depart from a strip which was only marginally longer than the minimum length required. He reported that when takeoff power was applied, an overboost warning light illuminated. Although a considerable power reduction was required on the right engine before the light extinguished, the pilot continued with the takeoff attempt. He advanced the right throttle to match the position of the left lever, but as the aircraft became airborne it struck the boundary fence and the left mainwheel was dislodged. The pilot elected to return for a landing at the strip. During the landing roll, the left gear leg collapsed and the aircraft ran off the side of the strip.

No fault was subsequently found with the engines and associated systems of the aircraft. The overboost warning light system fitted to the aircraft type is characterised by a significant lag during power reduction. The normal method of re-setting power under these circumstances is by reference to the manifold pressure gauges. Although the strip was marginal for the intended operation, the engines were not advanced to a high-power setting before the brakes were released.

Cessna 150L, Alice Springs N.T., Mar. 86, PPL, 149 hrs.
At the completion of a local pleasure flight the pilot decided to carry out three practice circuits. The first two landings were without incident but on the third landing the aircraft touched down on the right mainwheel and bounced. The pilot applied power in an attempt to stabilise the aircraft but the angle of bank to the right increased and the right wing struck the ground. The aircraft cartwheeled onto the left wing and came to rest inverted, 190 metres to the right of the runway centreline.

The landing was attempted in gusty crosswind conditions. The aircraft manufacturer's owners manual recommends that a mimimum flap setting be used in these conditions; however, on this occasion the pilot selected full flap. The pilot stated that when the aircraft bounced, he attempted to raise the right wing by the application of left aileron but seeing the skid ball was well out to the right, he then applied right rudder. The aircraft then rolled rapidly to the right and the wing struck the ground.

Cessna 150M, Geelong Airport Vic., Mar. 86, CPL/Cl. 1, 1000 hrs.
The flight was intended to be a revision exercise in crosswind circuits and landings. The first landing was completed satisfactorily and the student subsequently advised that the flaps were raised to the takeoff setting and full power was applied. However, the instructor reported that only partial power was applied and he said to the student 'I've got the flaps'. The student believed the comment was 'Take it off', and she responded by closing the throttle. The instructor took control and continued the takeoff, but the tail tie-down ring struck the boundary fence and the aircraft then collided with mounds of soil beyond the fence.

The investigation was unable to resolve the apparent confusion which existed in the cockpit with regard to the amount of power the student applied or the phraseology which was used by the instructor. At the point where the student closed the throttle, the instructor considered that insufficient strip distance remained to stop the aircraft.

Cessna 172M, Walcha N.S.W., Mar. 86, Student, 26 hrs.
At the conclusion of a dual check-flight, the student landed the aircraft into a light north-westerly wind. The landing roll was completed about half-way along the 838-metre strip, and the pilot turned the aircraft around preparatory to taxiing back to the upwind threshold. The instructor left the aircraft at this point after briefing the student on the solo sequences he wished him to practise. Shortly afterwards, full power was applied as the student commenced a takeoff downwind. The aircraft failed to become airborne, collided with a fence and overturned.

The student was subsequently unable to give any reason for his decision to commence a takeoff roll from other than the threshold of the strip.

Airparts 24, Armidale N.S.W., Mar. 86, CPL/Ag. Cl. 1, 3500 hrs.
Before commencing the 17th spreading flight for the day, the pilot noted that one fuel tank indicated empty and the other indicated one-quarter full. After a normal takeoff and turn at

about 150 feet above ground level, the engine lost all power. The pilot was committed to a landing in a small paddock with a downhill slope. Touchdown was made in light tailwind conditions, and during an attempt to turn the aircraft to lengthen the landing distance available, the left wing struck the ground. The aircraft partially ground looped, one tyre was rolled off its rim, and the aircraft came to rest within the confines of the paddock. The pilot then physically checked the fuel tank contents and found that only a few litres remained in one of the tanks while the other was empty.

The loss of engine power was caused by fuel starvation. The pilot had not previously flown the aircraft and was not aware of the time the aircraft had been flown since it had last been refuelled. He did not accurately determine the quantity of fuel in the aircraft prior to commencing the operation, nor did he have any method of determining the duration of the flight. He relied solely on the fuel gauges to determine the quantity of fuel in the aircraft.

This occurrence was not the subject of an on-site investigation.

Bellanca 8GCBC, Harts Range N.T., Mar. 86, PPL, 664 hrs.
During the landing roll, both mainwheels entered soft areas in the strip surface. The aircraft swung through 120 degrees to the left, then slid sideways for 17 metres before the right maingear collapsed. The wing struck the ground and was bent upwards.

The condition of the strip surface was unsatisfactory because the first 500 metres contained soft spots. The positions of the soft spots were not marked nor was the strip threshold displaced. The pilot had used the strip previously but on this occasion he did not check its serviceability before the flight.

Piper PA-28-161, Narrogin W.A., Mar. 86, PPL/Cl. 4, 167 hrs.
The pilot, who held a Class Four Instrument Rating, had planned the flight as currency training. At Narrogin, he set the aircraft up on a long final approach but reported that on several occasions during the approach, he found that the aircraft became low and he needed to adjust the flight path. About midway along final, the pilot stated that he felt a thump on the left side of the aircraft but the aircraft continued to operate normally, so he continued with the approach and landing. After parking the aircraft the damage to the left wing was noticed.

The pilot had a total of 15 hours night flying experience and this was the first time since obtaining his Class Four Instrument Rating, some 12 months previously, that he had landed an aircraft at night at any location other than Jandakot. The pilot stated that he had developed the habit of carrying out a flat approach to ensure he made good his nominated touchdown point. He believes he carried out the same procedure on this occasion. The tree struck by the aircraft was 15 metres high and situated about 500 metres before the strip threshold, it was below the required approach gradient.

Piper PA-28-161, Lilydale Vic., Mar. 68, Student, 25 hrs.
The pilot was conducting her second solo flight. She reported that following a normal approach, the aircraft touched down and bounced. She was unable to correct the situation and a further two bounces occurred before the aircraft could be brought to rest. An inspection revealed damage to the nosegear assembly and the engine mounts.

Piper PA-29-250, Bankstown N.S.W., Jan. 85, CPL/Cl. 4, 830 hrs.
The pilot reported that the three gear-position indicator lights were green as he commenced the takeoff roll. At about 40 knots the gear commenced to retract and the aircraft slid to a halt with all wheels retracted and the position lights indicating that the gear was up and locked.

No fault was subsequently found with the landing gear system which might have contributed to the accident. The pilot had not checked the position of the gear selector lever during his preflight and prestart checks. The sequence of events during the attempted takeoff was consistent with the selector being in the up position. The gear system includes an anti-retraction valve which prevents inadvertent retraction while the weight of the aircraft is on the mainwheels. When the aircraft had reached about 40 knots, there was evidently sufficient lift being developed to allow the anti-retraction valve to close and the gear to retract.

Cessna 404, Canberra A.C.T., Mar. 85, SCPL/Cl. 1, 6528 hrs.
In order to avoid thunderstorms in the immediate vicinity, the pilot requested takeoff from a runway direction giving a slight downwind component. Light rain was falling at the time, but it increased in intensity shortly after the aircraft commenced to roll. The initial stage of the takeoff run was normal, but the aircraft then failed to accelerate. The takeoff was abandoned at about 65 knots Indicated Air Speed; however, braking effectiveness was reduced because of the wet runway conditions. A ground loop was attempted, the nosegear subsequently became detached and the aircraft slid sideways into the aerodrome boundary fence.

No fault or defect was subsequently found with the aircraft engines, propellers or braking system which might have contributed to the development of the accident. A detailed engineering study revealed that under the existing conditions the wind velocity, rainfall rate and runway slope combined to prevent normal drainage off the runway. As a result, water tended to pool on the runway to a greater depth than anticipated. Quantitative estimates indicated that under these conditions, the rate of acceleration of an aircraft could be reduced by up to 50 per cent. When the pilot abandoned the takeoff attempt and applied the brakes, the depth of water present was such that the aircraft commenced to aquaplane.

Beech 65, Biloela Qld, Aug. 85, SCPL/Cl. 1, 11575 hrs.
This aircraft had only recently been acquired by the company. It had a fuel system different to other aircraft of the same type in the fleet. On the other aircraft there were three detents for each fuel selector: On, Off, Crossfeed. On this aircraft there were four detents: Off, Outboard, Inboard, Crossfeed. The pilot had not previously flown this aircraft. After a flight time of about 110 minutes the pilot reported that both engines had stopped and he was unable to access fuel from the outboard tanks. When the wreckage was located, no evidence of fuel was found in the inboard tanks.

An inspection of the wreckage did not reveal any fault with the engines or fuel system which may have contributed to the occurrence. It was evident that the engines had stopped when the fuel from the inboard tanks was exhausted. A quantity of fuel remained in the outboard tanks.

The day prior to this flight the pilot was briefed on the fuel system of VH-FDR by the company check pilot. The briefing was carried out with the use of the pilots operating manual for the aircraft. Because VH-FDR was not available at the time, the pilot was not able to study the fuel management panel in daylight hours. It is not known if the pilot familiarised himself with the panel before commencing the flight.

