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BUREAU OF AIR SAFETY INVESTIGATION

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Covers
The covers continue the theme of over 30 years of *Digests* — the Australian aviation industry at work.
Front. A Bell Jetranger is shown lifting a Robinson R22 from a remote location following an accident attributed to dynamic rollover. Photograph by Mr John De Ruyter of BASI, Brisbane.
Back. A Hiller 12C at Moorabbin in 1962. Photograph courtesy of Mr Neil Follett.

Editorial

This is the last regular issue of the *Aviation Safety Digest* to be prepared by the Bureau of Air Safety Investigation. The Safety Education Section of the Bureau will be transferred to the Flight Standards Division of the Department of Aviation on 1 July 1986. The purpose of this change is to allow safety regulation and safety education functions of the Department to be administered by the one unit, thereby achieving a higher degree of co-ordination.

The origins of the *Digest* lie in the incident reporting system which was developed during the years following the Second World War, and which led to the regular issue of a report entitled the *Accident and Incident Summary*. Due to the wide interest which this document attracted, an expanded discussion of selected accidents and incidents was commenced with the production of *Aviation Safety Digest* No. 1 in July 1953. During the subsequent thirty two years the *Digest* underwent several gradual changes in response to requests from the industry, or new requirements perceived from within the Department.

The Bureau itself had several ancestors, the first being the Accident Investigation and Analysis Branch of the old Department of Civil Aviation, followed by the Division of Air Safety Investigation. After some minor name changes it became the Air Safety Investigation Branch in 1964, and finally the Bureau of Air Safety Investigation was established in June 1982. Production of the *Digest* was maintained as these changes occurred, and it became a magazine which was much anticipated and well received by the industry. Overseas interest in the *Digest* has also grown with the passage of time, and it is now widely distributed throughout the world to safety authorities, airlines, air forces, universities, and various General Aviation organisations and operators. In return this has opened lines of communication which have often proved to be mutually beneficial, through exchange of information and reports concerning aviation safety matters.

Although annual accident rates have been gradually reducing in Australia for some time, it seems that the rate of improvement has slowed or even plateaued. At the same time the proportion of accidents where pilot factors are assigned continues to be unacceptably high. For instance, between January 1969 and May 1985 there were exactly 50 fatal accidents where the pilot-in-command factor 'continued VFR flight into adverse weather conditions' was assigned as a principal or contributory factor. In these accidents 159 passengers and crew were killed, nine people seriously injured, and only two persons survived unscathed. The past four decades have seen the introduction of regulations, orders and rules to control the aviation industry with the objective of improving safety levels. It is now believed both here and overseas, that civil aviation generally may have reached the limit of accident prevention through regulation, and that the way forward is through improved safety education.

The Department of Aviation has every intention of continuing to monitor compliance with existing regulations, to modify regulations where necessary, and to develop new ones wherever appropriate. However the Bureau itself does not have any regulatory functions, as its role is to investigate accidents and incidents as an independent instrumentality, making recommendations where necessary to the regulatory divisions with a view to enhancing safety. The *Aviation Safety Digest* was part of the Bureau's safety education unit. With the transfer of this unit to Flight Standards it will be possible to achieve better co-ordination of regulatory and safety education functions by having both under control of the one division. It is also important that the Bureau should not be seen to have the dual role of investigator and educator. The aviation industry is in a state of gradual but continuous change, and it is hoped that the new arrangements will lead to further reductions in the number of accidents through improved education of pilots and other personnel engaged in the industry.

Paul Choquenot
Director
Bureau of Air Safety Investigation

Helicopter safety — loss of directional control

Photograph by Mr C. Alviani

The subject referred to as 'unanticipated right yaw', 'loss of tail rotor effectiveness' or 'loss of directional control' in helicopters has been a matter of considerable concern for some time, and a number of articles on the topic have been written.

This section of the *Aviation Safety Digest* contains two such items: the first is reprinted by courtesy of the Flight Safety Foundation and contains recent information derived from extensive flight and wind tunnel testing of the OH-58 (the U.S. Army version of the Bell Jetranger); the second was prepared by the Department of Aviation. The Department's article is the second of two notices previously issued to helicopter pilots and operators warning them of the phenomenon and advising on avoidance and recommended recovery procedures.

The two articles are considered complementary.

FLIGHT SAFETY FOUNDATION

The information presented in this item is important to pilots of all single rotor/anti-torque tail rotor configuration helicopters.

The information which follows has been given wide dissemination among helicopter operators overseas because it describes a phenomenon of low-speed helicopter flying that has only recently been fully understood. Earlier misconceptions have undoubtedly contributed to some fatal helicopter accidents.

The phenomenon is called variously, unanticipated right yaw or loss of tail rotor effectiveness. The renewed understanding has come from extensive flight and wind tunnel tests of the OH-58, the U.S. Army version of the Jetranger. These tests disproved several earlier assumptions concerning the yaw phenomenon. And although the tests relate to only the one helicopter type, the American FAA has issued advice that the phenomenon applies to all single rotor helicopters with an anti-torque tail rotor.

It would be as well at this point to emphasise that all figures given below relate specifically to the OH-58. They can be taken as a guide for other aircraft, however, except that for 'continental' helicopters (with rotors that turn clockwise when viewed from above) azimuths are mirrored and the phenomenon becomes unanticipated left yaw.

Definition of unanticipated right yaw

Unanticipated right yaw is the occurrence of an uncommanded right yaw rate which does not subside of its own accord and which, if not corrected, can result in the loss of aircraft control.

Low speed flight characteristics

Four aircraft characteristics during low speed flight have been identified through extensive flight and wind tunnel tests as contributing factors in unanticipated right yaw. For the yaw to occur, the relative wind must fall within certain azimuths and speeds. The four aircraft characteristics and their associated relative wind velocities (figures for OH-58) are as follows:

- weathercock stability (120-240 degrees, 5-17 knots)
- tail rotor vortex ring state (210-330 degrees, 7-17 knots at 270 degrees, changing to 14-17 knots at the arc limits)
- main rotor disc vortex interference (285-315 degrees, 10-20 knots)
- loss of translational lift (all azimuths)

The aircraft can be operated safely with the above relative winds if proper attention is given to controlling the aircraft. If the pilot is inattentive for some reason, however, and an unanticipated right yaw rate is initiated while in one of the above relative wind regions, the yaw rate may increase unless suitable corrective action is taken.

Weathercock stability

Relative winds from the rear will attempt to weathercock the nose of the aircraft into the relative wind. This characteristic comes from the fuselage and vertical fin. The helicopter will make an uncommanded turn either to the right or left, depending upon the exact wind direction, unless a resisting pedal input is made. If a yaw rate has been established in either direction, it will be accelerated in the same direction when the relative winds enter the 120-240 degree sector, unless corrective pedal is applied. The importance of timely corrective action by the pilot to prevent high yaw rates from occurring cannot be overstressed.

Tail rotor vortex ring state

Relative winds from the left will cause development of vortex ring state of the tail rotor. The vortex ring state causes tail rotor thrust variations, which result in irregular yaw rates. Since these thrust variations are irregular, the pilot must make corrective pedal inputs as the changes in yaw acceleration are recognised.

The resulting high pedal workload in tail rotor vortex ring state is well known, and helicopters are operated routinely in this region. If corrective action is timely, this characteristic presents no significant problem. But if a right yaw rate is allowed to build, the helicopter can rotate into the wind azimuth region in which weathercock stability will accelerate the right turn rate.

Main rotor disc vortex

Relative winds from a small sector of the front left quadrant can cause the main rotor vortex to be directed onto the tail rotor. The effect of this main rotor disc vortex is to change the tail rotor angle of attack. Initially, as the tail rotor comes into the area of the main rotor disc vortex during a right turn, the angle-of-attack of the tail rotor is increased. This increase in angle-of-attack requires the pilot to add right pedal (reduce thrust) to maintain the same rate of turn.

As the main rotor vortex passes the tail rotor, the tail rotor angle-of-attack is reduced. The reduction in angle-of-attack causes a reduction in thrust, and a right yaw acceleration begins. This acceleration can be surprising, since the pilot was previously adding right pedal to maintain the right turn rate. (Analysis of flight test data has verified that the tail rotor in this situation does not stall.)

Thus the helicopter will exhibit a tendency to make a sudden, uncommanded right yaw which, if uncorrected, will develop into a high right turn rate. When operating in this region, the pilot must therefore anticipate the need for sudden left pedal inputs.

Main rotor vortex from a Bell 47G engaged in agricultural spraying

Figure 1. Weathercock stability

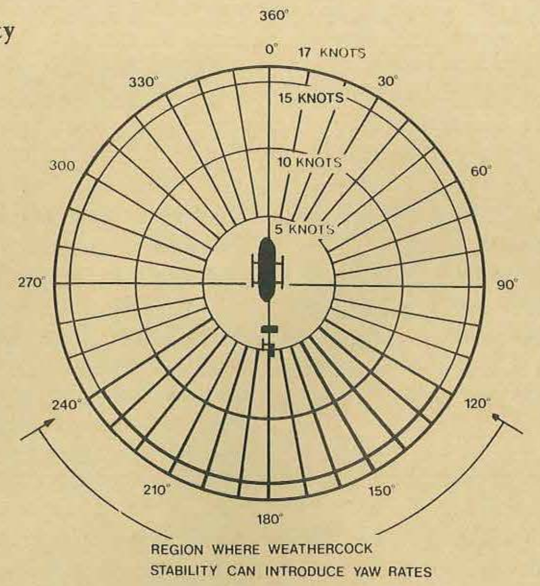


Figure 2. Tail rotor vortex ring state

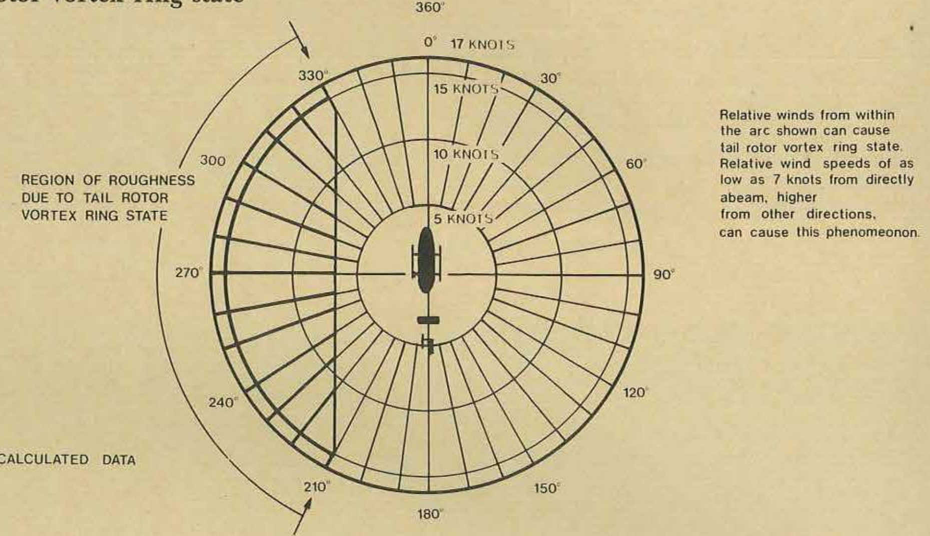
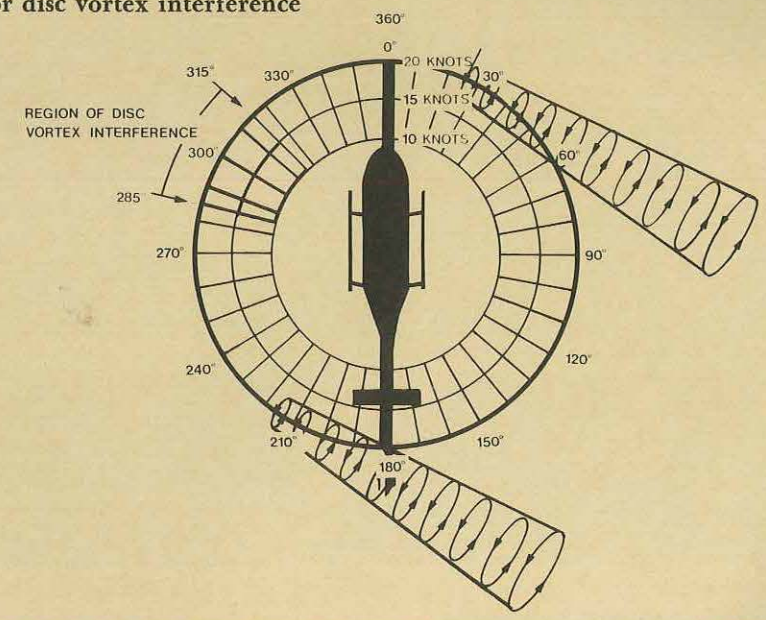


Figure 3. Main rotor disc vortex interference



Loss of translational lift

The loss of translational lift results in increased power demand and additional anti-torque requirements. If the loss of translational lift occurs when the aircraft is experiencing a right turn rate, the right turn will be accelerated as power is increased unless corrective action is taken by the pilot. When operating at, or near, maximum power, this increased power demand could result in rotor rpm decay.

This characteristic is most significant when operating at, or near, maximum power and is associated with unanticipated right yaw for two reasons.

First, if the pilot's attention is diverted as a result of an increasing right yaw rate, he may not recognise that he is losing relative wind and hence losing translational lift.