The aircraft is normally operated with the inboard tanks selected for takeoff. Evidence was obtained from flight documentation found in the wreckage which indicated that the pilot had changed the fuel selections from inboard about 30 minutes before he reported that the engines had stopped. However, the exhaustion of the fuel contained in the inboard tanks indicates that the selectors could not have been correctly positioned in the detents for the outboard tanks. Tests carried out found that if the selectors were positioned between the inboard and outboard detents, sufficient fuel, to allow the engines to be operated, would still be drawn from the inboard tanks.

The reason the pilot was unable to access fuel from the outboard tanks could not be determined.

Cessna 310R, Pt Hedland W.A., Sept. 85, SCPL/Cl. 1.
Prior to touchdown the gear-position indicator indicated that the gear was down. During the landing roll the right main gear collapsed and the right wing, engine, propeller and flap struck the ground.

Collapse of the right maingear resulted from excessive wear of the right overcentre lock bush bearing. The reason for the excessive rate of wear of the bush could not be determined. Thirty-six landings had been recorded since the last scheduled maintenance inspection of the gear and it is considered that some evidence of the excessive wear should have been present at that inspection.

Cessna 172N, Pinjarra W.A., Nov. 85, PPL, 500 hrs.
Prior to attempting the landing the pilot carried out an aerial inspection of the strip. The aircraft touched down on a gravel road leading to the strip; however, the ground track of the aircraft was affected by a windrow along the side of the road and the pilot was unable to control the aircraft. The pilot applied power to carry out a go-around, but the right mainwheel struck a car tyre, which was used to mark the strip threshold, causing the aircraft to veer to the left towards a fence. The pilot managed to manoeuvre the aircraft over the fence but it struck the ground, wingtip first, in an adjacent paddock.

The surface of the strip within the boundary markers consisted of a 4 metre wide road and the pilot was apprehensive about its use. However, following the conduct of a circuit at the strip by the aircraft's owner, the pilot decided to use the strip, as the passengers were waiting to depart for Geraldton. On the return flight the pilot was apprehensive about the landing, but decided not to divert to a nearby airfield because of the likelihood of the passengers experiencing subsequent transportation delays. To increase the landing distance available, the pilot decided to land short of the threshold marked by the tyres at the edge of the road. Once on the ground, the pilot's view of the tyres was restricted by long grass.

Victa 115, Victor Harbour S.A., Nov. 85, PPL, 1312 hrs.
The pilot had arranged to take each of his guests on a scenic flight of the local area. On the second of these flights, the passenger took along a video camera. The aircraft was observed flying at a low altitude and subsequently struck the top wire of a 10 metre high three-strand power line. The aircraft then continued towards rising ground and climbed over a row of trees before descending rapidly into the ground. A fire broke out and consumed the fuselage of the aircraft.

An inspection of the wreckage revealed that only the underside of the rear of the aircraft had struck the wire. It is considered unlikely that this impact would have adversely affected the control of the aircraft, other than to reduce its airspeed. The inspection did not reveal any other defect that could have contributed to the occurrence.

It is probable that as the aircraft was climbing over the trees it stalled and that there was insufficient altitude available for the pilot to recover the aircraft. Both occupants survived the impact but were apparently unable to evacuate the aircraft and died in the subsequent fire.

Piper PA-18-150, Meekatharra W.A., Dec. 85, PPL, 4143 hrs.
The pilot was engaged in sheep mustering. The aircraft was being flown at 200 feet agl, and about three minutes after the fuel tank selection was changed, the engine lost power. The pilot selected the other fuel tank but the engine did not respond. The aircraft touched down heavily on unsuitable terrain and the main gear collapsed.

No defect was found with the engine and 55 litres of fuel was drained from the fuel system following the accident. It is considered probable that the loss of power resulted from fuel starvation caused by the pilot inadvertently turning the fuel selector beyond the correct position. An inspection of the fuel selector valve found that it had been incorrectly assembled. This resulted in there being no effective detent to indicate that the selector had been correctly positioned. Also it was found that if the selector was positioned slightly beyond the required position, fuel flow was considerably restricted.

Bell 47G-2, Colson Camp N.T., Jan. 86, CPL-H, 340 hrs.
The aircraft was carrying out a survey in a remote area. When last light occurred, the aircraft was still some distance from the base camp. The pilot decided to follow a road into the camp. En route the engine lost power and an autorotation descent was carried out for a landing on the road. During the landing the left skid struck a low dirt bank and the tail rotor struck the dirt bank on the opposite side of the road.

Throughout the survey the pilot had used a higher-than-normal cruise power setting, but had not recalculated the endurance for the higher fuel usage. The engine failed after the fuel became exhausted.

Hughes 269C, Hughendon Qld, Feb. 86, CPL-H, 8121 hrs.
The helicopter was being used as a platform for test equipment. Part of the test equipment included an aerial that was mounted vertically below the helicopter. This aerial could be retracted and stowed in a horizontal position for landing by operating a control which was positioned in front of the technician. On this occasion the pilot inadvertently attempted to land the helicopter with the aerial extended. Just prior to touchdown the helicopter began to vibrate, the pilot lowered the collective and the helicopter rolled onto its right side.

Following the completion of each test it was normal for the technician to raise the aerial prior to landing. On this occasion, the technician became engrossed with the transmission of test data and forgot to retract the aerial. The pilot was concentrating on the landing and neglected to ensure that the aerial had been retracted.

Normally if a landing is attempted with the aerial extended, a weak link in the system fails and the aerial is retracted by a spring. However, it is believed that because the helicopter touched down with little forward speed, the weak link did not fail at the required time in the landing sequence.

Enstrom F-28F, Narellan N.S.W., Mar. 86, CPL-H, 574 hrs.
The pilot had been carrying out a series of joy flights at a rural field day. Refuelling was taking place from 200-litre drums, which had been placed in the shade of a large tree. On the second occasion that fuel was required, the pilot hover-taxied to the drums, which were rolled out of the way on completion of the refuelling. As the pilot started to hover-taxi again, the helicopter suddenly rose higher than anticipated and the main rotor struck the overhanging branches of the tree. One rotor blade de-laminated, severe vibration occurred, and the helicopter struck the ground heavily.

With the helicopter hover-taxiing two feet above the ground, there was only three feet of clearance between the rotor blades and the tree branches. The reason the helicopter rose sharply and struck the branches was not determined, but may have been the result of a wind gust.

Bell 206B, Nowra N.S.W., Oct. 85, CPL-H/Cl. 4, 5140 hrs.
The helicopter had been chartered because the passenger's farm had been isolated by floodwaters. The crew carried out a survey of the area before landing to check the suitability of the chosen site. Shortly after takeoff, the aircraft collided with a power line which was about 25 feet agl, and then struck the ground heavily about 15 metres beyond the line.

Both the pilot and the crewman reported that they had sighted the power line during the survey prior to landing. However, the pilot subsequently forgot the presence of the line and conducted a shallow climb after takeoff. Because the rear seat cushions were wet, the passenger was placed in the front seat while the crewman occupied the rear seat. When he became aware that the helicopter was climbing at a shallow angle, he reminded the pilot to beware of the wires.

The pilot then saw the power line directly ahead of the aircraft, but was unable to avoid the collision.

Bell 206B, Spencers Brook W.A., Dec. 85, CPL-H/Cl. 4, 3355 hrs.
The helicopter was being used as an airborne filming platform. It was being flown at about 30 feet above ground level along the side of a roadway, while the film crew filmed a bus that was travelling along the road. The helicopter was observed to gain altitude and pass over a power line, then descend again to 30 feet above ground level. After travelling a further 500 metres the helicopter struck a spur line running from the main power line, then pitched nose-up before descending out of control and colliding with the ground. The wreckage slid 50 metres before coming to rest on the road.

The position of both the sun and the support poles of the spur line would have made detection of the line difficult unless the pilot had prior knowledge of its position. The pilot was not seen to conduct a survey of the area for obstacles prior to commencing low-level operations. The task required the pilot to concentrate on the bus to the right of the helicopter as well as the flight path ahead.

Examination of the wreckage did not reveal any malfunction which may have contributed to the occurrence. It appeared that on impact with the spur line, one cable contacted the bottom of the windscreen pillar and the other became entangled in the rotor blades. All significant damage to the aircraft appeared to have resulted from ground impact.

Aerospatiale SA-341G, Mt Perisher N.S.W., Dec. 85, CPL-H/Cl. 4, 5018 hrs.
The helicopter was being used to transport empty fuel drums from a dump at an elevation of about 6500 feet on the summit of the mountain to the valley floor. One load of five drums had been successfully lifted about 10 minutes previously, and the pilot returned to sling load a further four drums. He subsequently reported that as he began to lift the drums he detected a change in the engine note. The load was immediately jettisoned, but the engine continued to wind down and the pilot was committed to a landing in a confined clearing. Full collective was applied to arrest the forward speed and the aircraft landed heavily. After the helicopter had come to rest, the pilot extinguished a small fire which had broken out at the rear of the engine compartment.

At the time of the accident, the helicopter was being operated well within its performance capabilities. When the heavy touchdown occurred, the exhaust pipe was severely distorted, restricting the flow of exhaust gases. As a result, the turbine assembly experienced an extreme over-temperature condition and the blades and guide vanes were melted before the engine was shut down. This damage precluded the investigation of any possible malfunction of the assembly during the hover immediately before the engine apparently lost power. No other defect or malfunction was discovered and the reason for the reported loss of power remains undertermined.

Romainian 1S-28B2, Leongatha Vic., Jan. 86, Glider, 1043 hrs.
The pilot, who was also the holder of a Private Pilot Licence, was conducting his first gliding flight for the day. The glider was aerotowed to 1100 feet above the aerodrome, but only weak lift was encountered in the area. The pilot elected to return for landing and commenced a normal circuit. On the downwind leg, strong sink was encountered and the base turn was conducted at about 300 feet above the ground Indicated airspeed at the time was reported to be about 55 knots. The pilot subsequently advised that the roll into the turn was normal, but he was unable to level the wings again, even with full opposite aileron. The aircraft continued descending in a wing-low attitude and struck the ground about 250 metres before the threshold of the strip.

Investigation revealed no evidence of any pre-impact defect or malfunction of the controls, and astmospheric conditions at the time were reported as being stable. When the sink was encountered on the downwind leg, the pilot had modified his circuit by flying closer to the strip. As a result, the angle of bank required for the base turn was steeper than normal. It was considered probable that the aircraft had stalled during this turn onto base, with insufficient height remaining to allow the pilot to recover control.

Schleicher KA-6, Temora N.S.W., Jan. 86, Glider, 130 hrs.
Towards the end of a 4 hour competition flight, the pilot realised that the aircraft would not reach the finishing line and that an outlanding would be necessary. After establishing the aircraft on final approach to the selected paddock, the pilot noticed a pile of stones obstructing the target touchdown area. While manoeuvring to avoid this obstruction, the left wing of the aircraft struck the ground and a ground loop ensued.

The pilot had been suffering the effects of a head cold and sinus infection, and had probably become fatigued during the flight in demanding conditions. He had persisted in his efforts to reach the finish until the glider was too low to allow a more suitable paddock to be selected for the outlanding.

This accident was not the subject of an on-site investigation.

Schneider ES-60B, Ross Tas., Jan. 86, Glider, 51 hrs.
The pilot had been soaring in wave conditions when sink was encountered and an outlanding became necessary. The field initially selected was obstructed by a power line and the pilot manoeuvred towards another area. On late final approach the aircraft collided with a single-strand power line and subsequently struck the ground heavily. The pilot later advised that he had seen a pole supporting the line but had thought it was aligned in another direction.

The large distance between the poles supporting the power line reduced the possibility of the pilot being able to accurately assess the direction of the line.

Rolladen LS4, Benalla Vic., Jan. 86, Foreign, 1562 hrs.
The pilot was a member of the French team competing in the 'Austraglide '86' gliding championships. At the end of a cross-country exercise the pilot reported that he was 5 kilometres from the finish line. The pilot of another glider observed that when the subject aircraft was 1 kilometre from the line it was apparently low. Shortly afterwards the glider collided with power lines. The tailplane was cut off by this impact and the glider then struck the ground in a steep nose-down attitude.

The glider was seen leaving an area of thermal activity with apparently sufficient altitude to complete the flight to Benalla. The reason why the glider subsequently descended to the low altitude which resulted in the collision with the power lines could not be determined.

Glaser-Dirk DG300, Benalla Vic., Jan. 86, Glider.
The pilot was competing in the Austraglide '86 international gliding championships. During a cross-country exercise a number of gliders were thermalling in the same area. The pilot noticed several gliders underneath his aircraft as he entered the thermal at about 4000 feet above ground level. His entry was made via a 45 degree bank right turn, but after turning through about 90 degrees the left wingtip contacted the forward under-fuselage area of a Discus B sailplane, VH-HNZ. This aircraft had been in a left turn with about 12 degrees angle of bank. Following the collision, both aircraft remained under control and were flown to the planned destination without further incident.

Neither pilot saw the other aircraft prior to the collision. VH-HNZ and the other aircraft established in the thermal were turning to the left. The pilot of D-2870 did not realise any aircraft were above him, and elected to carry out right-hand turns. This procedure was contrary to the accepted practice laid down by the competition organisers, where the direction of turns was governed by aircraft already in a thermal. The pilot advised that he was turning towards the sun when the collision occurred.

Schemp Discus B, Benalla Vic., Jan. 86, Glider.
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Neither pilot saw the other aircraft prior to the collision. VH-HNZ and the other aircraft established in the thermal were turning to the left. The pilot of D-2870 did not realise any aircraft were above him, and elected to carry out right-hand turns. This procedure was contrary to the accepted practice laid down by the competition organisers, where the direction of turns was governed by aircraft already in a thermal. The pilot advised that he was turning towards the sun when the collision occurred.

Glasflugel H206, Bacchus Marsh Vic., Mar. 86, Glider, 200 hrs.
Gliding operations during the day had been conducted on strip 19. On this occasion the pilot planned to approach to that strip but to land on the cross-strip 09, to allow the glider to complete its landing near the club hangar. During the turn onto final approach, to strip 09, the pilot noticed a tug aircraft apparently making an approach to the same strip. He continued his turn in order to avoid any conflict with the tug, and the aircraft subsequently touched down across strip 19. It then ran through a ditch before colliding with a fence.

The tug pilot stated that he saw the glider and thought that it would land on the left sife of strip 09. The tug aircraft was not fitted with a radio which denied two-way communications between the two aircraft. The two aircraft came into close proximity and the glider lost excessive height as the pilot forgot to retract the airbrakes during the turn to avoid the tug aircraft. The tug pilot continued the approach and landed but the glider pilot was committed to a downwind landing and attempted to land across the other strip.

Rolladen LS3, Forbes N.S.W., Dec. 85, Glider, 163 hrs.
An instructor who was watching the aircraft as it entered the circuit estimated that the aircraft was about 200 feet too low on the downwind leg. The base turn was conducted at about 50 feet and during the turn onto final the wing of the glider struck the boundary fence. A subsequent examination indicated that the altimeter was over-reading by some 200 feet.

The altimeter had been set to indicate zero prior to departure. In the following four and a half hours, pressure changes had occurred which resulted in the apparent over-reading. During the circuit, the pilot had been concerned with other traffic about to take off, and had attempted to alter the flap setting in order to modify the circuit. However, he had inadvertently applied the dive brakes and the glider lost height rapidly until the situation was corrected. A landing straight ahead was considered, but the pilot elected to try to reach the strip. It was likely that he was suffering a degree of fatigue after a long flight.

Corrigendum

The following is an amended version of a final update which appeared in Aviation Safety Digest *126. The report as originally published indicated that one of the probable factors in the occurrence was that the student glider pilot may have been inadequately briefed before the flight. Following representations from various parties the report was reviewed. It was agreed that the assigned probable factor should be deleted, as there was no evidence to show whether any briefing at all had in fact been given.*

Czech Blanik L13, Woodbury Tas., Aug. 84, Glider, 232 hrs.
The student glider pilot had carried out three previous flights during the day. Her instructor had informed her that she was at a suitable stage of training to be introduced to practise emergency procedures. After sighting her training log book, the instructor for the final flight left the glider to speak to the pilot of the tug aircraft. The instructor returned to the glider and preparations for takeoff were then continued.

Witnesses observed that the tug and glider became airborne and subsequently carried out normal turns to position the aircraft on a downwind leg at about 500 feet agl. The tug aircraft was then seen to waggle its wings sharply three times. Almost immediately this aircraft assumed a steep nose-down attitude, its tail apparently being pulled into a vertical position by the tow rope which was still attached to the glider. The glider then also assumed a steep nose-down attitude and both aircraft spun or spiralled towards the ground. The tow rope was released from both aircraft, but neither pilot regained control before impact with the ground.

The subsequent investigation did not disclose any defect or malfunction with either aircraft that might have contributed to the development of the accident.

During glider towing operations when the pilot of the tug waggles the aircraft wing, it is a signal to the glider to immediately release from the tow. This 'wave-off' signal would normally be given when the tug pilot detects some malfunction or when the glider is sufficiently far out of position behind the tug to affect the tug pilot's control of his aircraft.

On this occasion, it was considered likely that the instructor in the glider had arranged for the tug pilot to simulate an emergency by giving a wave-off signal. The wave-off signal was observed to be given in the normal position relative to the strip for such training manoeuvres to be performed. The reason for the subsequent loss of both aircraft could not be determined; however, it was evident that when the aircraft released the tow rope there was insufficient height remaining to permit recovery to normal flight.

Probable significant factors
There was sufficient evidence available to determine the precise cause of the accident. Nevertheless, the following were considered to be probable factors in the development of the occurrence:

1. The gliding instructor and the tug pilot arranged to give the student a practice emergency.
2. When the wave-off signal was given, the glider did not immediately release from the tow.
3. Control of both aircraft was lost at too low a height to permit recovery.