Second, if the pilot does not maintain airspeed while making a right downwind turn, the aircraft can experience an increasing right yaw rate as the power demand increases and the aircraft develops a sink rate.

Thus, insufficient pilot attention to wind direction and velocity can lead to an unexpected loss of translational lift. The pilot must continually consider aircraft heading, ground track, and apparent ground speed, all of which contribute to wind drift and airspeed sensations. Allowing the helicopter to drift over the ground with the wind results in a loss of relative wind speed and a corresponding decrease in the translational lift produced by the wind.

Any reduction in translational lift will result in an increase in power demand and anti-torque requirements.

Recovery technique

The U.S. Army/Bell tests showed that the aerodynamic loss of tail rotor efficiency that induces the unanticipated right yaw in some low-speed regimes is not a tail rotor stall caused or aggravated by the application of left pedal, as had been previously thought. The tests also determined that:

- full left pedal to counteract the yaw, and
- forward cyclic to increase speed

invariably stopped the unanticipated right yaw.

Collective pitch reduction will also aid in arresting the yaw rate but may cause an excessive rate of descent. Any subsequent large, rapid increase in collective to prevent ground contact may then increase the right yaw rate. The decision to reduce collective must therefore be based on the pilot's assessment of the height available for recovery.

If the right yaw cannot be stopped and ground contact is imminent then an autorotation may be the best course of action.

Conclusion

Operating a single rotor helicopter with relative wind velocities from certain sectors requires a sound knowledge of the forces and phenomena involved and a high level of concentration on controlling the aircraft, with particular attention to the correction of unanticipated yaw in any direction, but more so if the yaw is to the right (or left for 'continental' helicopters).

* * *

DEPARTMENT OF AVIATION

In April 1983 the Department of Aviation distributed a paper titled 'Loss of directional control in helicopters' to Australian helicopter operators and pilots. Since then, the Department has continued to investigate the problem of loss of directional (yaw) control in helicopters due to non-mechanical causes. As a result of this ongoing investigation and in the light of extensive research and trials conducted by Bell Helicopter Textron in the U.S.A., it is now necessary to modify the advice of April 1983 in some respects. It should be noted, however, that the Department is not yet satisfied that the complete facts relating to this phenomenon have been established, and further information is being sought from overseas civil aviation and military authorities.

In the meantime, it is considered desirable in the interests of flight safety to disseminate what is presently known about this problem, to reiterate the need for avoidance of conditions likely to lead to a loss of yaw control, to stress pilot awareness of the problem and to clarify recovery actions should control be lost.

While all of the known loss of yaw control accidents and incidents in Australia have involved Bell 206 helicopters, sufficient evidence is available to indicate that this phenomenon is not unique to that type of helicopter. Insufficient information is available to determine whether some types are more susceptible than others. This paper should therefore be taken to apply to all tail rotor-equipped helicopters including those with main rotors rotating in a clockwise direction. However, in the interests of clarity, only helicopters with counter-clockwise rotating rotors are discussed.

Background

In recent years in Australia, five lives have been lost, six injuries have occurred, and four helicopters have been destroyed or substantially damaged in accidents attributed to or suspected of being caused by loss of tail rotor control. In addition, the Department has received informal advice of several other occurrences where yaw control was lost but the pilot involved managed to regain control. It is unfortunate, of course, that these incidents were not formally reported when they occurred and subjected to normal investigative action — a clearer and more comprehensive picture of the extent of this problem may have been identified much earlier.

It is difficult to determine why this phenomenon has only relatively recently been recognised and given publicity. The tail rotor exhibits much the same aerodynamic characteristics as the main rotor, and it is not unreasonable to suspect that a vortex ring state or settling with power condition could also occur in the tail rotor when an airflow equal and opposite to the induced flow is introduced. Nevertheless, opinion continues to be divided on the cause and effect of this phenomenon. For example, when the Federal Aviation Administration in the U.S.A. was recently asked whether they had any knowledge of this problem they stated, in part: 'The suggested tail rotor stall condition . . . has not been considered a cause factor to any accidents or incidents . . .' The U.S. Army on the

Photograph courtesy of Mr Andrew Lang

other hand has been concerned since at least 1977 about what they term 'loss of tail rotor effectiveness' in their OH-58 helicopters.

One explanation is that, in part, helicopters are being operated differently now than ten or twenty years ago. In the military, emphasis is now on nap-of-earth flying, and in the civil environment, police, rescue, ambulance and especially media helicopters are often called upon to operate out of ground effect at low airspeeds or in a hover. While modern helicopters are much more capable of operating in this environment due to better power-to-weight ratios, basic piloting skills and techniques may have suffered as a result.

Be that as it may, there can be little doubt that loss of yaw control is an increasing rather than a diminishing problem. In the short term, it is improbable that manufacturers will be able to overcome it by design changes or engineering modifications. Like main rotor vortex ring, retreating blade stall, ground resonance, dynamic rollover etc. loss of yaw control is just one more aerodynamic problem that helicopter pilots must contend with. The answer, therefore, lies in pilot training and awareness and in avoidance of situations where it is likely to occur.

Conditions conducive to the onset of loss of yaw control

The airflow around a tail rotor can be quite complex, and is influenced by the movement of the tail rotor in relation to the air mass around it (caused by control inputs or ambient wind), main rotor trailing vortices (similar to wing tip vortices in a fixed-wing aircraft) and the airflow generated by the tail rotor itself by virtue of its rotation and aerodynamic properties. The flow through the tail rotor can, of course, be from either side of the plane of rotation depending on whether the rotor is under power or operating in a windmill state.

In normal cruise flight, main rotor vortices do not interfere with the air mass in the vicinity of the tail rotor and main rotor torque is balanced by a combination of fuselage/vertical stabiliser slip-streaming and thrust from the tail rotor. The direction and velocity of the airflow into the tail rotor are relatively constant under these conditions.

This situation changes markedly when the helicopter is decelerated to airspeeds below approximately 30 knots, especially if a left crosswind is present or is created by allowing the helicopter to yaw to the right. On this latter point, the absence of visual cues at heights above approximately 200 feet makes the maintenance of heading difficult, particularly if the pilot's attention is diverted by other requirements relating to the task he is attempting to perform. An inadvertent, unnoticed and hence uncorrected right yaw can be a major factor in the onset of loss of yaw control.

As effective translational lift is lost, increasing left pedal must be applied to maintain heading. If this is not done or if the helicopter is deliberately yawed to the right during this critical transition stage, the trailing main rotor vortex may introduce turbulent air into the tail rotor and cause large and rapid changes to the amount of thrust produced. Depending on the relative direction of the left crosswind, it is possible for the helicopter to simultaneously encounter a strong weather-cocking yaw to the right and a vortex ring may be generated when the airflow from the left of the tail rotor's plane of rotation equals the induced flow. Under certain circumstances, insufficient left pedal may be available to control the combined effect of these yawing moments and the helicopter will enter an uncontrolled yaw to the right. The onset of this yaw can be quite rapid and has been likened, by those who have experienced it, to a complete loss of tail rotor thrust as would occur if the drive shaft had failed. In some cases, the uncontrolled yaw has been accompanied by a severe nose down or nose up pitch. The reason for this has not yet been determined.

High gross weight and/or density altitude may also have a bearing on the likelihood of encountering this phenomenon in that both require additional left pedal when hovering. Neither is considered to be critical, however, and numerous incidents of loss of yaw control have been recorded at quite low weights and density altitudes. Main rotor and hence tail rotor droop can also affect the onset of loss of yaw control and the subsequent recovery by limiting the thrust available from the tail rotor.

Recovery actions

Much conflicting advice has been published over recent years concerning recovery from loss of yaw control. Bell 206 operators will recall Bell Helicopter Textron Operations issued two Safety Notices dated 31 October, 1983, detailing recovery action. The Department did not agree with the proposed action and recommended an alternative autorotative recovery in a letter to helicopter operators dated 19 December 1983. This was done on the basis of reports from pilots who had successfully recovered the helicopter using that procedure and because the pilot had no way of knowing whether the loss of tail rotor control had been caused by aerodynamic effects or by a mechanical failure or malfunction.

Since that time, Bell Helicopter Textron (BHT) has conducted wind tunnel and flight trials which indicate that the recovery procedures contained in the BHT Safety Notices of 31 October 1983, plus a BHT Information Letter dated 6 July 1984, are the most appropriate FOR BELL 206 TYPE HELICOPTERS. The BHT aerodynamic analyses and recovery procedures have also been endorsed by the Federal Aviation Administration in the U.S.A. In the absence of flight test or other data to refute or throw doubt on the BHT findings, the Department has no alternative other than to endorse the recovery actions proposed in Bell's references. Accordingly, the Department's letter of 19 December 1983 has been cancelled and Bell 206 pilots should follow the BHT recovery procedures when there is no doubt that the loss of yaw control was caused by aerodynamic effects rather than by a mechanical malfunction or failure.

As previously mentioned, overseas experience indicates that loss of yaw control can and does occur in other helicopter types. Unfortunately, little is presently known about the effectiveness or otherwise of the recovery procedures used, and no firm recommendations can be made at this time. It would appear reasonable, however, to suggest that the immediate application of full pedal opposite to the direction of the yaw together with forward cyclic will recover the helicopter during the incipient or early stages of the uncommanded yaw. If this does not have the desired effect, and if height permits, entry into forward autorotational flight may be the best solution. Once control has been regained, normal powered flight can, of course, be resumed.

Summary

An uncommanded yaw can occur when a helicopter is operated below approximately 30 knots out of ground effect with crosswinds opposing the induced flow through the tail rotor. Unless timely corrective action is taken by the pilot, control of the helicopter may subsequently be lost.

Pilots should therefore *avoid* situations which involve a combination of the following:

- (a) flight below 30 knots, out of ground effect
- *(b) crosswinds from the left, particularly left rear crosswinds
- (c) high density altitude/high gross weight
- (d) sudden loss of effective translational lift
- (e) main rotor droop
- *(f) right yaw either inadvertent or pilot induced

*The 'avoid' situations listed above refer only to those helicopters with counter-clockwise rotating rotors. For helicopters with clockwise rotating rotors the 'avoid' situations marked * are reversed, as follows:

- (b) crosswinds from the right, particularly right rear crosswinds
- (f) left yaw either inadvertent or pilot induced

Common sense and airmanship dictate that such a combination should never be deliberately flown when within the helicopter's height/velocity avoid curve.

If low speed flight is necessary:

- (a) ensure the helicopter is decelerated smoothly
- (b) maintain the helicopter's nose into the wind
- (c) prevent rotor droop
- (d) prevent any deviation in the yawing plane

* * *

References

1. Department of Aviation, Loss of Directional Control in Helicopters, April 1983.
2. Bell Helicopter Textron Operations, Safety Notices OSN 206L-83-7 and OSN 206-83-10, 31 October 1983.
3. Department of Aviation, Letter M131/1/363-1, 19 December 1983.
4. Bell Helicopter Textron Information Letter 206-84-41/206L-84-27, 6 July 1984.

Helicopter operators and pilots who do not already have these references can obtain them by writing to:

The Director, Special Operations Section, Flight Standards Division, Department of Aviation, P.O. Box 367, Canberra City, A.C.T. 2601 (for references 1 and 3).

Bell Helicopter Australia (Attn: Librarian), P.O. Box 18, Brisbane Airport, Qld 4007 (for references 2 and 4) ●

fuel selection

One of the first emergency checks a pilot has to carry out following a loss of engine power concerns the fuel selector — is it ON, and is it selected to the desired tank?

An incident involving a Cessna 310R raised a number of interesting points regarding fuel selector checks which are completed under pressure.

Power line patrol

The Cessna was engaged on a low-level power line inspection, looking for a broken line. As the operation was being conducted over fairly rugged terrain, the pilot was devoting all his attention to flying the aeroplane. A reduced power setting of 18" of MAP and 2300 RPM was being used, sometimes with 15° of flap, to keep the IAS between 110-120 knots.

In due course the broken section of the line was located, but the spotter wanted to continue the inspection to see whether thunderstorms from the previous evening had caused any other damage.

Approaching a small hill, which necessitated a gentle climbing turn, the pilot applied power to both engines. While the right engine accelerated normally, the left engine lost power.

Trouble checks, including the fuel selector, were immediately performed, but failed to restore power. The pilot suspected it was some kind of fuel problem, even though the selector and quantity checks had not revealed any apparent anomaly. Because of this suspicion he did not feather the left propeller after the emergency check. This in turn created performance problems. It was a hot day, so, with the high density altitude, the 310 did not want to climb. After some minutes the pilot did, however, feather the left propeller, and a slow but safe climb was established, and a safe single-engine recovery made.

Company inspection

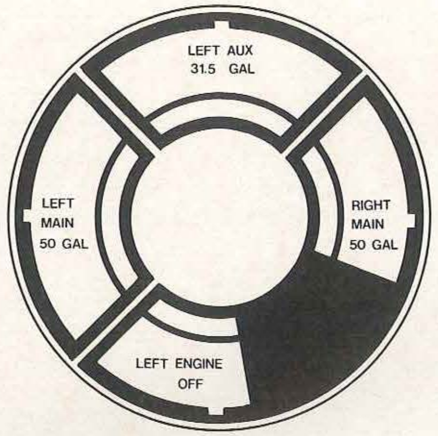
Company engineers removed the cowls and inspected the engine; they could find nothing wrong. A senior pilot then took the aircraft out and carried out power checks, which also were satisfactory. However, the pilot then carried out a number of trials, which eventually pinpointed the problem.

The C310R has a fuel selector for each engine. For the left engine, the sequence of selection on the circular indicator, reading in a clockwise direction, is:

- Left engine OFF
- Left main
- Left aux.
- Right main

The pilot found that with 18" MAP and 2300 RPM, moving the selector from 'Left main' (which had been the setting at the time of the power loss) to 'Left aux.' did not affect the engine's output. However, if the selector was positioned towards the OFF segment, just enough for the fuel flow indication to flicker, the situation changed.

Under those circumstances, when the left throttle was opened, the engine failed. This clearly was a



consequence of insufficient fuel being available to satisfy the increased demand.

Analysis

Further examination by the company showed that, for this particular aircraft, the left fuel selector pointer could move some radians without actually moving the vertical shaft on which it was mounted, i.e. without moving the fuel selector valve. Thus, it was possible for the pointer to indicate 'Left main' when in fact it was partially OFF. It was also found that the placard for the selector was not glued properly and could move, which further increased the possibility of an erroneous indication occurring.

At this point some comment on the design of the selector label is warranted. As shown in the diagram, the 'Left main' position encompasses an arc of about 60 degrees. However, there is a precise detent for the ON position, and it is essential for the selector to be in that detent. It seems highly likely that it was not in the detent when the incident occurred.

Follow-up

Not satisfied with leaving his investigation at that, the senior pilot concerned carried out two more 'tests'. When the power failure happened, the pilot-in-command had Instrument Approach Charts on the floor near the fuel selectors. It was determined that it was feasible for those documents to move the fuel selector if bumped against them.

On the emergency procedures aspects, the opportunity was taken during an Instrument Rating Renewal on another pilot several days later to observe his emergency procedures. When a simulated engine failure was given in flight, the pilot identified, confirmed, and, during his trouble checks, pointed to the left fuel selector and stated 'Fuel on'. He did not, however, physically check that the selector was in the detent. As it happened, the pilot undergoing the Renewal had given the pilot who had the engine failure his 310 endorsement. Game, set and match to the senior pilot who had traced this incident through with commendable thoroughness.

All company pilots and engineers were made aware of the circumstances, and a detailed report was submitted to the Department of Aviation for the benefit of C310 (and similar types) operators ●

Private pilot flight skill retention

Photograph by Mr R. Sibley

Some pilots believe that flying an aeroplane is like riding a bike — once you have learnt, the skills are never really forgotten and all that is needed is an occasional refresher flight.

However, the evidence is that this is not the case. All pilots get 'rusty' to some extent if their skills are not exercised sufficiently. Early discussions between Department of Aviation pilots and industry instructors indicate that a degradation of skills is often apparent during a Biennial Flight Review.

Those who undoubtedly suffer most from the problem of infrequent flying are the recreational pilots, who, in the great majority of cases, hold a Private Pilot Licence.

The extent to which pilot skills degrade was the subject of a study sponsored by the U.S. Federal Aviation Administration (FAA). Entitled 'Private pilot flight skill retention', this study was initiated with the objective of identifying the following items:

- The retention patterns for skills needed to perform a representative range of private pilot flight tasks.
- The factors influencing the retention of these skills and the nature and degree of such influences.
- The continuation training methods necessary to maintain or improve skills.

A secondary objective was to assess pilots' ability to predict and evaluate their own proficiency level.

While there are differences between U.S. and Australian General Aviation — training, flying conditions and so on — there are also many similarities, to the extent that the findings of the FAA study have considerable relevance in Australia, both for the individual pilot in assessing his competence and the flying supervisor who plans and monitors continuation training.

With the kind permission of the FAA, a summary of the study is presented below.

A note for frequent flyers

Even though this study is concerned with PPL holders, it is most important to note that all pilots are subject to skill degradation, regardless of their licence category and frequency of flying, if their technique or continuation training cycle is deficient. For example, evidence can be cited which shows that professional pilots lose skills in sequences, e.g. emergencies, which are not practised often and regularly; while if sequences are performed frequently, but in a sloppy fashion, skill degradation will again occur.

The study — introduction

Flight skills will degrade over time if not exercised sufficiently for the pilot to be able to retain or improve them. Thus, pilots who do not fly for extended periods of time, or who fail to practise certain critical tasks when they do fly, may be expected to make errors. These errors can, in turn, contribute to a variety of safety problems from which accidents and incidents may be the end result.

The flying skill degradation problem can be addressed through effective continuation training programs. Such programs should be implemented on the basis of a clear perception of the flight skills that degrade over time and an understanding of the factors that affect this degradation.

The pilot proficiency data analysed in the present study were collected 8, 16 and 24 months after the subjects received their certificates. All data could be meaningfully compared since flight and written tests used to collect the skill retention data were identical to those used earlier in conjunction with private pilot certification.

This study was conducted at the FAA Technical Centre, Atlantic City Airport, New Jersey. Subjects were personnel employed by the FAA. Of the initial 42 subjects, 12 were available for the final 24-month check. At the time of the final retention check, subjects had a mean of 162 total flight hours (standard deviation = 51 hours), and had flown a mean of 89 hours (standard deviation = 47 hours) since passing their private pilot flight test. Some of the subjects had undertaken additional training between their private pilot flight test and the various retention checks, whereas other subjects received no such training.

All flight proficiency data were acquired via the use of an objective inflight data collection instrument containing a standard sequence of flight tasks to be administered in the aircraft. Error percentages on tasks contained in the instrument served as the major dependent measure of skill retention. In other words, the percentage of errors made on the task was used as the fundamental measure of how much of a pilot's skill had been retained. However, four other types of data were collected on each subject. They were:

1. survey data concerning flying activities since certification
2. scores on an adaptation of the FAA Private Pilot Written Test
3. precheck (prediction) questionnaire data
4. postcheck (evaluation) questionnaire data

The experimental design for this study evolved into one in which comparisons were made of the skill retention levels of the subjects who underwent additional instrument training sessions during the 24-month interval versus those subjects who did not.

A second performance comparison was derived from an examination of when additional training was received relative to the three retention checks. This comparison was between two training subgroups, one of which received most of its additional training before the 8-month check (Group A) and the other of which received most of its training after the 8-month check (Group B). Thus, the skill retention of these two subgroups and that of the no-training subgroup (Group C) was compared across flight checks.

Results and discussion

Data were analysed for all three retention checks relative to private pilot checkride performance. The majority of flying experience acquired by subjects during the 2-year interval occurred in conjunction with their participation in other FAA-sponsored training research projects. At the time of the 24-month check, a mean of more than 5 months had elapsed since subjects had flown, and most of the subjects' additional flying experience had accrued during the 12 months following private pilot certification.

General decrement in performance was apparent for all groups as represented by the decreases in percentage of correctly performed measures over time. With respect to combined groups, the decrement was curvilinear (i.e. skills degraded in a curved-line pattern and not uniformly with time) and approximated the classical 'forgetting curve' described in psychological literature. However, the pattern of the decrement was group-specific (i.e. degradation of skills was relatively consistent within the three groups, but the specific pattern of skill decay was different for each group). Group A's decrement was delayed by the effects of its involvement in additional training occurring during the initial 8-month retention interval. Group B experienced substantial decrement initially but relatively less decrement during the second 8-month interval when the majority of its additional training was received.

Subjects' flying activity data at the time of the 24-month retention check

	Mean	*Standard deviation*
Total flight time (hours)	162.3	51.7
Recency (days since last flight)	157.0	98.1
FLIGHT EXPERIENCE SINCE PRIVATE PILOT CERTIFICATION		
Flight time (hours)	89.1	46.8
Instrument training (hours)	46.4	14.1
Multi-engine training (hours)	14.8	6.2
Hood time (hours)	42.1	15.3
Dual time (hours)	64.4	35.1
Simulator time (hours)	29.2	22.6
Cross-country time (hours)	34.7	30.0
General Aviation aircraft passenger time (hours)	10.9	27.1
General Aviation aircraft types flown (number)	3.9	2.0

Group C, which received no additional training, experienced virtually all of its skill loss during the first 8 months. While Group A's decrement was relatively less than that of Group B and C during the first 8 months, the decrement was statistically significant for all three groups, a finding of definite operational concern. In other words, the loss of flying skills since certification was statistically significant for every group — it could not be attributed to chance.

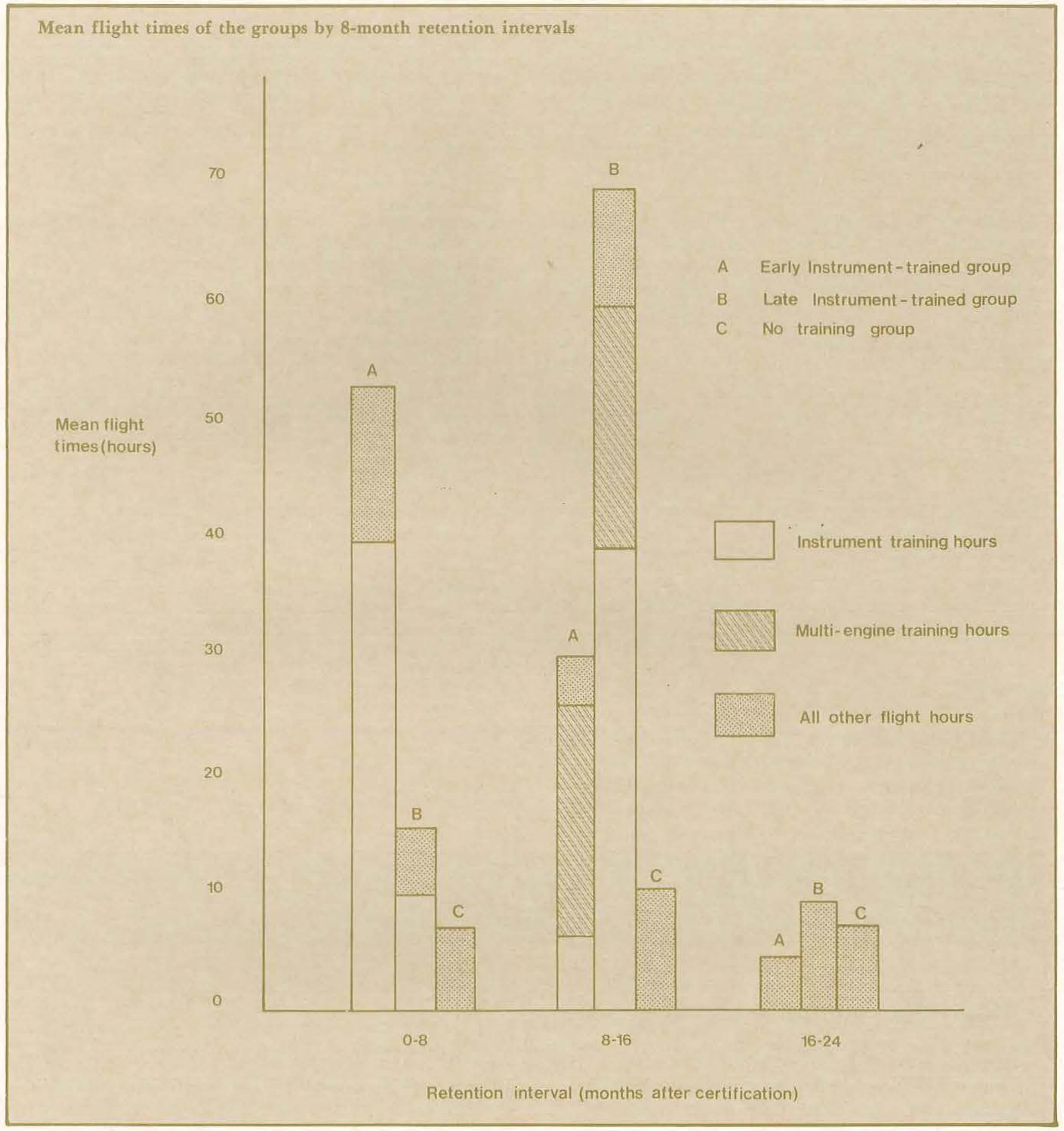
Skill decrement over the 24-month period was statistically significant for combined flight tasks, as well as for each task considered separately (except one involving the use of a checklist). Flight tasks exhibiting the greatest and least decrement over the 2-year retention interval were identified.

Scores on written examinations significantly decreased over the initial 8-month period, but no relationship was found between these scores and inflight error rates on the 8-month check.

Subjects demonstrated a moderate ability to predict and evaluate their own overall proficiency at the 8-month check. However, they were not accurate in the case of predictions/evaluations of specific flight tasks.

Results of the present study strongly indicate that private pilots who do not operate aircraft frequently need continuation training to maintain or improve flight skills. To attempt to identify the specific types of flying skills that degraded in the present study, a preliminary analysis was conducted of performance errors. This analysis revealed that cognitive/procedural components were frequently performed in error on the retention checks. For instance, all subjects failed to acknowledge at least one ATC instruction at some point during the 24-month check, and 70 per cent of the subjects used improper entry procedures for one or more of the stall manoeuvres.

Both the general literature on skill retention and the results of the present study suggest that generation of methods to improve the retention of cognitive skills should be one of the primary objectives of continuation training. General aviation continuation training, as it presently exists, does not sufficiently address the cognitive/procedural types of skills that are rather rapidly lost during lapses in operations.