Aviation Regulatory Proposals

Aviation Regulatory Proposals (ARPs) are an important means by which the Department consults with industry about proposed changes to operational legislation and requirements. Copies of all proposals are circulated to relevant organisations, and occasionally to individuals for information and comment. The comment received provides a valuable source of advice which greatly assists the Department in the development of the completed documentation.

In future, each edition of the *Digest* will contain a listing of those ARPs circulated since the previous edition.

As this is the first listing, it includes all ARPs on which action is still in train.

Should you wish further information about any of the ARPs, please contact your industry organisation.

Number	Subject	Status
83/10	Separation requirment for VFR flights in primary control zones	Awaiting action on ANR 94
83/15	Supplementary Airline licence requirements	ANO Amendment being processed
84/4	Preferred runway procedures	AIP being processed
84/10	Medical Standards	ANO Amendment being processed
84/12	Safety Precautions during aerodrome works	Comments under consideration
84/14	Instrument ratings	Comments closed 31 March '86 now under consideration
84/22	Operation of helicopters on aerodromes	Amendments being processed
84/24	Transit flights below 500ft — agricultural operations	ANO Amendment being processed
84/27	Aircraft Engine Emissions	postponed pending overseas developments
84/28	Miscellaneous amendments of ANRs	ANR Amendments being processed
85/2	Night aerial spraying	ANO Amendments being processed
85/6	Aerodrome standards for ab-initio Pilot Training	AIP Amendment being processed
85/7	Sideways-facing seats	ANO Amendment being processed
85/10	Ultralight Air-worthiness Standards	Comments under consideration. No action pending outcome of Parliamentary inquiry
85/11	Minimum Runway Width	Comments closed 1 June '86 now under consideration
85/12	Aerial Agricultural Rating	ANO Amendment being processed
85/16	Helicopter Winching and Rapelling operations	Comments closed 31 March '86 now under consideration
86/2	CPL — Aeroplanes	Comments closed 30 April '86 now under consideration
86/4	CPL — Balloons	Issued 24 June '86. Comments due 31 July '86
86/6	Air Service Licence requirements — charter and Aerial Work	Issued 7 April '86. Comments due 1 August '86
86/8	Model Aircraft	Issued 30 May '86. Comments due 30 June '86
86/11	Cabin Fire Safety	Issued 10 May '86. Comments due 13 June '86

Ground-run fiasco

As he was driving past the aerodrome where his American Aviation AA5-B was parked, the owner decided on the spur of the moment to call in and give its engine a ground-run because the machine was not being flown much, and a couple of months ago he had noticed that the battery charge was low.

Arriving at the aircraft, he opened the cockpit and tried to start the engine. However, the battery was completely discharged. Accordingly, he decided to hand swing the propeller.

The pilot checked that the park brake was set and ensured that the three tie-down ropes were in place. He opened the throttle an estimated one-quarter of an inch and swung the propeller. The engine fired on the third kick. Initially it 'spluttered', but then the rpm rapidly increased to an obviously high power setting.

Leaving the propeller area, the pilot started to run around the right wing to return to the cockpit so that he could throttle the engine back. Just as he reached the wingtip, the right tie-down rope snapped and the aircraft began to move. The pilot managed to clamber onto the wing near the cockpit, but before he could take any action to retrieve the situation he was thrown off balance when the AA5's right wingtip struck the tail of a Cessna Aerobat.

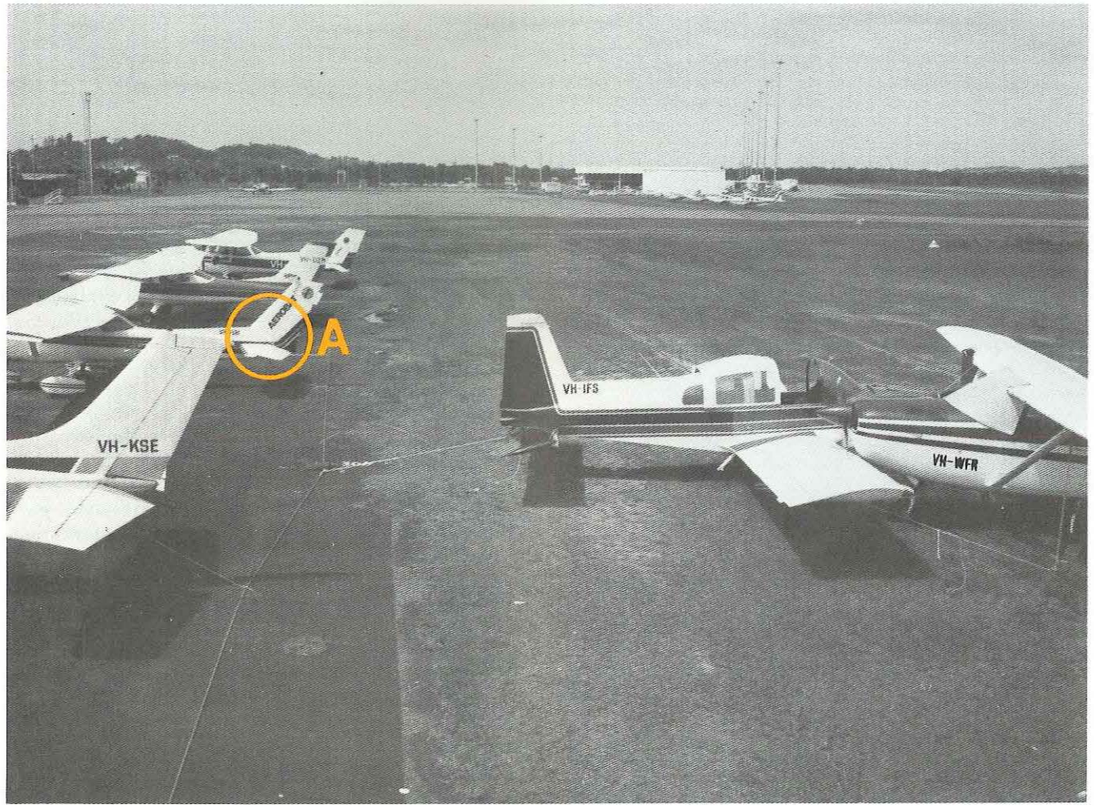
At this stage both the tail and right wing tie-down ropes had snapped, and the aircraft was starting to turn to the left, swivelling around the left wing tie-down rope, which remained secure. The aircraft turned through 180 degrees before running into a Cessna 182, which was parked in the line behind the AA5's original position. The pilot was still hanging on when the second impact occurred, and was subsequently able to get into the cockpit and shut down the engine.

All three aircraft were substantially damaged.

Lessons

The safety lessons emerging from this occurrence are self-evident in the sequence of events identified by the air safety investigator:

- The park brake was not set effectively.
- The wheels were not chocked.
- Assistance from another pilot was not obtained, even though an aero club was only 100 metres away.
- The nylon rope tie-downs were rotten.
- Close to full throttle must have been set before the propeller was swung.
- Once the engine started, the pilot was unable to restrain or re-enter the runaway aircraft ●



The right wing of VH-IFS struck the tail of VH-FUH at A and continued into VH-WFR.

Human factors in wheels-up landings

A recent wheels-up landing in western N.S.W. raised a number of interesting questions which prompted the Bureau of Air Safety Investigation to undertake a computer-based review of accidents and incidents of this type, covering the period January 1980 to March 1985. The variety of circumstances involved in each case proved to be very wide as one might expect; however, some common factors emerged which are of interest.

The particular accident in western N.S.W. involved a Piper PA28,in which an electrical failure disabled the aircraft's normal means of gear extension. The pilot-in-command could not recall the procedure used to manually extend the gear and the outcome was a wheels-up landing. A key point which emerged from the investigation was that the aircraft handbook was stowed in the rear locker, and consequently unavailable to the pilot. There were no injuries to the occupants although the aircraft sustained severe damage. Such an avoidable accident led to this review of all wheels-up landings over the above period.

Analysis

The total number of wheels-up landings was 171. These accidents have not been separated according to category of operation as the objective was to obtain an overview of the relative importance of human factors in probable causes. Statistics indicate that approximately 52 per cent of wheels-up landings were probably attributable to human factors. Equipment malfunctions or failures accounted for another 33 per cent of the accidents, although these have not been subdivided according to human and other factors. Approximately 1 per cent of wheels-up landings occurred as a result of conscious pilot decisions, and the remainder involved human, technical, weather and other factors in differing combinations. Separation of the statistics into two broad categories of human and technical factors was made to facilitate the review, and it is not suggested that all accidents are so easily separable. The probable cause of an individual accident usually involves several factors acting separately or in combination.

By far the most common shortcoming highlighted amongst the 52 per cent of accidents in the human factors group could be termed 'complacency'. Pilots either misused the checklist, failed to use it at all, or recalled it incorrectly from memory. There were several instances where pilots followed the checklist precisely, but in giving challenge and response made the cardinal error of omitting to check that the particular selector or indicator was in agreement with the checklist requirement before giving the response. In nearly 10 per cent of cases the pilot stated that he or she 'forgot' to select the gear down prior to landing.

While many of those pilots claimed they simply forgot to lower the gear, others were able to identify reasons which contributed to their accident. Some were distracted by radio communications at a critical moment, the presence of other traffic, a change of runway, and occasionally personal stress. Personal stress varied from pressures of the environment, due to weather or system malfunctions, to family and domestic problems. Occasionally a pilot operated the wrong selector when the aim was to lower the gear, and there were several instances where the flaps were raised instead of lowering the gear.

Some light aircraft with retractable undercarriage systems have an automatic extension facility designed to lower the gear should the pilot omit this item in the pre-landing check list. In addition, most aircraft have an aural warning system to alert the pilot that the gear is still up when the throttle(s) is retarded with zero or specific flap settings. The accident reports show that in many cases these automatic extension and warning systems were either inoperative, malfunctioning, or out of adjustment.

The classic case of continuing with an approach whilst the undercarriage warning horn was sounding arose in several instances, while pilots occasionally pulled the undercarriage warning horn circuit breaker to silence an incorrectly adjusted system during flight — then 'forgot' to reset it during the pre-landing checklist. Some light singles and twins have automatic dimming to the undercarriage warning lights when the navigation lights are on, and from time to time pilots who were unaware of this characteristic on their type failed to realise that the gear was in fact down and locked prior to landing. This could then lead to further non-standard manipulation of the normal and emergency gear controls until a wheels-up landing occurred.

Aircraft types involved over the whole spectrum of these accidents ranged from a Grumman Gulfstream to Cessna 177RGs. Cessna 210 models accounted for 19 per cent of the accidents, Piper PA28s 7 per cent, while Cessna 310 and Beech A36 models each accounted for 4.7 per cent of the total.

Checklists

Regardless of the statistics relating to individual types, the Bureau is concerned about the high percentage of wheels-up landings involving human factors. Many of these accidents may have been avoidable with a more thorough attitude towards checklists and better knowledge of aircraft systems and emergency procedures. A complacent pilot makes the game tough enough without also leaving the aircraft manual in an inaccessible place. Don't be complacent, know your checklists and use them, understand the aircraft systems, and have a sound grasp of abnormal, alternative, and emergency systems. Automatic extension systems and visual and aural warning devices are intended to be back-ups in properly conducted operations, and were never designed to provide pilots with primary cues to lower the undercarriage prior to landing. That is the proper function of the checklist.

Other factors

An approach with the gear up is conducive to higher airspeeds, and in turn this may preclude the operation of undercarriage warning systems. Higher speeds may also inhibit the operation of automatic extension devices until the throttle(s) is closed by which time it is too late. The review also revealed a number of instances in which pilots made late gear-down selections, and landed on partly extended gear. Incorrect application of emergency drills with both fully functioning or malfunctioning undercarriage systems often revealed a low standard of knowledge with drills and systems.

Undercarriage components are frequently exposed to the elements with water, mud, and other debris being thrown into wheel-well bays and other sensitive areas. In one instance a pilot in northern Australia demonstrated very poor airmanship by taking off from an airstrip which was so rain-drenched and muddy, that on arrival over the destination the gear could not be shifted by either normal or emergency methods.

Conclusion

Airmanship is a theme which should run through the thought processes and actions of pilots in all day-to-day operations. In particular, the review of wheels-up landing accidents pointed to a misuse of checklists, and in turn this frequently indicates a poor standard of airmanship. In the majority of cases there was no need for haste in attempting to resolve an undercarriage problem. It is far better to proceed to a quiet area and carefully complete all drills relevant to the emergency, than attempt to deal with communications and other traffic at the same time. ATC and FSU officers are also usually on hand to assist pilots in any way possible ●

Look out . . . listen out . . .

It is not uncommon for instructors to turn down the volume control of the radio to eliminate distracting noises at times when a student is struggling to hear and to understand a particular lesson.

In the training area there is some risk that in doing so, a call from Flight Service or from another aircraft will be missed. Such a call could be both important and urgent.

To turn down the radio volume in the circuit area though is fraught with danger, both for the aircraft concerned and for everyone else in that circuit area.

Try to avoid turning down the volume at all. If it is necessary to do so, keep the time to the absolute minimum and don't forget that you have turned it down. *Under no circumstances turn it down when in the circuit area.* The busiest, noisiest time could be when it is most important that you listen and remain attentive to radio transmissions ●

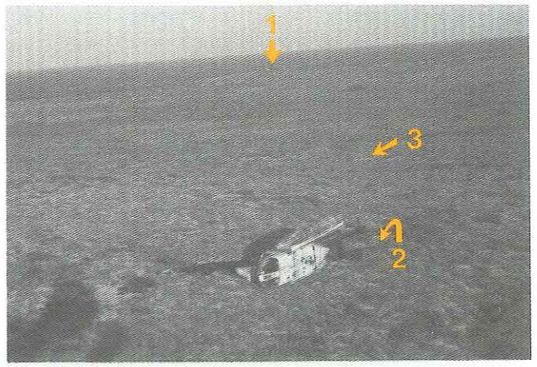
Slung-load instability

A Bell 206B Jetranger was being used to ferry slung loads between a ship and a shore base. The pilot had over 2500 hours flight experience on rotary wing aircraft but, apart from a recent refamiliarisation course and the preceding few days' operations, had not flown helicopters for two years. Carrying slung loads was not covered during the refresher flying as at the time it was not believed that the pilot would be involved in that activity.

Following one ship to shore run, the pilot was asked to backload a container which was identical in appearance to others he had previously carried. The load was hooked up and the B206 departed for the ship. The pilot noted on lift-off that this box was much lighter than those he had shifted before.

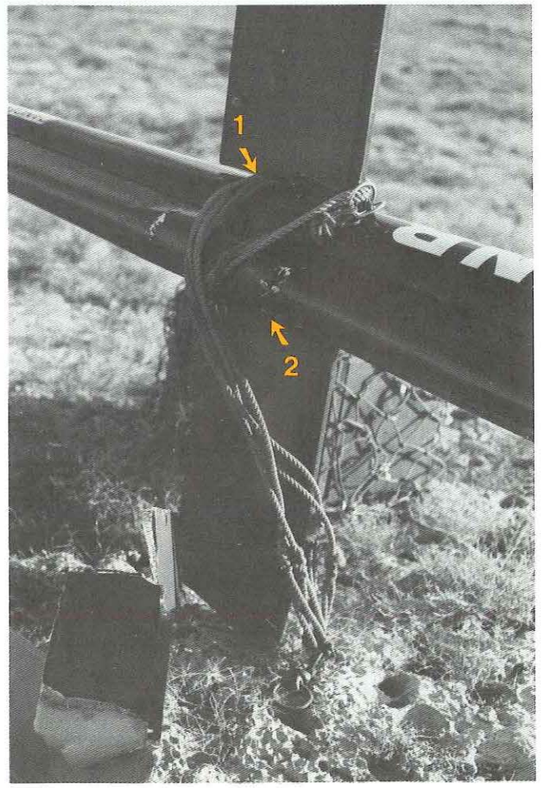
After levelling off at about 120 feet agl and 60 knots, the pilot felt a bump on the rear of the helicopter and noticed that the machine pitched up slightly. He countered this motion with cyclic. However, the 'bump' and pitch-up occurred again, so he pressed the load-release button.

Almost immediately the helicopter started to yaw to the right, so a descent for landing was initiated and control inputs made to try to arrest the yaw. However, the aircraft continued to rotate and after several turns impacted the ground on the front of the right float, which had been inflated. The Jetranger then toppled over onto its right side, sustaining substantial damage. The pilot, who received minor injuries, was able to escape through the broken canopy.



Above. General view of aircraft showing (1) base camp (2) final resting place of box and (3) approximate position of tailrotor wreckage.

Below. View of horizontal stabilizer showing (1) rope securely attached and (2) point of tailrotor shaft breakage.



Analysis

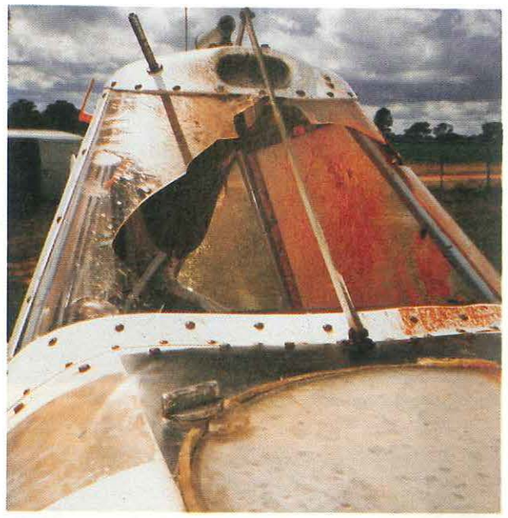
It was apparent that the slung load had become unstable and had struck the tail boom. In fact, it had also passed over the tail boom between it and the main rotor, and was sitting on the tail boom — this explained the bump and pitch-up which was experienced twice. When the load was subsequently released, it slid back and was struck by the tail rotor, breaking off one blade and snapping the drive shaft.