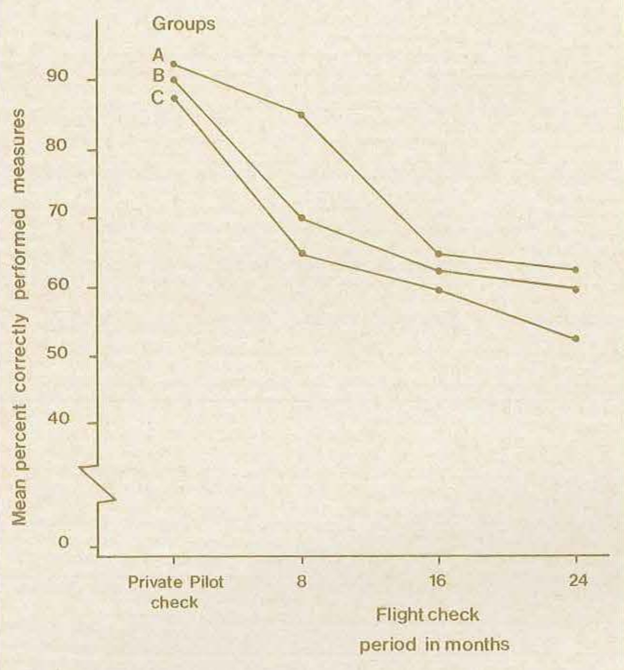
Conclusions

Based on the results presented and the discussion and implications thereof, a number of general conclusions can be drawn:

1. Recently certificated private pilots who do not fly regularly can be expected to undergo a relatively rapid and significant decrement in their flight skills. Further, such decrement will affect most flight tasks that are required of the private pilot.
2. The effect of additional flight training is to forestall (not prevent) skill decrement.
3. Instrument training, properly conducted, can exert positive effects on the retention of both contact and instrument flight tasks.
4. Greater and more pervasive performance decrements may be expected for flight tasks that require appreciable co-ordination between cognitive and control skills.
5. Written test (i.e. knowledge) scores decrease significantly during the 8-month period following certification; however, written test scores are not useful for predicting actual flight performance.
6. Private pilots who do not fly frequently need periodic diagnostic assistance to help them pinpoint specific flight tasks on which they need continuation training.
7. Continuation training methods should be skill-specific and emphasise the development and reinforcement of cognitive cues.
8. An urgent need exists for the development of more effective performance criteria and of continuation training methods designed to aid private pilots in meeting those criteria.

(continued overleaf)

Mean per cent correctly performed measures by groups across flight checks



Mean per cent correctly performed measures for each flight task across flight checks

Tasks	*Initial licence check*	*Flight check (months)* 8	16	24
1. Engine runup before takeoff check	100	98	100	94
2. Takeoff and departure	95	74	64	60
3. VOR tracking	79	68	48	50
4. Straight and level	72	74	76	66
5. Minimum controllable airspeed	83	62	37	39
6. Takeoff and departure stall	99	77	79	71
7. Approach stall	98	84	80	76
8. Steep turns	79	54	51	38
9. Accelerated stall	90	51	52	57
10. Engine failure during flight	92	88	67	77
11. Forced landing	95	74	67	76
12. Traffic pattern (uncontrolled field)	89	70	52	56
13. Landing (uncontrolled field)	94	68	55	51
14. Short field takeoff	95	75	56	56
15. Short field landing	90	67	54	51
16. Soft field takeoff	94	80	65	61
17. Crosswind takeoff	93	89	53	75
18. Crosswind landing	93	81	58	63
19. S-turns across a road	88	54	53	41
20. Turns about a point	83	52	52	41
21. Rate climb (hood)	84	56	62	38
22. Magnetic compass turn (hood)	74	51	40	33
23. Unusual attitude recovery (hood)	97	66	70	66
24. 180° turns (hood)	90	79	63	52
25. Go-around	100	90	85	78
26. Landing (controlled field)	94	68	65	54
27. Communications	100	93	87	74

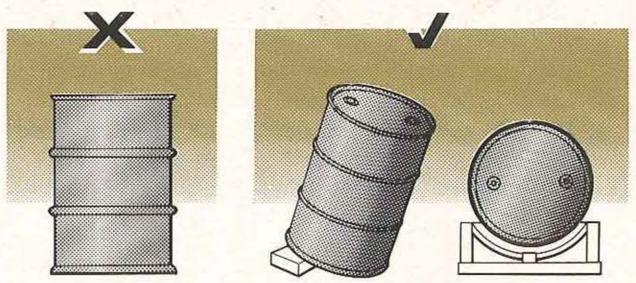
Editor's note

Further to this article, in mid-1985 the FAA issued a proposal which included a number of changes in the requirements for a Private Pilot's Licence. These included the proposal that non-instrument-rated private pilots with less than 400 hours of total flight time would be subject to a new 2-hour annual training requirement and annual review and recent flight experience requirements ●

Stop water contamination (corrigendum)

Page 12 of *Aviation Safety Digest* 126 carried an article on the outside storage of fuel drums and requires correction. Somewhere between artwork preparation and printing the drum lying down was 'rolled' 90 degrees, so that the bungs in the diagram were shown as being in the 6 o'clock position instead of the 3.45 position. The correct position ensures both bungs are covered so that a leaking bung will show, and also minimise 'weathering' of fuel should a drum breathe due to expansion and contraction. If a drum constantly breathes and a bung is not covered with fuel, the light fractions in the fuel will gradually be lost to atmosphere and the fuel will be off specification. The tilted drum was intended to indicate the recommended position for pumping and water testing. The low side of the drum is tested for water, while the foot of the pump should be on the high side.

The policy of some oil companies is that refuelling aircraft directly from drums is an exceptional situation, and the drummed fuel should first be pumped into a tanker or other approved arrangement with proper filters and drains. Any leaking drum, one which has had the seal tampered with, or one which has an illegible expiry date is downgraded to mogas or otherwise disposed. The oil companies have no policy regarding partly used drums, so that an opened drum should be used immediately ●



Aircraft accident reports

LAST QUARTER 1985

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

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

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

Note 1: All dates and times are local

Note 2: Injury classification abbreviations

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

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

PRELIMINARY REPORTS (The following accidents are still under investigation.)

Date / *Time*	*Aircraft type & registration* / *Location*	*Kind of flying* / *Departure/Destination*	*Injuries* / *Record number*
03 Oct 1125	Robinson R22-Alpha VH-UXR / Wanaaring 83WSW	Non commercial — aerial application/survey / "Reola" Stn NSW/"Reola" Stn NSW	C1N / 8521054

The pilot intended to land the helicopter near a water tank so that he could free sheep bogged in the muddy ground. When the aircraft was at about 80 feet agl on descent, the pilot applied power and raised the collective to reduce the rate of descent. He heard a bang, followed by a noise he described as clutch growl and the helicopter began to vibrate severely. The collective was lowered momentarily and power was re-applied, however, the clutch growl and vibration continued. The pilot lowered the collective but the helicopter struck the ground firmly at a low forward speed and the main rotor severed the tail boom.

05 Oct 1200	Jodel D9-A VH-SJZ / Gatton QLD	Non commercial — pleasure / Gatton QLD/Gatton QLD	C1N / 8511046

After completing a circuit, the aircraft was flown along the strip at an altitude of 50 feet. An airspeed of 50 knots was maintained with a low power setting. Towards the end of the strip the pilot attempted to apply climb power but the engine did not respond. The pilot selected a clear area straight ahead and landed the aircraft. During the landing roll the aircraft struck a tree stump which was hidden in the tall grass.

09 Oct 1415	Hiller UH12-E VH-AGL / Cape Portland TAS	Aerial mustering / Cape Portland Tas/Rushy Lagoon H'stead	C1N, P1N / 8531020

The pilot reported that while he was hovering the helicopter at about 25 feet agl, the engine suddenly lost power. He placed the helicopter in an autorotation but maintained the throttle setting that had been set while the aircraft was hovering. Just as the skids were about to contact the bushes, the engine momentarily regained power. The helicopter impacted the ground on its right hand side and fire broke out. Both the occupants escaped from the helicopter before it was destroyed by fire.

09 Oct 1000	Cessna 182 P VH-IRL / Lawn Hill Stn QLD	Non commercial — pleasure / Tennant Creek NT/Lawn Hill Stn QLD	C1N, P1N / 8511048

The pilot stated that the aircraft was caught in a downdraught just prior to touchdown. The aircraft landed heavily and bounced. After a second bounce the pilot carried out a go around. Following the subsequent landing, the damage to the propeller, fuselage and engine firewall was discovered.

Date Time	Aircraft type & registration Location	Kind of flying Departure/Destination	Injuries Record number
09 Oct 1030	Cessna 150 G VH-KPP Nookawarra HS WA	Non commercial — pleasure Nookawarra HS WA/Nookawarra HS WA	C1N 8551027

After the aircraft had been airborne about 90 minutes, the engine began to run roughly. The pilot's attempts to restore full power were unsuccessful and the engine stopped. During the latter stages of the subsequent landing roll, the aircraft struck a dead tree and damage was caused to the left wing and lower engine cowl.

10 Oct 1230	Quickie Q200 VH-FMV Bankstown NSW	Test Bankstown NSW/Bankstown NSW	C1N 8521057

The aircraft was being flown for the first time. The pilot stated that after takeoff the aircraft felt very nose heavy and that he had difficulty in maintaining a nose-up attitude after liftoff. When he attempted to reset the elevator trim the friction nut broke. The back pressure that he was required to hold with the control column reduced as the airspeed increased. During the subsequent approach the pilot found he had insufficient elevator control available to flare the aircraft. On touchdown the aircraft bounced and a go around was carried out. The pilot made several other landing attempts but on each occasion the aircraft bounced. On the final attempt the aircraft bounced a number of times before the right canard collapsed and the aircraft ran off the runway.

10 Oct 0059	Israel 1124 VH-IWJ Maroubra NSW 3E	Charter — cargo operations Sydney NSW/Brisbane QLD	C2F 8521056

The aircraft was planned to conduct a regular freight service to Brisbane and Cairns. After an evidently normal takeoff from Runway 16 the crew contacted Departures Radar, advised that the aircraft was climbing to Flight Level 370 and requested the direct track to Brisbane. Approximately two minutes later the crew did not respond to calls from the radar controller, and the aircraft faded from the radar screen. Witnesses subsequently reported that the aircraft was seen diving steeply towards the water.

To date some of the wreckage has been recovered and attempts are being made to locate and recover the remainder, together with the flight data and cockpit voice recorders. Water depth in the area is about 85 metres.

12 Oct 1410	Hughes 269 C VH-SBR Kununurra 97NNE	Aerial mapping/photography/survey Kununurra WA/Kununurra WA	C1M, P1M 8551028

The pilot was requested, by the passenger, to land the helicopter on the mud flats to the north of Kununurra. He decided to make a run on landing as he believed he may have difficulty in hovering the helicopter. As the aircraft approached the touchdown point, the pilot allowed it to yaw into wind, but it contacted the ground still moving sideways. The left skid caught in the dry mud and the helicopter rolled onto its side.

14 Oct 0615	Hughes 269 C VH-WPP Clermont QLD 5W	Non commercial — business Leigh Holme QLD/Epping Forest QLD	C1N 8511047

About five minutes after takeoff, the pilot heard a change in engine note and felt a slight yaw to the left. This occurred several times in quick succession. The pilot reduced power and commenced a descent towards a disused mining area. At about 200 feet agl, the engine failed and an autorotational descent was set up. As the pilot was attempting to manoeuvre the helicopter into wind and clear of some mullock heaps, the tail rotor struck the ground. The main rotor then severed the tail boom and the helicopter came to rest 10 metres from the initial point of impact.

14 Oct 1000	Robinson R22-Alpha VH-HBQ Warooka SA 5S	Non commercial — pleasure Warooka SA/Warooka SA 5S	C1N, P1M 8541018

The pilot positioned the helicopter on the downwind leg of the circuit at an altitude of about 300 feet agl. The wind was gusting between 30 and 35 knots. Towards the end of the downwind leg the pilot noticed that the helicopter was yawing to the right and that a high rate of descent had developed. The pilot applied full power and lowered the collective slightly. The helicopter continued to descend and the pilot applied full up collective, but the helicopter struck the ground heavily and bounced. On the second touchdown, the tail rotor struck the ground and broke off.

15 Oct 1515	Bell 206 B VH-PHB Nowra NSW 26N	Charter — passenger operations Nowra NSW 26N/Albion Park NSW	C1S, P2S 8521058

The helicopter had been chartered because the passenger's farm had been isolated by flood waters. 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.

19 Oct 1430	Schemp STD Cirrus VH-GYZ Horsham VIC	Non commercial — pleasure Horsham VIC/Horsham VIC	C1N 8531021

During the launch by a tug aircraft for the pilot's first flight of the day, turbulence was encountered at about 40 feet agl. The pilot released from the tow and attempted to land straight ahead, however the right wing struck a post of the aerodrome boundary fence and the aircraft ground looped before coming to rest.

22 Oct 0709	Piper 32 300 VH-PPF Peterborough SA	Non commercial — business White Well SA/Mildura VIC	C1F, P4F 8541019

Prior to departure, the pilot obtained a weather forecast for the route to be flown. He then submitted flight details that indicated the flight would be conducted in accordance with visual flight rules. The aircraft was later observed to takeoff and head towards the north-east. At the time of departure, it was reported that rain was falling and that low cloud covered the area.