Given the invidious circumstances, it is problematical whether the pilot could have done any more than he did. If the uncommanded yaw was to be countered, then an almost immediate autorotation had to be initiated. The pilot later stated that he was not sure at first whether the Jetranger had suffered a tail rotor failure, for, while the loss of yaw control was total, it was not severe (as is to be expected, though, the severity increased as airspeed reduced). The low altitude also was a factor in his decision-making, as he had little time to think about alternative courses of action. His decision was to try to fly the aircraft using whatever cyclic control remained, and to attempt to cushion the impact by using the cyclic to raise the nose and pulling full collective at the last second. He later said that at the point of touchdown the helicopter had little forward speed and was almost level.

The slung load

During the investigation it emerged that the box in the sling may have had a defective latch. It was postulated that this may have allowed the box's lid to come open once the load was airborne, thus creating extra drag and causing the load to become unstable. There was reason for some concern in the fact that the loader had not received any formal training, and could not remember if he had closed the latch properly. He was aware that one of the boxes being used had a defective (bent) latch but could not remember if it was the one used on this particular flight. [Continued opposite.]

Protective clothing



How much value do you place on your life? This is a question that pilots employed in comparatively high-risk operations such as aerial application and cattle mustering should ask themselves when assessing the cost of protective clothing. It is a question that should not be difficult for one particular pilot to answer following the rapid return he got on just such an investment.

The pilot was spraying a small crop of wheat and had completed the first run. He began the second run and was side-slipping around a large tree and between telephone lines at a height of about 6–7 feet AGL when, in his words, 'the windscreen shattered and the inside of the cockpit was showered with blood and guts'. Pulling his PA25 up and away from the paddock, he determined that the aircraft's windscreen had sustained a severe birdstrike. He was able to fly back to his airstrip and spent the rest of the morning cleaning the remains of a large Cormorant from the Piper's cockpit. (The bird's weight was later assessed at about 3½ kg.)

There is, however, more to this incident than that. At the time of the birdstrike the pilot had been wearing a helicopter-type SPH helmet, with visors, that he had acquired ten days earlier. Again to use the pilot's words '. . . but for the fact that I had the helmet on *and the visor down* the story would have ended differently, as the bird came through the perspex relatively intact and hit the visor with considerable force'.

The helmet which almost certainly saved this pilot's life retails for about $850. By any measure, that amounts to a bargain. Readers should also note that protective flying clothing may be tax deductible, either fully or through depreciation. The Department of Aviation strongly supports the use of good quality protective clothing by those pilots involved in comparatively high risk operations ●

Operational technique

Some difference of opinion was expressed by senior check and training helicopter pilots regarding the operational aspects of the accident.

It should be mentioned that once a pilot has received an initial endorsement for slung-load operations, refresher training in the technique is not mandatory. At the same time, the consensus among the senior pilots with whom the BASI investigator spoke was that, while the basics of the procedure are not forgotten, the finer points may take some time to resurface if a pilot has not flown helicopters for a year or so. In this regard, the training pilot who conducted the Jetranger pilot's refresher said that he would have included slung-load operations in the training sequences had he known that the pilot was going to be sent on the particular task.

General agreement was also reached on the issue of 'flying' the load. The collective opinion of the specialists was that once the pilot had lifted the container off the ground and noted that it was lighter than the others, he should have treated it as an entirely new load: he should have monitored it carefully in the mirror attached to the aircraft for that purpose, and been cautious about selecting a forward airspeed. The key requirement was to use a speed at which the load would remain stable.

On this brief flight, the pilot had checked the load in the mirror as he lifted the box clear of the ground, and it had appeared to be sitting flat on its normal base, while the net seemed symmetrical. A cruising speed of 60 knots was used as it had been on all other transits. The load was not checked again in the mirror until the unexpected thumps were felt. It was because he then could not see the load that the pilot decided to release it.

Conclusion

This was a difficult and dangerous occurrence, in which events unfolded rapidly. In the circumstances, the bottom line is that the pilot walked away from it. At the same time, as the BASI investigation showed, there were a number of factors evident which should be of interest to all those involved in this sort of operation.

Perhaps the final word should be given to a helicopter specialist who, in an article in *Rotor News*, stated that:

> There is no one set of rules that assures every load will fly the same. Quite often you may fly the same type of load; and because of some minute difference of airspeed, wind gust, rigging, etc. your next load could fly erratically.

This accident was a case in point ●

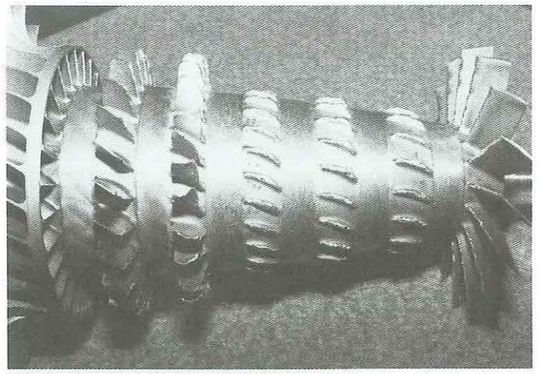
Compressor washing

During takeoff the engine instruments of a Bell 206B were checked while the helicopter was in a hover. No abnormalities were noted. However, just as forward movement was commenced a loud noise was heard and all engine power was lost. A significant drop in rotor rpm occurred and, during the subsequent forced landing, the main rotor struck the tail boom.

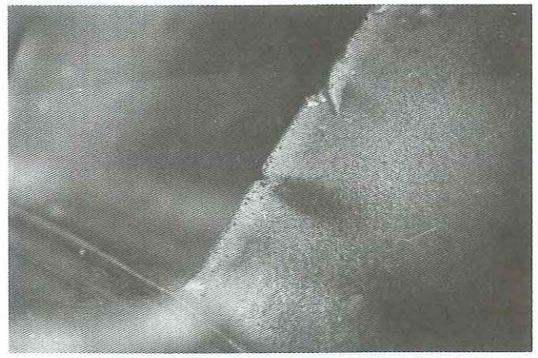
Post-accident inspection revealed a total mechanical failure of the engine compressor.

The majority of compressor blades were found to be broken and the resulting degree of damage precluded identification of the location of the initial failure. However, the examination of sections of blades revealed corrosion pitting consistent with inadequate compressor washing servicing.

The Jetranger had been operating in a corrosive atmospheric environment, and it is probable that the initial failure within the compressor resulted from corrosion-induced fatigue.



Damage to compressor rotor.



Pitting, FOD damage and streaking on a sixth-stage rotor blade.

Technical investigation

Damage to the rotor of the Allison 250-C20 engine was severe. The second, third and fourth stage rotor blades had been completely stripped from the rotor and all that was left were small 'stumps' at their roots. These stumps had been severely battered, preventing conclusive analysis of the fracture surfaces. The damage was consistent with the failure of a blade or vane in stages 2, 3 or 4, probably stage 2 or 3.

The compressor was very dirty, suggesting that it had not been washed regularly. Streakings of dirt could be seen coming from pits on the leading edges of blades in three of the four remaining stages of rotor blades. Dirt could not be found on the other (fifth) stage because of the damage to its leading edges caused by the break-up of the other stages. However, because pitting, foreign object damage (FOD) and dirt streaking were found on blades upstream and downstream of the stages that had either failed or been badly damaged, it was clear that there would have been similar damage and streaking on the stages that had failed.

The corrosion pitting, dirt streaking and amount of dirt present indicated two main facts:

- the Jetranger had been operated for a long period in harsh and dirty environments; and
- the compressor had not been receiving rinses and washing as required by maintenance instructions.

Case studies

A letter distributed by the Allison Company in 1976 discussed the effectiveness of compressor washing in relation to compressor failures. It cited the example of a helicopter organisation operating a fleet of 125 aircraft in the Gulf of Mexico. At one stage the organisation was experiencing an average of a compressor failure every month. However, after purging the fleet of corrosion-affected components and instituting daily compressor washes, they had not had a failure for three years — and during that time the fleet had expanded to 170 aircraft, each averaging more than 100 hours a month.

Other information unearthed during the investigation into a Jetranger accident indicated that one group of military helicopters (presumably U.S.) which did not receive compressor washing experienced a number of low-time accidents at around the 200–400 hour mark. Also, one Australian operator involved in sea rescue is known to have had a failure from corrosion fatigue 188 hours after an overhaul. Consequently a program of daily compressor washing was introduced, and when the compressor was subsequently split for inspection after 300 hours of operation, there was no sign of corrosion.

Comment

The Allison Operation and Maintenance Manual for the 250-C20 provides a specific warning regarding corrosion as follows:

WARNING

SALT LADEN HUMIDITY AND CHEMICALS WILL CORRODE COMPRESSOR BLADES AND VANES AND CAUSE THEM TO FAIL.

It continues:

> Engines subjected to salt water or other chemically laden atmosphere (including pesticides) shall undergo water rinsing after shutdown following the last flight of the day. Perform the rinse operation as soon as practical after flight, but not before the engine has cooled to near ambient temperature.

Corrosive conditions

Operators should be aware that salt-laden air may be encountered as far as 75 miles inland under certain weather conditions. Furthermore, chemically burdened air in the vicinity of industrial complexes is a corrosive source requiring the same daily maintenance as salt air conditions. In some meteorological situations air contaminated by industrial waste may travel through valleys and be found considerable distances from the source.

Washing procedures

Washing procedures and the terminology used can vary between engine manufacturers and operators. In general terms 'compressor washing' is used to define a procedure intended to overcome contamination problems. 'Washing' is perhaps best defined and understood as the following actions:

- **Rinsing:** the application of fresh/demineralised water to remove deposits accumulated by operation in salt and/or chemically laden environments.
- **Cleaning:** the application of a chemical cleaning solution to remove dirt and contaminant products when performance is affected, followed by rinsing.

These processes can vary in procedure and the method of application. Some general observations are, however, valid:

- For some engines, rinsing without closing the bleed valve/s allows water to exit the compressor via the bleed valve orifice, leading to ineffectual rinsing of the later stages of the compressor.
- Chemical cleaning must be followed by thorough rinsing, because residual chemicals can be as detrimental to the engine as a contaminated environment.
- Accumulations of residual water in the engine following rinsing can be harmful to systems (e.g. anti-icing, fuel control/governing) which use air tapped off the compressor. Therefore, a drying-out ground run is necessary to complete the rinsing procedure.

Preservation

Operators should also appreciate that if an aircraft is not going to be used for an extended period, preservation of the compressor is necessary to combat corrosive deterioration of stators and rotors. If a compressor has been preserved, thorough rinsing is essential before further flight.

Conclusion

Compressor washing can play an important part in engine safety. For the exact procedures for your particular engine, consult the relevant operation and maintenance manual ●

In brief

During instruction in the use of VOR as a fixing aid, the VOR in an RAF HS-125 was tuned to 113.4 Mhz, but it continued to code (indent) and indicate the previously selected beacon, which was 113.5 Mhz. When a frequency of 112.4 Mhz was selected, the bearing and coding were those for the beacon on 112.5 Mhz. The equipment was eventually persuaded to operate on a frequency which included 0.4 Mhz by stepping through 0.1 to 0.3 Mhz.

This occurrence emphasises the need for a careful check of the aural coding whenever a navaid is retuned. The selection of a new frequency is no guarantee that the information displayed will be correct.

* * *

A Cessna 310 was cruising at 10 000 feet when the left-hand wing locker burst open and discharged about 75 bags of surgical cotton balls. The bags containing the cotton balls were sealed, unvented, non-evacuated plastic containers. They had expanded because of the reduction in ambient atmospheric pressure as the C310 climbed, to the extent that they eventually forced the locker door open.

* * *

An S-61 helicopter was engaged in transferring one passenger and his baggage by winch to the deck of a research ship. The passenger was transferred without incident, but during the winching down of his baggage the co-pilot observed a black polythene dustbin bag being drawn into the rotor disc on the port side of the aircraft. This was ingested into the number 2 engine, causing it to stall with a complete loss of engine torque. Unable to maintain the hover the aircraft sank, with the landing gear up, on to the deck. As the co-pilot slowly retarded number 2 engine speed select lever, power was regained, torque matched and the aircraft was quickly lifted into the hover. The landing gear was extended, brakes and safety pins were applied, and the aircraft was landed on the deck of the ship without further incident.

It has been determined that the aircraft was 2182 pounds above the maximum permitted (single-engine) hover weight (out of ground effect) for the conditions (15 250 pounds) when the winching operation commenced.

The occurrence draws attention to the dangers of plastic bags and plastic sheeting left insecure in or around a helicopter landing area.

* * *

While taxiing in strong winds, a Cessna 172 was caught by a gust and flipped on its back. The wind was estimated to have been gusting up to 50 knots. As a general guide, it is risky to taxi a light aircraft in winds above 35 knots.

How to make the game tough

A private pilot with probably about 150 hours asked his employer, who owned a Cessna 182, whether he could borrow the aircraft over a winter weekend for personal use. The proposal was to fly from Camden to Bankstown to carry out some night circuits, and the next day fly out to Bathurst. The owner agreed to this proposal, however at Bankstown the pilot submitted an IFR flight plan from Bankstown to Cooma, and departed Bankstown at 1738 EST.

The pilot had told various people from time to time that he was studying for an instrument rating. He mentioned some training organisations to different people where it was purported the training was being conducted, although it was subsequently found that he was not enrolled with any approved organisation in the Sydney area. In addition, there was no Department of Aviation record of the pilot having completed any of the necessary theory examinations for the issue of an instrument rating.

The general weather situation between Bankstown and Cooma at the time of the flight was characterised by a fresh north-west airstream over the area, with a cold front lying approximately 50 nautical miles east of a line Melbourne–Hay. This front moved through Cooma around 0300 EST the next morning. Although there were probably no more than two-eighths of stratocumulus at Cooma when the Cessna arrived at 1902, nevertheless there was the possibility of severe turbulence in the circuit area. The pilot of an aircraft which landed at Cooma shortly before the Cessna 182 reported a very strong westerly wind, no significant cloud, considerable turbulence, a 20 knot windshear on final approach to runway 36, and generally difficult conditions. This pilot required power variations on final ranging from idle to 75 per cent, and experienced difficulty staying on the centreline. He noted that it was a black night without moon, and the only lights were those associated with the runway.

After the pilot of the Cessna 182 reported in the circuit area at Cooma for landing on runway 36, he failed to give any subsequent calls, and the Alert Phase was declared at 1917. Subsequently the Distress Phase was declared when the aircraft could not be located. The aircraft wreckage was found at approximately 0700 the next morning, 5 km south of the Cooma airport. The aircraft had struck the ground in at least a 50 degree nosedown attitude in a slight left yaw and turn. The force of the collision with the ground was such that the distance from the initial point of impact to the point where the tail came to rest was 60 metres. Large components were thrown from the aircraft along the wreckage trail and the aircraft nosed over before finally coming to rest. The wreckage was consumed by fire and the cabin area reduced to ashes. The pilot's body had been thrown from the aircraft during the breakup.

Post-mortem reports indicated that the pilot had a significant blood alcohol level, to the extent that his piloting performance would have been adversely affected. During inspection of the wreckage six cans of beer had been found, three of which had been opened by using the 'ring pull'.

The wreckage also contained the pilot's handwritten summary of the Cooma NDB approach chart, although whether he had endeavoured to complete or had completed any part of that approach could not be determined. A thorough technical examination of the wreckage did not reveal any evidence of a defect or malfunction which might have contributed to the accident.

The pilot had submitted an IFR flight plan without holding an instrument rating, and whilst heading south for a return to land on runway 36 at Cooma he would have had no external visual clues, local turbulence may have been severe, there was considerable crosswind and evidently windshear, and to make things really tough the pilot had been consuming alcohol. It was likely that the pilot lost control of the aircraft while manoeuvring to land in conditions which might have been demanding for well-qualified and experienced pilots. This pilot however stacked the odds so completely against himself that the outcome may have been predictable from the moment the flight departed Bankstown ●

Loose aerosol can causes fire

A Beech 58 on a charter flight from Laverton to Kalgoorlie was 10 miles from destination when the pilot noticed black smoke entering the cockpit from the base of the forward bulkhead. Alternators and unnecessary equipment were switched off, and after advising Kalgoorlie FSU of a cabin fire, VHF Comm and the battery were also switched off. The black smoke thickened rapidly,and in an effort to make the cockpit environment bearable the pilot opened the main cabin door with the assistance of his sole passenger. The battery was switched on prior to gear and flap extension, FS was advised the aircraft was on a right base for RW28, and the battery then switched off again.

Flight Service implemented aerodrome emergency procedures, but due to the proximity of the aircraft to the aerodrome the police, fire brigade, and ambulance did not arrive until one minute after the aircraft had landed. A Flight Service Officer and a local CFI raced to the Beech as it came to a stop on the runway, with smoke pouring from the nose locker. They carried fire extinguishers from the FSU and were able to bring the fire under control within a few minutes. Later the aircraft was taxied clear of the runway escorted by the fire engine.

Investigation

Several loose items were found in the nose locker including two 1 litre cans of oil, and three aerosol cans, one of which contained paint. The fire had caused damage to electrical wiring and looms, melted a plastic heater duct which carried hot airconditioning air to the cabin from a heater under the locker floor, burnt a hessian mat on the floor and damaged soundproofing material. The aircraft skin was not buckled although it was discoloured by smoke inside the locker.

The flight had experienced light to moderate turbulence en route to Kalgoorlie, and an unrestrained aerosol can containing paint had found its way into a recess which held the alternator circuit breakers. Although normally protected by rubber boots the alternator circuit breaker contacts were bridged by the aerosol can which then heated, ruptured, and caught fire. The fire spread rapidly and it was extremely fortunate for both occupants that they were so close to Kalgoorlie, otherwise the outcome of the incident may have been quite different. Circuit breaker protective devices vary between different Beech 58 models, and it was not possible to determine the condition of the protective devices on this particular aircraft after the fire had occurred.