Approximately 40 minutes after the aircraft departed, the wreckage was sighted by a passing motorist. Ground marks indicated that the aircraft had struck the ground while heading in a north-westerly direction.

26 Oct 1705	Hughes 269-C VH-MSL Karratna WA 61SE	Ferry Mardie Stn WA/Mundabullangana HS	C1N 8551029

As the helicopter was cruising at 1000 feet agl, the engine suffered a complete loss of power. An autorotation was commenced and the pilot headed the aircraft towards a clear area, to land. At the completion of the landing flare, the heel of the skids dug into the ground and the main rotor blades struck the tail boom.

Date Time	Aircraft type & registration Location	Kind of flying Departure/Destination	Injuries Record number
31 Oct 1245	Cessna A188B-A1 VH-UAY Naracoorte SA 46NW	Aerial agriculture Naracoorte SA46 NW/Naracoorte SA 46NW	C1N 8541021

The pilot was engaged in spraying an area of grape vines. On the final spray path the aircraft had to pass under a set of power lines. The pilot reported that as the aircraft approached the power lines, it was affected by an updraught. He pushed the control column forward but the propeller and fin mounted wire deflector struck the power lines. The aircraft descended and struck a post used to support the vines before it came to rest in the crop.

01 Nov 1657	Maule M7-235 VH-MBL Bankstown NSW	Non commercial — pleasure The Oaks NSW/Bankstown NSW	C1N, P1N 8521059

The pilot was making a landing approach in moderate crosswind conditions. Touch-down was made in a three-point attitude at an airspeed of about 40 knots. Immediately afterwards, the pilot experienced difficulty in preventing the into-wind wing from rising. He elected to go around and applied full throttle, but was unable to maintain directional control. The propeller struck the ground and the aircraft cartwheeled before coming to rest.

01 Nov 1730	Cessna 172 N VH-BWN Pinjarra WA 5E	Non commercial — pleasure Geraldton WA/Pinjarra WA	C1N, P3N 8551030

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, which the pilot believed formed part of the strip. The ground track of the aircraft was affected by a wind-row 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, however, the right main wheel struck a car tyre which was used to mark the strip, 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.

02 Nov 1413	Cessna 172RG VH-KPL Compton Downs QLD	Non commercial — pleasure Compton Downs QLD/Richmond Downs QLD	C1N 8511050

The pilot reported that at about 50 knots during the takeoff run, he heard a loud noise and the aircraft began to progressively adopt a nose-low attitude. The nose of the aircraft dug into the ground and the aircraft overturned. When the pilot inspected the aircraft following the accident, he found that the landing gear was retracted and that the gear selector was in the up position. The pilot did not recall the position of the selector before the commencement of the takeoff.

07 Nov 0900	Cessna 152 VH-WFQ Wollongong NSW	Instructional — solo (supervised) Wollongong NSW/Wollongong NSW	C1N 8521060

The student was conducting a series of circuits with touch-and-go landings. Wind conditions were calm and during the fifth circuit the pilot decided to carry out a full-stop landing before using another runway. At a speed of about 30 knots during the landing roll the pilot applied braking, but the aircraft immediately veered sharply to the right and ran off the side of the runway. The nosegear was broken when the aircraft entered a ditch before coming to a halt.

08 Nov 1150	Piper 28 R180 VH-CHI Cessnock NSW	Instructional — solo (supervised) Cessnock NSW/Cessnock NSW	C1N 8521061

The pilot had successfully carried out a series of seven circuits with touch-and-go landings. He subsequently advised that he had been experiencing difficulties in maintaining accurate height and tracking on the downwind leg, and while concentrating on these points on the eighth circuit he forgot to lower the landing gear. As he flared the aircraft, he heard a radio message instructing him to go around. Full power was immediately applied, but the aircraft contacted the runway and skidded to a halt.

09 Nov 1208	Victa 115 VH-FHP Cairndale SA	Non commercial — pleasure Aldinga SA/Aldinga SA	C1F, P1F 8541022

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 aircraft was observed flying at a low altitude and subsequently struck the top wire of a three-strand power line. The aircraft then climbed over a row of trees before descending steeply into the ground. A fire broke out and consumed the fuselage of the aircraft.

10 Nov 1704	Hughes 369 HS VH-FAM Baxter VIC	Non commercial — pleasure Moorabbin VIC/Moorabbin VIC	C1F, P1F 8531022

The pilot and passenger were en route to Hastings to make an aerial inspection of a boat which the two men were considering buying. The aircraft was in cruising flight at a height estimated to be between 200 and 500 feet above ground level. A number of witnesses reported that the engine made a spluttering noise, followed by a bang. Pieces were then observed falling from the aircraft, and some witnesses saw the tail rotor assembly detach. The helicopter then dived to the ground and was destroyed by the impact and a fierce fire which broke out immediately afterwards.

10 Nov 1950	Westland Scout VH-NVY Schofields NSW	Ferry Schofields NSW/HMAS Nirimba NSW	C1N 8521062

The helicopter had been transported by road to Schofields to form part of the static display associated with an airshow. Although it was airworthy, the helicopter was the only one of its type in the country and had not been approved for flight at the show. At the conclusion of the show, one of the persons responsible for the restoration of the aircraft became concerned for its security, and he elected to hover taxi the helicopter a short distance onto Naval property. Control of the aircraft was lost shortly after it became airborne, and it struck the ground while moving backwards before coming to rest on its side some 60 metres from the parked position.

12 Nov 1616	Cessna 177 VH-DZD Morven QLD 9N	Non commercial — pleasure Mitchell QLD/Charleville QLD	C1N 8511054

The pilot reported that while the aircraft was established in cruise, the engine rpm suddenly increased and the windscreen covered with oil. The engine oil pressure gauge was indicating zero. During the subsequent landing, the aircraft ran off the sealed roadway.

Date	*Aircraft type & registration*	*Kind of flying*	*Injuries*
Time	*Location*	*Departure/Destination*	*Record number*

13 Nov	Sweargen 226 T (B) VH-SWK	Supplementary airline	C1N, P5N
1115	Coober Pedy SA	Olympic Dam SA/Coober Pedy SA	8541023

The pilot reported that as the aircraft approached the flare height, it yawed violently to the right. The right maingear and nosewheel struck the ground heavily and the aircraft turned to the right before the pilot was able to regain control. An inspection of the aircraft revealed that the four blades of the right propeller had been bent and the lower fuselage skin was buckled.

13 Nov	Robinson R22 VH-UXE	Aerial mustering	C1N, P1N
1555	Pt Hedland 84SW	Croydon Yard WA/Croydon Yard WA	8551031

The pilot was mustering a herd of cattle across a tree-lined dry creek bed, when the mob scattered. He positioned the helicopter at tree-top height to block the escape of the cattle from the creek. The rotor rpm rapidly decayed and the pilot was unable to prevent the aircraft sinking and landing heavily on the bank of the creek.

16 Nov	Piper 25 235 VH-SPB	Aerial agriculture	C1S
1146	St Arnaud VIC 24N	Donald VIC/Donald VIC	8531023

At the end of each spray run, the aircraft was flown under a power line before the turn to change direction was commenced. Several runs had been completed when the pilot climbed the aircraft to commence the turn and the aircraft collided with the power line. The pilot dumped the remainder of the load and the aircraft continued to fly, trailing the power line. After travelling a short distance the aircraft apparently stalled and struck the ground in a nosedown attitude. A fire broke out and completely engulfed the wreckage.

21 Nov	Beech B24 R VH-DJD	Non commercial — business	C1N, P3N
1510	Emerald QLD 37N	Morana Station QLD/Emerald QLD	8511051

After having inspected a property, the pilot and his passengers returned to the aircraft to prepare for departure. A storm was approaching the strip from the north and a 10–15 knot crosswind prevailed at the strip. A takeoff into the east was commenced and as the aircraft crossed the upwind end of the strip it was affected by a sudden gust of wind. The aircraft yawed to the right, lost altitude and struck the ground, before coming to rest in a ploughed paddock.

22 Nov	De Hav 82 VH-MDV	Non commercial — pleasure	C1N, P1N
0740	Camden NSW	Camden NSW/Camden NSW	8521065

The aircraft had been refurbished during the preceding months, and at the completion of this work the pilot intended to carry out a short test flight. He subsequently reported that as soon as the aircraft became airborne after a normal takeoff roll, it veered sharply and the right wing dropped. Corrective control inputs had no effect, the wing and propeller struck the ground and the aircraft overturned, coming to rest about 200 metres from the start of the takeoff roll.

22 Nov	Cessna 172 N VH-UWD	Non commercial — business	C1N, P3N
1030	Quilpie QLD 32SSW	Quilpie QLD 32SSW/Quilpie QLD	8511052

At about 200 feet agl after takeoff, the engine began to vibrate and lose power. The pilot turned the aircraft to the right to position over more suitable terrain. The aircraft was stalled into small trees and bushes before touching down heavily on the nosewheel, which broke off. The aircraft then overturned and came to rest inverted.

23 Nov	Cessna 402-C VH-UEZ	Charter — passenger operations	C1N, P3N, 02S
1345	Pulparee SA	Pulparee SA/Brisbane QLD	8541024

The flight had been arranged to take passengers and freight from Pulparee, a seismic exploration field camp, to Brisbane. Just after the aircraft became airborne the right wing struck two men who were working on the top of the cabin of a truck. A section of the right wing was torn from the aircraft, however, the pilot was able to land the aircraft at Pulparee without further incident. The truck was located approximately 24 metres to the right of the centreline of the strip.

02 Dec	Piper 18 150 VH-CPI	Non commercial — aerial mustering	C1N
0820	Meekatharra 150W	Boolardy HS WA/Boolardy HS WA	8551032

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.

03 Dec	Beech 58 VH-SWT	Charter — passenger operations	C1N
1530	Collarenabri 22NE	Collarenabri 22NE/Pt Macquarie NSW	8521068

As the aircraft was being rotated for takeoff, the pilot detected a slight loss of performance from the right engine. He looked towards the engine and saw evidence of fire around the air intake on top of the cowling. The takeoff was abandoned, both propellers were feathered and heavy braking was applied. The aircraft overran the strip and entered a very muddy field. The nosegear collapsed and the right engine was torn from its mounts before the aircraft came to rest 110 metres beyond the strip threshold. The pilot rapidly vacated the aircraft and waited for several minutes until rescuers arrived and extinguished the fire.

04 Dec	Piper 23 250 VH-MMZ	Charter — cargo operations	C1N
0340	Blackwater QLD	Brisbane QLD/Emerald QLD	8511053

The pilot had intended to conduct a night freight service to Emerald. There were several thunderstorms in the Emerald area and the pilot elected to divert to Blackwater, 70 kilometres to the east.

On arrival in the Blackwater area, the pilot reportedly commenced holding at an altitude about 1700 feet above ground level, while he waited for the runway lights to be displayed. The aircraft then entered cloud and severe turbulence was encountered. The pilot stated that his headset was thrown off his head and that he accidently knocked the gear lever into the down position. He said he made no further control inputs. The aircraft struck the ground in a 40 degree turn to the right, at a shallow angle of descent, about 250 metres to the east of the Blackwater runway. The aircraft rotated to the right and slid for about 150 metres before coming to rest. The maingear, right engine, aileron and both flaps had been torn from the aircraft during the impact sequence.

Date	*Aircraft type & registration*	*Kind of flying*	*Injuries*
Time	*Location*	*Departure/Destination*	*Record number*

05 Dec	Beech C23 VH-IHP	Instructional — solo (supervised)	C1N
0830	Cairns QLD	Cairns QLD/Cairns QLD	8511055

The pilot was carrying out a period of solo circuit training, after having completed three check circuits with an instructor. On the second landing, the aircraft bounced, then touched down again heavily on the nosewheel. The nosewheel was detached and the aircraft ran off the runway.

09 Dec	Bell 206 B VH-FUT	Aerial mapping/photography/survey	C1F, P1S, P1M
0930	Spencers Brook WA	Clackline WA/Spencers Brook WA	8551033

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. It somersaulted through the air before colliding with the ground.

11 Dec	Conaero LA4-200 VH-XDH	Non commercial — company flight	C1N, P2M
1945	Strahan Tas 18N	Strahan Tas 18N/Strahan Tas 18N	8531025

The pilot had not previously landed at the particular area, but had carried out a detailed inspection to ensure no debris was present in the water, which was about one metre in depth. Almost immediately after touchdown the nose yawed some 20 degrees to the left and the aircraft pitched forward and overturned. A subsequent inspection revealed considerable damage to the hull below the cabin floor.

12 Dec	Bell B206-L1 VH-HIL	Charter — passenger operations	C1M, P1F, P2S, P2N
0923	Black Reef QLD	Hamilton Island QLD/Black Reef QLD	8511056

Four helicopters had been arranged to transport twenty-one Hamilton Island resort guests to Black Reef for a boat cruise. At Black Reef the helicopters were to be landed on a pontoon, which had recently been marked to accommodate three helicopters at the one time.

The first helicopter to arrive (a Bell 222, VH-HIA) was parked in the centre position, then shut down with the rotor blades positioned along the fore and aft axis of the aircraft. The second to arrive was parked to the left of VH-HIA and shut down. The third helicopter landed and after off-loading passengers proceeded to a nearby smaller pontoon. The fourth helicopter arrived, parked, and as the pilot selected idle power he noticed that the forward rotor blade of the adjacent helicopter (VH-HIA) was moving towards the rotor arc of his own aircraft (VH-HIL). The rotors became entangled and VH-HIL turned violently through 180 degrees. During the manoeuvre two passengers were ejected from VH-HIL, and the main rotors, the mast, and a section of the roof were torn from the aircraft.

Initial investigation has revealed that the rotor brake on VH-HIA was not in the 'park' position.

12 Dec	Rockwell S2R VH-PCE	Aerial agriculture	C1N
1320	Boggabri 14NNW	Gunnedah NSW/Boggabri NSW	8521071

Before commencing operations, the pilot had carried out a detailed survey of the area and noted that a power line crossed the particular paddock to be treated. On the second spraying run the pilot temporarily forgot the presence of the power line, and the gear legs collided with the wires. The aircraft subsequently struck the ground in a steep nose-down attitude and cartwheeled for 30 metres before coming to rest with only the cockpit area still intact.

13 Dec	Cessna A188B A1 VH-UDV	Aerial agriculture	C1N
1200	Koo Wee Rup Line	Nar Nar Goon VIC/Nar Nar Goon VIC	8531026

The pilot was spraying a potato crop in a paddock which had a power line running along one boundary. Spray runs were conducted at right angles to the wires, and the pilot was flying under the wires on each run. At the end of one run the pilot pulled up, conducted a procedure turn, and was then slightly distracted by noise on his CB radio. While adjusting the squelch on the set, he forgot the presence of the power line and the aircraft struck the wires about 32 feet agl. The aircraft remained under control and the pilot was subsequently able to make a normal landing at his destination strip.

13 Dec	Aerospat SA341G VH-PWS	Non commercial — aerial application/survey	C1M, C1N
1225	Mt Perisher NSW	Mt Perisher NSW/Perisher Valley NSW	8521072

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 5 drums had been successfully lifted about 10 minutes previously, and the pilot returned to sling-load a further 4 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.

15 Dec	Comwlth 28 C VH-SSY	Non commercial — aerial application/survey	C1N, P1N
1600	Wangaratta VIC	Wangaratta VIC/Wangaratta VIC	8531027

A fly-in had taken place to the site of an aviation museum. At the conclusion of the organised activities, it was decided to position the Ceres in such a manner as to allow it to be photographed against the background of the museum hangar. Shortly after start-up, the engine stopped of its own volition, and after the restart it faltered again prior to a normal takeoff. During the flight the engine again lost power and the pilot was committed to a forced landing. The only area suitable for landing had a group of Tiger Moth aircraft at the far end, and after touchdown the pilot initiated a groundloop in order to avoid these aircraft. The left gear leg collapsed and the aircraft slewed to a stop short of the parked aircraft.

17 Dec	Beech 95 B55 VH-EHN	Charter — cargo operations	C1N
2016	Bankstown NSW	Moruya NSW/Nowra NSW	8521073

On arrival in the destination area the pilot was unable to obtain a down and locked indication for the landing gear. An inspection from another aircraft indicated that the left gear was only partially extended and the pilot elected to divert to Bankstown. All further efforts to lower the gear fully by normal or emergency means were unsuccessful, and the gear ultimately jammed in the mid-position. A safe landing was subsequently made, with the aircraft touching down on a grass undershoot area and sliding to a stop on the selected runway.

Date Time	Aircraft type & registration Location	Kind of flying Departure/Destination	Injuries Record number
18 Dec 1400	Piper 25 235 VH-MCH Lismore NSW 19SW	Non commercial — aerial application/survey Lismore NSW/Lismore NSW	C1N 8521074

The pilot was carrying out a survey of various properties he intended to spray in the near future. While climbing to return to Lismore after surveying the last property, the engine suddenly ran roughly and then stopped. The pilot was committed to a forced landing on unsuitable terrain, and the aircraft collided with a wind-row of fallen trees 146 metres after touchdown. A fire then broke out and engulfed the wreckage.

19 Dec 1625	Cessna 182 P VH-TSA Miles QLD 2NE	Non commercial — pleasure Miles QLD 2NE/Miles QLD 2NE	C1N 8511057

As the aircraft was being taxied for takeoff, the nosewheel struck a small termite mound. The nosegear was broken off and the aircraft came to rest on the lower engine cowl.

20 Dec 1715	Cessna 404 VH-BPM Townsville QLD	Charter — passenger operations Townsville QLD/Palm Island QLD	C1N, P11N 85211058

As the pilot was applying power at the commencement of the takeoff run, the right engine lost power. An explosion was then heard from the vicinity of the right engine. The pilot secured the engine and after stopping the aircraft, evacuated the passengers before leaving the aircraft himself. He then noticed a small fire under the right wing which he extinguished with a fire extinguisher obtained from the aircraft.

Initial investigation has revealed a loose fuel line union in the right wing just outboard of the engine.

21 Dec 1245	Cessna R182 VH-ITS Somersby NSW	Non commercial — pleasure Mittagong NSW/Pt Macquarie NSW	C1N, P5N 8521075

While cruising at 3000 feet, the aircraft suddenly encountered strong turbulence. Almost immediately afterwards, the engine commenced to run roughly and the pilot was unable to maintain height. He intended to carry out a precautionary landing on a freeway, but then sighted a strip nearby and positioned the aircraft for a left circuit. He subsequently advised that he elected not to lower the landing gear because he considered that the aircraft would have rolled beyond the end of the 550 metres long sealed strip. The aircraft touched down some 350 metres beyond the threshold and slid for 134 metres before coming to rest.

26 Dec 1530	Piper 25 235 VH-CKL Meander TAS	Aerial agriculture Meander TAS/Meander TAS	C1N 8531029

The pilot was spraying a small paddock, to the south-east of which the ground rose steeply. All spraying runs were being conducted towards the south-east, with the pilot carrying out left-hand orbits at the end of each run in order to reposition the aircraft. However, manoeuvring in this manner was taking the aircraft close to houses in a noise-sensitive area. The pilot therefore decided to carry out a procedure turn and conduct a run into the north-west. About half way around this turn the aircraft lost performance, probably as the result of a downdraught, and then stalled at about 100 feet above the ground. There was insufficient height available for the pilot to effect recovery and the aircraft struck the ground in about a 30 degree nosedown attitude.

27 Dec 0746	Pazmany PL4-A VH-URR Parafield SA	Non commercial — practice Parafield SA/Parafield SA	C1N 8541026

The pilot had built the single seat aircraft himself and had previously only flown it on one occasion. After completing the first circuit, the aircraft was taxied back to the threshold and the second takeoff commenced. Just after liftoff the aircraft was observed to pitch nose up. The right wing dropped and the aircraft turned to the right before impacting the ground.

29 Dec 1430	Cessna P206 VH-MYD Katoomba NSW 2N	Charter — passenger operations Katoomba NSW 2N/Katoomba NSW 2N	C1N, P4N 8521077

During the pre-landing checks, the pilot noted that no pressure was available from the left brake pedal. The strip has a slight slope, and the pilot elected to land up the slope in light quartering tailwind conditions. The aircraft bounced twice after touchdown and the pilot commenced a go around. The aircraft veered off the strip and collided with several trees before coming to rest 50 metres from the centre of the strip.

29 Dec 0630	Burkhart Astir VH-WGL Parkes NSW 30N	Non commercial — pleasure Forbes NSW/Forbes NSW	C1N 8521076

The pilot was carrying out a cross-country flight when sink conditions were encountered and an outlanding became necessary. The pilot was making his approach parallel to trees on the side of the intended landing area, when the right wing struck a small tree. The glider rotated 90 degrees to the right before coming to rest.

30 Dec 1800	Rolladen LS3 VH-WUR Forbes NSW	Non commercial — pleasure Forbes NSW/Forbes NSW	C1N 8521079

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 strip boundary fence. A subsequent examination indicated that the glider altimeter was over-reading by some 200 feet.

31 Dec 1420	Cessna U206 G VH-SHO Brisbane QLD 61NW	Non commercial — pleasure Archerfield QLD/Somerset Dam QLD	C1M, P3F, P1M 8511060

The flight had been arranged by one of the passengers as a scenic joy flight. The aircraft departed Bribie Island and landed at South Stradbroke Island, where the occupants had lunch. After departing South Stradbroke Island, the aircraft landed at Archerfield to refuel before proceeding to Somerset Dam where it was intended that the passengers have a swim before returning home.

As the aircraft was approaching to land on Somerset Dam, witnesses observed that the four wheels were extended. When the aircraft alighted on the water it immediately nosed over and sank, then floated inverted under the water. The pilot surfaced and immediately dived down to the aircraft and freed one of the passengers. However the efforts of the pilot and others were unsuccessful in rescuing the remainder of the occupants.

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

Date Time Pilot licence	Aircraft type & registration Location	Age	Kind of flying Departure point/Destination Hours total	Hours on type	Rating	Injuries Record Number
02 Oct 1527 Private	Piper 24 250 VH-MCD Fork Lagoon QLD	42	Non commercial — pleasure Fork Lagoon QLD/Craiglands QLD 920	870	None	C1N, P2N 8511045

When the aircraft was at about 50 feet above ground level after takeoff, the engine lost power, recovered to full power, then lost power again. The pilot commenced an approach for a landing, straight ahead. During the approach the engine again recovered power, the pilot closed the throttle and landed the aircraft in a tree strewn paddock. The left wheel struck a dead tree lying in the paddock and the aircraft groundlooped before coming to rest.

The loss of engine power resulted from a design defect within the aircraft fuel system. Wear in the internal valves of the engine-driven fuel pump caused valve seats to move off centre and stick open. This allowed fuel under pressure to be recycled back to the inlet of the electric fuel pump and resulted in a loss of fuel pressure to the carburettor. The loss of fuel pressure may have also resulted in fuel vapour locks forming downstream of the electric fuel pump which had been selected 'on' prior to takeoff.

04 Oct 1203 Private	Piper 24 400 VH-EDM Launceston TAS	36	Non commercial — pleasure Longdown TAS/Fernleigh VIC 340	60	Instrument rating class 4	C1N, P2N 8531019

The pilot reported that as the aircraft became airborne, he noticed a loss of engine power and believed the aircraft may have touched the ground after the landing gear was selected up. He was subsequently unable to obtain a gear down and locked indication, although the gear appeared to ground observers to be fully extended. During the landing roll the right main gear collapsed.

The right gear did not fully retract or extend because of damage sustained by the retraction mechanism, probably as a result of ground contact after the down lock had been released. The cause of the partial power loss reported by the pilot was not determined.

27 Oct 1440 Commercial	Hughes 269 C VH-FHJ Tully QLD 13WNW	24	Non commercial — pleasure Walkamin QLD/Tully QLD 13WNW 3375	2975	Instrument rating class 4	C1N, P1N 8511049

The pilot advised that during the approach he did not notice a piece of blue plastic tarpaulin in long grass adjacent to the landing area. As he lowered the collective control after touchdown, there was a loud bang and the aircraft began to shake violently. Main rotor rpm had virtually ceased before the pilot was able to shut down the engine. As the aircraft became stationary the pilot noticed a piece of the tarpaulin was attached to one of the main rotor blades.

The pilot had not previously landed at this property, and was unaware that the tarpaulin had been left on a loading ramp. It had evidently been lifted into the air by rotor slipstream and had then fallen into the rotor disc. This caused one blade to become partially detached, with resulting imbalance of the rotor system and a short period of ground resonance.

11 Nov 1540 Senior commercial	Cessna 402 C VH-ANO Batchelor NT	37	Charter — Passenger operations Batchelor NT/Pt Keats NT 4500	1250	Instrument rating 1st class or class 1	C1N, P3N 8541025

The pilot reported that as the aircraft was climbing through 3000 feet it suffered a bird strike. The aircraft was landed at the departure aerodrome without further incident. The bird, an eagle, became embedded in the vertical stabiliser.

13 Nov 1103 Commercial	Beech 95 B55 VH-MLC Hunthawang NSW	54	Charter — passenger operations Narrandera NSW/Hunthawang NSW 16285	5215	Instrument rating 1st class or class 1	C1N, P1N 8521063

Shortly before the aircraft landed a tractor had finished slashing the strip. The driver had not noticed any soft areas, and the strip appeared to be of a uniform colour. As the aircraft decelerated to about 20 knots during the landing roll, the nosewheel suddenly broke through the strip surface and sank to a depth of some 30 cm. Shortly afterwards the wheel snapped off near the bottom of the strut, which then folded rearwards and the aircraft skidded to a halt on its nose.

The strip was in regular use, however this had been the first landing since isolated heavy rain had falled over the area two days previously. It was probable that the rain had affected a small section of the strip, but not to the extent where the soft patch was detectable by aerial or ground inspection.

17 Nov 1910 Private	Beech A36 VH-RNM Lilydale VIC	37	Non commercial — pleasure Hay VIC/Lilydale VIC 200	26	None	C1N, P4N 8531024

On arrival in the destination area the pilot encountered deteriorating weather conditions, including rain and turbulence. Strong sink was experienced on the base leg of the circuit and the pilot found it was necessary to increase power and raise the landing gear in order to maintain adequate control of the aircraft. The approach was continued but the pilot forgot to re-select the gear down. The warning horn sounded just before ground contact and the aircraft slid to a halt on the strip.