The Flight Manual for the Beech 58 requires alternator and battery switches to be turned off if an electrical fire is suspected. Opening the pilot's small side window is recommended for smoke evacuation if necessary following a fire. Although the intensity of the smoke was intolerable to the pilot, opening the main cabin door would have increased the airflow through the aircraft and fanned the fire. Again, it was the proximity of the destination which prevented an incident developing into a serious accident.

Conclusion

Air Navigation Orders Part 33 specifies the conditions covering the consignment, handling and carriage of dangerous cargo by air. The cans of oil and aerosol carried in this incident were not only unrestrained but the aerosol, and possibly the oil, required special packaging in order to comply with the requirements. Any pilot who may carry a can of aerosol when flying should take considerable heed from this incident, since it could easily have ended in disaster. Any cleaning agents are best left back at base and aerosol cans in particular should not be carried around in the off chance that they might be needed. Complacency is dangerous, and pilots should always be on the lookout for any personal item or piece of cargo which might be potentially dangerous ●

Reader contribution

Dangerous fumes

A Cessna 402 pilot's experience with a leaking outboard motor illustrated the danger posed by toxic fumes in a confined area.

After a flight to an island airstrip the pilot had to lift an outboard motor off some luggage in the nose baggage locker. Although the motor was new it obviously had been tested before shipment, as some fuel had dripped onto the floor. This spillage was cleaned up, and the pilot then confirmed that the motor's fuel tank was empty. With the matter seemingly resolved, the flight was continued.

Some slight odour was apparent after takeoff, but this was not considered significant. Another stopover was made and, again, on the subsequent leg, fumes were noticed. They seemed to be originating from the left side of the nose locker, where the outboard motor was still located. Both the pilot and the passenger sitting in the co-pilot's seat were aware of the fumes. This particular leg took an hour, during which time the pilot's stomach began to feel empty: he attributed this to hunger. Shortly afterwards he started to feel light-headed, and again decided that hunger was the cause.

That sector also concluded at an island strip, where some time was spent outside the aircraft. Takeoff was then made for a further leg.

About 25 minutes after departure the pilot tried to eat something but found he had no appetite. He also again began to experience a feeling of light-headedness, although this time it was more pronounced. At this stage he began to suspect that he may have been experiencing mild food poisoning from the previous evening. He was not too concerned, as he felt he was in complete command of the situation.

However, several minutes later he began to vomit. In view of his condition, the pilot wisely decided to engage the autopilot. Having been sick, he almost immediately felt better and assumed that all his problems were gone. This was not the case, for, when he arrived in the circuit area, the manoeuvring for landing again made him ill: he was particularly aware of feeling weak and drained.

The 'drained' feeling persisted after landing so the pilot drank some staminade, which seemed to improve his condition. About 20 minutes later he was ready to depart again, but, just after he had finished checking the security of all baggage lockers, he suddenly became ill and once more started vomiting. The drained feeling returned and he also began to experience dizziness.

At that stage he decided he should not fly again, but instead should stay overnight where he was, and seek medical attention.

Treatment was administered by a nurse, who put the pilot on oxygen for one hour and advised him to rest all evening. Oxygen was made available for use if necessary during the night.

Follow-up action

Concerned by the incident and appreciating that its consequences could have been worse, the pilot took some trouble to pass on to others what had happened. Details were broadcast to other operators by R/T, while a comprehensive report, on which this article was based, was sent to the Bureau of Air Safety Investigation.

Medical advice

Generally the hazards of petrol vapour are relatively slight, with the exception of their flammability. It would be for the latter reason that the presence of such fuels in open containers and/or with inadequate ventilation would usually be strongly discouraged.

The inhalation of petrol vapour does have a mild anaesthetic action. Concentrations required to have this anaesthetic effect are generally quite high; however, at lower concentrations a variety of effects may be noticed. These include giddiness, flushing of the face, nausea, loss of appetite and inco-ordination. In extreme cases this can progress to disorientation, convulsions and coma.

While these effects of petrol vapour inhalation are usually mild at sea level, they become of much greater significance at altitude. The petrol mist acts by displacing oxygen in the air, thus worsening the expected pilot hypoxia at a given altitude.

If petrol vapour is noticed in flight, all efforts should be made to increase ventilation and use an oxygen mask, if available.

Treatment of mild cases consists of removal from the exposure area to fresh air. More severe cases may require oxygen therapy or assisted respiration ●

Wishful thinking

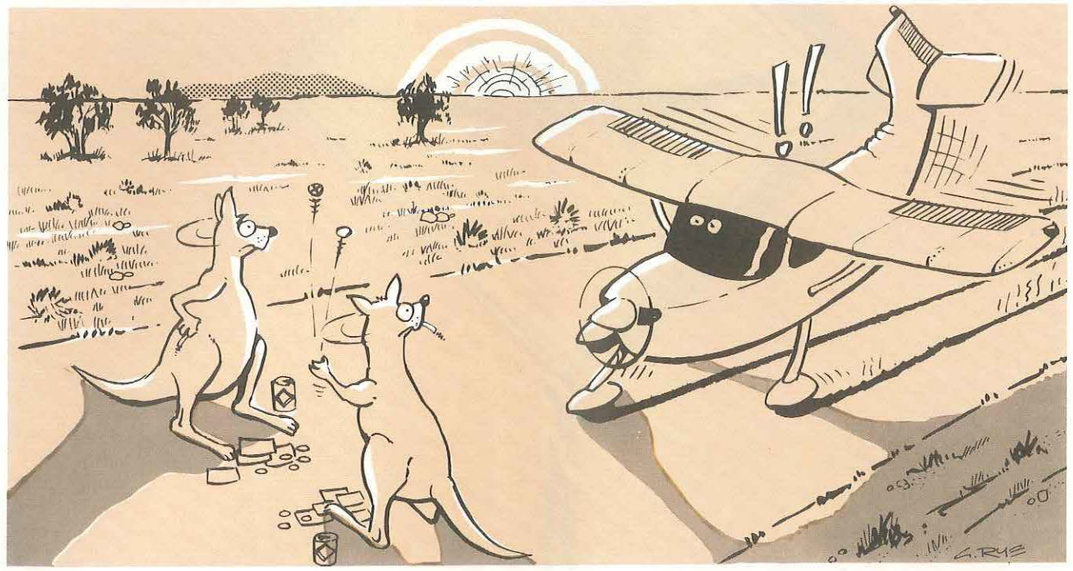
When a pilot makes a decision to continue in marginal conditions, it may be that he is indulging in a little wishful thinking.

It is one thing to make a decision based on local knowledge or experience — it is an entirely different matter to press on in marginal conditions, believing that things always get better. Consider a local fog with a forecast for improved conditions. It would be downright foolish to count on the fog clearing to the extent of being committed to land on arrival and having no options. Or consider the occasion when there is an excessive rpm drop on runup — it would be just as foolish to assume that it is plug-fouling and that it will clear on takeoff.

Whenever we say 'She'll be right, mate', we are exposed to unnecessary risk. A good gambler not only considers the odds but he also refuses to bet more than he can afford to lose.

In aviation the stakes are too high — wishful thinking is not often survivable ●

Animal acts



In a representative 2½ year period, there were 57 reported occurrences of animals obstructing landing areas in Australia: doubtless there were other instances which were not reported. These self-propelled obstructions ranged from cattle to sheep, dogs to foxes, and emus to kangaroos. They were democratic in their choice of landing areas, picking on licensed aerodromes and ALAs without apparent favour.

In those 57 occurrences, damage to aircraft varied from nil for incidents in which a go-around or aborted takeoff was successfully executed, to substantial when either collision with the animal occurred or attempted avoiding action resulted in an accident.

Obviously, every effort should be made to prevent this problem.

ALAs

The responsibility for ensuring that an ALA is clear rests squarely with the pilot-in-command. The Visual Flight Guide (VFG) states:

> The pilot in command shall not land or take off unless persons, animals, vessels and other objects are clear of the runway strip or channel and clear of the aircraft on the ground or water when an engine is operating.

It is also important to note that pilots should contact the 'owner, occupier or controlling authority' before using an ALA, and it clearly makes sense that the likelihood of animals — especially livestock — being on the strip should be checked at that stage.

Notwithstanding the foregoing, owners of ALAs are strongly encouraged to take all reasonable steps to keep animals off their strips.

Licensed aerodromes

Aerodrome licensees are responsible for, *inter alia,* ensuring that no 'vehicle, person or thing enters or remains upon any part of the aerodrome in circumstances in which the safety of any aircraft or its passengers or crew is likely to be imperilled'. As there have been a number of incidents lately in which livestock have gained access to movement areas, it would seem that some aerodrome operators/owners are not complying with their Conditions of Licence.

Conclusion

All aerodrome licensees must be aware of their responsibilities and the possible consequences of neglect. The dictates of good airmanship also demand that a pilot checks that any movement area is clear before it is used, regardless of whether he is at an international airport or an ALA ●