18 Nov 1200 Commercial	Piper PA36-375 VH-JND Griffith NSW 26SW	30	Aerial agriculture Griffith NSW 26SW/Griffith NSW 26SW 5700	200	Agricultural class 1	C1M 8521064

The pilot was carrying out the first spraying run in the particular paddock. Towards the end of the run he was distracted when a large flock of birds suddenly flew up in front of the aircraft. The pilot descended in order to fly under the birds, but temporarily forgot that there was a power line in the vicinity. As he pulled up at the end of the run, the main gear snagged the wire. The wire cutters fitted to the gear did not sever the wire and the aircraft subsequently struck the ground 82 metres beyond the run of the power line.

Date / Time / Pilot licence	Aircraft type & registration / Location	Age	Kind of flying / Departure point/Destination / Hours total	Hours on type	Rating	Injuries / Record / Number
26 Nov 1745 Senior commercial	Piper 601 VH-CUO Macksville NSW 6E	26	Charter — cargo operations Macksville NSW 6E/Sydney NSW 3150	25	Instrument rating 1st class or class 1	C1N 8521066

During the takeoff roll the right mainwheel entered an area of soft sand and sank to a depth of 230 mm. The resultant loads applied to the scissor link caused it to fail and the wheel swivelled through 180 degrees. This in turn produced flexing of the gear leg, the downlock disengaged, and the leg collapsed. The aircraft swerved to the right and came to rest just outside the flight strip.

The pilot and the operating company were aware that soft areas were present on the strip. The pilot had landed and departed again during the morning without undue problems, and had made an uneventful landing shortly before this particular takeoff attempt. However, on this occasion wind conditions dictated a takeoff in the opposite direction to that employed earlier in the day and a soft area was encountered at a speed of about 50 knots.

30 Nov 1830 Commercial	Ayres S2R-T15 VH-WBE Tarcoola NSW	36	Aerial agriculture Moree NSW/Moree NSW 6514	2100	Agricultural class 1	C1N 8521067

The pilot intended to spray a cotton crop. A power line crossed the area at an oblique angle, and at the point where the aircraft passed under the wire there was a head ditch one metre high, dividing two paddocks. On the first spraying run the pilot misjudged the clearance under the wire and the mainwheels struck the top of the ditch. The aircraft remained controllable and an uneventful landing was subsequently carried out at the destination aerodrome. Damage was confined to the gear truss points and shock absorbers.

05 Dec 1230 Other (Foreign, Military, etc)	Transav PL12 T-400 VH-TRX Cudal NSW	42	Instructional — check Cudal NSW/Cudal NSW 2000	10	None	C1N 8521069

The pilot was a member of a group of Chinese ex-military pilots who were being trained to allow them to reach the equivalent of an Australian agricultural rating. He had almost completed this course and was being checked on a simulated spraying exercise by an Examiner of Airmen watching from the ground. The pilot, who did not speak English, was being provided with instructions via an interpreter.

At the completion of the check, the pilot intended to carry out a normal landing into the east. However as he was about to turn downwind, he was advised to "come back quickly". A steep turn was made to position the aircraft on a low and close base for landing into the west. The final approach turn was overshot, and during the attempt to line up with the strip the aircraft stalled, struck the ground heavily and overturned.

The instructor supervising the training of the pilots had noticed that thunderstorms were developing about 20 kilometres south of the strip. He had asked the interpreter to advise the remaining pilots not to waste time during their respective flights, in case the storms moved closer. The interpreter, who did not have an aeronautical background, had misconstrued the message and had passed the instruction to return quickly to the pilot. During the modified approach the pilot had not monitored the airspeed and had insufficient height available to recover control when the aircraft stalled.

20 Dec 1700 Student	Cessna A152 VH-THF Tyabb VIC	34	Instructional — solo (supervised) Tyabb VIC/Tyabb VIC 12	12	None	C1N 8531028

Following a period of dual instruction, the student was authorised to conduct a series of solo circuits and landings. On the first approach he lowered 30 degrees of flap and the aircraft touched down normally. After travelling about 50 metres, the aircraft veered sharply to the left, ran off the side of the strip, and came to rest in a shallow ditch just outside the boundary of the strip.

The approach and landing had been conducted in light crosswind conditions. While compensating for these conditions, the pilot had probably inadvertently applied excessive forward pressure to the control column and a "wheel-barrow" situation developed. The elevator trim was found to be in the takeoff position, which would have compounded the nose-down tendency during the landing roll.

21 Dec 0815 Private	Cessna R182 VH-MQG Bowen QLD	19	Non commercial — pleasure Charters Towers QLD/Bowen QLD 137	34	None	C1N 8511059

On landing the aircraft bounced about four times before the nose gear broke off. The aircraft overturned, coming to rest on the runway.

Gusty wind conditions prevailed at the time of landing. When the aircraft bounced on the initial touchdown, the pilot did not take suitable corrective actions and a "porpoising" situation developed until the nose gear failed.

30 Dec 0950 Student	Cessna 152 VH-SDT Cooranbong NSW	27	Instructional — solo (supervised) Cooranbong NSW/Cooranbong NSW 21	8	None	C1N 8521078

Following a dual check, the pilot was authorised to carry out three solo circuits and landings. The first of these was completed satisfactorily, but on the next landing the aircraft bounced and the pilot applied full power in order to go around. Shortly afterwards the aircraft stalled, struck the ground with the nosewheel and the left wing, and overturned. The pilot later advised that he had held the control column fully back during the go-around attempt, and the flaps had been lowered.

Date / Time / Pilot licence	Aircraft type & registration / Location	Age	Kind of flying / Departure point/Destination / Hours total	Hours on type	Rating	Injuries / Record / Number
31 Dec 1000 Commercial	Transav PL12 VH-MLJ Bridgport TAS 10W	22	Aerial agriculture Bridgport TAS 10W/Bridgport TAS 10W 1820	1000	Agricultural class 1	C1N 8531030

The aircraft was being operated from a strip which had been cleared in a hay paddock. The pilot was aware that the strip was of marginal length and had therefore reduced the load to be carried. On takeoff, the aircraft accelerated normally to about 40 knots but the performance then appeared to stagnate. The pilot attempted to dump the load, but only partial dumping was achieved before the right main gear struck a fence post as the aircraft became airborne. The impact displaced the gear, however the aircraft remained under control and the pilot diverted the aircraft to a more suitable aerodrome. The right main gear became completely dislodged during the landing.

A subsequent inspection of the strip revealed that it had a soft sandy surface, covered with short and thick grass. Heavy rain had fallen in the area during the night and early morning, and the grass was very wet at the time of the takeoff. When calculating the load he could safely carry from the strip, the pilot had not appreciated the degree to which the surface conditions would affect the takeoff performance.

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

Date / Time	Aircraft type & registration / Location	Age	Hours total	Pilot licence / Hours on type	Rating	Record number
03 Mar 84 0830	Mooney M20 F VH-ERS Redcliffe QLD	63	1126	Private 910	None	8411009

The pilot reported that prior to touchdown all gear down indications were normal. Shortly after touchdown the right gear collapsed and the aircraft came to rest on the right wing tip 6 metres from the edge of the runway.

A subsequent inspection found that the right gear collapsed because it failed to lock overcentre. This was probably caused by the inadequate lubrication of the landing gear system.

30 Mar 84 1030	Hiller UH12-E VH-FBZ Muttaburra 52NE	23	80	Private restricted — Helicopter 15	None	8411017

The pilot in command was occupying the rear control position, which did not have tail rotor control pedals, while another pilot flew the aircraft. During the approach to land the pilot-in-command became concerned when the airspeed decayed and he pushed the cyclic control forward to initiate a go-around. The aircraft yawed to the right, control was lost and the aircraft struck the ground heavily, coming to rest on its right side.

The inexperienced pilot occupying the front seat had been surprised when the rear seat pilot had taken control during the approach. Although he had been instructed to apply left pedal, it is likely that his delay in doing so prevented control from being regained before the helicopter struck the ground. Inspection of the aircraft revealed that forward cyclic control movement was limited by incorrect rigging. This may have also contributed to the loss of control.

05 Apr 84 0645	Cessna A185-F VH-SFS Cairns QLD 26NNW	32	6500	Commercial 1700	None	8411019

The aircraft had been refuelled the previous afternoon and hangared overnight. When the pilot and passengers arrived the following morning, the pilot loaded their baggage and freight into the aircraft. The aircraft was pushed out of the hangar and the pilot carried out a pre-flight inspection. After the passengers boarded the aircraft the engine was started and an engine check completed before the aircraft was taxied to commence takeoff from runway 15.

About 12 minutes after takeoff, the pilot reported that the engine was malfunctioning. It subsequently lost power completely and the pilot was committed to a forced landing. The sea conditions were unfavourable for the aircraft type, with estimated strong winds and about a 1.5 metre swell. The aircraft cartwheeled on touchdown and sank almost immediately. The pilot and two of the passengers were able to free themselves from the sinking aircraft and make their way to the surface. There they supported themselves on the floats which had become detached from the aircraft during the landing. Their subsequent attempts to locate the aircraft and rescue the other passenger were unsuccessful. The three men were later rescued by a police boat.

An extensive search of the area, at the time, failed to locate the missing aircraft. About twelve weeks after the accident the engine was located by a trawler and salvaged. Some six weeks later the airframe was located by another trawler, it was also salvaged. Following the salvage of each part of the aircraft it was washed down and subjected to extensive examination. The immersion of the wreckage in salt water and the growth of marine life on the wreckage inhibited this examination. However, no fault was found that may have contributed to the accident. The investigation did reveal that at the time of takeoff the aircraft was approximately 300 kg in excess of the maximum allowable all up weight.

04 Jul 84 1421	Piper 32 R300 VH-SBK Charleville QLD	42	1780	Commercial 350	Instrument rating 1st class or class 1	8411032

During cruise the pilot noticed that the electrical system was malfunctioning. The ammeter was reading zero, the system was switched off and a diversion for landing carried out. The pilot reported that, on arrival in the circuit area, the landing gear could not be lowered by the emergency system. A wheels-up landing was made.

An inspection of the aircraft revealed that the electrical problems were due to an alternator failure which resulted from a faulty connection on a brush lead. The reason that the gear was unable to be lowered by the emergency system could not be determined.

Date Time	Aircraft type & registration Location	Age	Hours total	Pilot licence Hours on type	Rating	Record number
13 Oct 84 1046	Piper PA36-300 VH-FET Finley NSW 18NE	53	21000	Commercial 420	Agricultural class 1	8421054

During the takeoff roll, the pilot noted a loss of aircraft performance, but considered that there was insufficient strip length remaining to safely stop the aircraft. Shortly after becoming airborne the tail assembly struck the wooden top railing of a bridge. The left wing tip struck a dead tree 65 metres further on, the aircraft slewed to the left, touched down and came to rest with the engine and landing gear torn from the fuselage.

No fault could be found with the aircraft systems which may have contributed to the reported loss of performance. The takeoff, on a one-way strip, was conducted with a slight tailwind component and the estimated takeoff weight slightly exceeded the climb weight limit specified in the aircraft P-chart. The pilot's technique to assist in getting the aircraft airborne was to progressively select full flap during takeoff. On this occasion the use of full flap apparently degraded the climb performance of the aircraft to such an extent that it collided with the bridge.

Date Time	Aircraft type & registration Location	Age	Hours total	Pilot licence Hours on type	Rating	Record number
20 Nov 84 1100	Cessna 150 L VH-DIV Muttaburra 65NNE	29	2289	Commercial 34	Instrument rating class 4	8411053

The pilot reported that the flight was commenced with full fuel tanks. An endurance of over 210 minutes was anticipated with the planned fuel flow. The engine failed after three hours and the aircraft sustained damage to the nosegear and right wing during the ensuing forced landing. The pilot advised that when he subsequently dipped the fuel tanks there was no fuel remaining.

The pilot had not leaned the mixture correctly, and the consequent fuel flow was greater than he had expected. On previous occasions he had operated the aircraft for shorter flight periods and had not calculated the actual fuel usage rate.

Date Time	Aircraft type & registration Location	Age	Hours total	Pilot licence Hours on type	Rating	Record number
27 Nov 84 0746	Beech 58 VH-ETV Maitland NSW	31	3273	Senior commercial 614	Instrument rating 1st class or class 1	8421068

The pilot advised that when he selected the landing gear down, aerodynamic noises were normal and the main gear green light illuminated. When he closed the throttles the warning horn did not sound, however during the landing roll the left gear collapsed and the aircraft came to rest on the grass adjacent to the landing runway.

The left gear uplock had failed to release at the appropriate stage of the extension cycle, possibly due to the incorrect fitment of the uplock release cable attachment bolt. This would have resulted in misalignment of the uplock assembly when the gear was in the up position. When the pilot selected the gear down the actuating rod became bent and prevented the gear from fully extending. However, the visual and aural warning systems for the gear are triggered by a microswitch on the actuator assembly, and if this has moved through its full travel the position of an individual gear leg is not necessarily accurately reflected.

Date Time	Aircraft type & registration Location	Age	Hours total	Pilot licence Hours on type	Rating	Record number
21 Dec 84 1715	Conaero LA4-200 VH-AOW Hook Island QLD	28	1610	Commercial 1310	Instrument rating class 4	8411059

Throughout the afternoon the pilot had flown the aircraft on a number of sorties in the area. During the subject flight the pilot reported abeam a point on Hook Island, en route to pick up some divers he had dropped off earlier. No further communications were received from the aircraft.

An extensive search failed to find any trace of the aircraft. A thorough investigation has found no reason for the disappearance of the aircraft.

Date Time	Aircraft type & registration Location	Age	Hours total	Pilot licence Hours on type	Rating	Record number
11 Jan 85 1133	Cessna 172 K VH-RGT Mittagong NSW 3ESE	45	208	Private	None	8521003

The pilot reported that the aircraft became airborne after a ground roll of about 760 metres and initial climb was commenced at an indicated airspeed of 65 knots. Soon after lift off the climb performance of the aircraft decayed and the airspeed reduced to 50 knots. Several gradual turns were made to avoid trees but the aircraft struck trees on rising terrain and impacted with the ground.

Examination of the engine revealed that the two front cylinders had been running over-rich. An incorrect model carburettor was found to have been fitted to the engine. However, it could not be determined if this had been the cause of the fuel mixture problem.

Local aero club pilots reported that, in this aircraft, with the mixture control in the full rich position, the engine obtained about 200 RPM less than the optimum. It was well known to club pilots that the mixture control required leaning out by about three centimetres before takeoff to achieve the correct engine performance. On the day of the accident, the pilot leaned the mixture slightly less than one centimetre. It is likely that the loss of aircraft performance was the result of reduced engine performance caused by an over-rich mixture.

Date Time	Aircraft type & registration Location	Age	Hours total	Pilot licence Hours on type	Rating	Record number
15 Jan 85 0635	Piper 34 200T VH-KGR Moramana QLD	24	550	Commercial 100	Instrument rating class 3	8511003

After arriving in the area the pilot was unable to locate the destination strip. He decided to land on a gravel road near a house to seek directions. Shortly after a normal touchdown the nosegear collapsed and the aircraft came to rest in a drain beside the road. The pilot reported that there had been nosewheel shimmy during the previous takeoff and just prior to the nose leg collapsing.

The pilot had not previously operated into the strip at his intended destination. The nosewheel tyre was found to be deflated, and it is likely that it had become deflated during the previous takeoff. However, due to the extent of the damage caused to the tyre during the landing, it was not possible to determine the reason the tyre had become deflated.

Date Time	Aircraft type & registration Location	Age	Hours total	Pilot licence Hours on type	Rating	Record number
20 Mar 85 1233	Cessna 404 VH-UOP Lismore NSW	30	8300	Senior commercial 650	Instrument rating 1st class or class 1	8521022

On initial touchdown the pilot detected an abnormality with the landing gear. An immediate go-around was carried out and the pilot of another aircraft reported that the left main gear was sloping rearwards of its normal alignment. The pilot was committed to a landing with the gear in this position and the gear leg subsequently collapsed at about 60 knots. Initial investigation indicated that the failure of a slotted pin allowed the trunnion forward pivot pin to work itself free, with consequent misalignment of the gear leg.

The pivot pin showed evidence of grinding, apparently carried out during maintenance in order to facilitate the fitting of the pin into its appropriate socket. However, the grinding also resulted in excessive free play, which allowed the pivot pin to apply bending loads to the slotted retaining pin and which resulted in the eventual failure of this pin.

Date Time	Aircraft type & registration Location	Age	Hours total	Pilot licence Hours on type	Rating	Record number
16 Apr 85 1530	Hughes 269 C VH-PHK Mt Hope QLD	33	650	Commercial — helicopter 350	None	8511018

The pilot reported that just after liftoff the engine seemed to lose power. She manoeuvred the helicopter to a suitable landing area, but during the landing the main rotor blades struck a sapling. The helicopter was then repositioned to another landing site where the engine was shut down and the damage to the main rotors noticed.

An inspection of the engine revealed that the number two and four exhaust valves had been sticking and that the valve guides were out of tolerance. It is probable that the loss of engine power was a result of the exhaust valves sticking.

Date Time	Aircraft type & registration Location	Age	Hours total	Pilot licence Hours on type	Rating	Record number
19 May 85 1130	Robinson R22 VH-ONE Mt House Stn	28	1419	Commercial — helicopter 694	Instrument rating class 4	8551012

After the helicopter had been transitioned to forward flight, the pilot felt a vibration through both the collective and cyclic controls. During his attempts to stop the vibration, the helicopter was allowed to descend. As he then selected a climb attitude the helicopter yawed to the right. The pilot was unable to correct the yaw and the tail struck a tree which slowed the yawing and allowed the pilot to land the helicopter. Initial inspection revealed that the intermediate flexplate in the tail rotor drive system had disintegrated.

A metallurgical examination of the flexplate indicated that it probably failed due to overload. The examination also revealed that prior to the application of the overload that resulted in the ultimate failure, the flexplate had been cracked and weakened by another previous overload. The cause of the overload that resulted in the pre-existing crack could not be determined. However, examination of the tail rotor indicated that the ultimate failure most likely occurred as a result of a minor tail rotor strike whilst the helicopter was transitioning into forward flight.

Date Time	Aircraft type & registration Location	Age	Hours total	Pilot licence Hours on type	Rating	Record number
29 May 85 0930	Bell 47 G5 VH-SJY Ivanhoe Stn WA	31	2800	Commercial — helicopter 2550	None	8551013

The helicopter was being flown at about 50 feet agl, when one main rotor blade grip failed. The main rotor blade separated from the helicopter and the resulting imbalance caused the other main rotor blade and transmission to be torn from the helicopter. The fuselage then fell to the ground, landing on its right side.

The main rotor blade grip failed due to a combination of fatigue and overload forces. Examination of the aircraft records revealed that because of an error in the recording of component hours, the 5000 hour service life of the grip had been exceeded by 687 hours.

During the investigation, inspections of the blade grips on several other helicopters were carried out. Fatigue cracking was revealed in a significant number of the blade grips inspected. As a result, the manufacturer of the aircraft has recommended a reduction in the service life of the component.

Date Time	Aircraft type & registration Location	Age	Hours total	Pilot licence Hours on type	Rating	Record number
03 Jun 85 1711	Conaero LA4-200 VH-AWY Shute Harbour QLD	36	10059	Commercial 49	Instrument rating 1st class or class 1	8511023

During the landing roll the aircraft began to swing to the right. The pilot attempted unsuccessfully to correct the swing by applying left brake and rudder. Because of the likelihood of striking a parked aircraft he then induced a ground loop to the right and the aircraft was brought to a stop. An inspection of the aircraft revealed that the right maingear had unlocked and the aircraft had settled on the right float.

No fault could be found with the landing gear system. The gear collapse was consistent with there being insufficient hydraulic pressure available to hold the gear locks in position during the landing. The post-accident inspection revealed that the hydraulic pump switch, which is located next to the electric fuel boost pump switch, was in the off position. It is likely that the hydraulic pump switch was inadvertently selected off after the previous takeoff.

Date Time	Aircraft type & registration Location	Age	Hours total	Pilot licence Hours on type	Rating	Record number
14 June 85 1150	Piper PA30 VH-UOY Armidale NSW	59	14436	Commercial 379	Instrument rating 1st class or class 1	8521037

The aircraft entered the circuit in preparation for a practice single engine landing. The gear was selected down, however neither pilot checked that the gear-down light illuminated. The aircraft was landed with the gear retracted and the pilots reported that they then noticed that the gear motor circuit breaker had popped.

The circuit breaker had probably popped during the previous retraction cycle. During the approach, the pilot under instruction was concentrating on handling the asymmetric situation, while the instructor was closely monitoring the airspeed and the handling techniques being employed. During the landing flare the gear up warning horn operated, but its sound was masked by the louder tone of the stall warning.

Date Time	Aircraft type & registration Location	Age	Hours total	Pilot licence Hours on type	Rating	Record number
21 Jun 85 1422	Piper 32 300 VH-MGQ Mer Island QLD	27	620	Commercial 120	None	8511026

When the aircraft became low on approach, the pilot applied power to correct the approach angle. However this resulted in a higher than recommended airspeed and touchdown was not effected until 170 metres after the threshold. As insufficient runway remained for the aircraft to be brought to a stop, the pilot attempted to carry out a groundloop. The aircraft skidded sideways off the strip and down a steep incline before coming to rest against a tree.

The pilot had encountered several problems prior to the accident. The aircraft battery had gone flat twice causing delays to the passengers. The passengers had become irritated by the delays and vented their anger on the pilot. The pilot stated that she was concerned about starting the engine after the landing and about the time available to complete the schedule before returning the aircraft to the base that night. She also stated that because of her preoccupation with the above matters she had not planned the approach and landing.

Date Time	Aircraft type & registration Location	Age	Hours total	Pilot licence Hours on type	Rating	Record number
17 Aug 85 1610	Cessna U206 G VH-APH Oodnadatta SA	28	209	Private 9	Instrument rating class 4	8541014

After touchdown the aircraft began a series of bounces. The pilot initially attempted to control the aircraft with the elevators but then applied full power to go around. However, the aircraft struck the ground in a nose-down attitude tearing off the nosewheel and bending the propeller blades.

The pilot was relatively inexperienced in the aircraft type. The circuit was poorly judged and resulted in a steep final approach at a low power setting. Following the misjudged landing flare, the pilot delayed in carrying out a go around.

Date Time	Aircraft type & registration Location	Age	Hours total	Pilot licence Hours on type	Rating	Record number
28 Aug 85 1142	Cessna 180 K VH-APW Parafield SA	43	2800	Commercial 2	None	8541015

The pilot, who had just purchased the aircraft but had little experience on tailwheel types, had completed two hours of training the previous day. On the following morning he intended to further familiarise himself with the aircraft, by carrying out a number of circuits. During an attempted three-point landing the left wingtip struck the runway and directional control was lost. The aircraft veered off the runway and came to rest outside the flight strip.

The landing on which the accident occurred was conducted in gusting crosswind conditions. The recent training received by the pilot did not include any instruction in crosswind landing techniques.

Date Time	Aircraft type & registration Location	Age	Hours total	Pilot licence Hours on type	Rating	Record number
20 Sep 85 1500	Cessna 150 G VH-RZD Muresk WA	59	777	Private 450	None	8551025

Earlier in the day the pilot had flown the aircraft from his farm to Muresk. Because no fuel was available at Muresk, he decided to fly the aircraft to Northam, 13 kilometres to the north. Just after the aircraft became airborne, the engine lost power. The pilot was committed to landing in a paddock. During the landing sequence the aircraft struck a fence and ran over a depressed roadway, tearing off the nosegear.

The loss of engine power was due to fuel exhaustion. Prior to commencing the takeoff, the pilot did not check the quantity in the fuel tanks, nor did he calculate the remaining fuel endurance.

Date Time	Aircraft type & registration Location	Age	Hours total	Pilot licence Hours on type	Rating	Record number
22 Sep 85 1210	Cessna A152 VH-FMG Camden NSW	45	32	Student 32	None	8521052

After flaring too high the student pilot continued with the landing attempt but the aircraft struck the runway heavily then bounced several times. The nosegear assembly was distorted and the engine support frame was bent.

Date Time	Aircraft type & registration Location	Age	Hours total	Pilot licence Hours on type	Rating	Record number
27 Sep 85 1750	Thorp T18 VH-ELW Cairns QLD	49	650	Private 500	None	8511044

The pilot-in-command, who was also the owner of the aircraft, was acting as the safety pilot for the other pilot, who had only recently received training on the aircraft. This was the first occasion on which the co-pilot had flown the aircraft from the right hand seat. He flared the aircraft too high on the first circuit and was advised by the pilot-in-command that the flare had been commenced too early. As he attempted to reposition the aircraft closer to the runway it struck the runway heavily and bounced. The co-pilot inadvertently closed the throttle and the aircraft struck the runway in a nose down attitude. Damage was caused to the propeller, engine firewall and the gear.

Date Time	Aircraft type & registration Location	Age	Hours total	Pilot licence Hours on type	Rating	Record number
29 Sep 85 1415	Cessna 185 A VH-AGI Hillman Farm WA	38	1400	Private 60	Instrument rating class 4	8551026

At the conclusion of a parachute dropping sortie, the pilot landed the aircraft at the strip in a strong crosswind. During the landing roll the aircraft began to swing to the left and the right gear leg collapsed. The right wing, tailplane and elevator were bent after contacting the ground.

The aircraft was one of four operating from the strip when the wind backed and increased in strength during the passage of a weak front. The pilot had been aware of the change in wind velocity attempting the landing.

Reader contribution
Refuelling check

Through this article I hope to impress upon all readers of the *Digest* the importance of completing a fuel check after every refuelling. One that I carried out almost certainly saved my two young sons and myself from a serious accident.

The incident which happened to me could happen to anyone. It was a perfect flying day, blue skies, nil wind, clear crisp morning and a very enjoyable flight until the incident. I was ferrying a Hiller UH12 helicopter through N.S.W. with my two small sons as company and we stopped at a major northern N.S.W. airport for fuel. We had just landed when an F27 Friendship arrived on a scheduled flight. As soon as the F27 parked the refueller began to top it up. I told him that I was in no great hurry and asked him to fill my helicopter when he finished the Friendship. We left him to it and refreshed ourselves with drinks, and had a chat to the locals. As soon as the refueller finished the Friendship and it had departed for Sydney, he refuelled the helicopter. We finalised all the paperwork (a mistake on my part as I never took any notice of what type of fuel he recorded on the docket), and then he proceeded to pack up and go home. The nearest township was 12 km away by road.

I started to have a look over the helicopter before continuing our planned flight; this included a water check, which I do before every flight. What did I find? To my shock and horror the fuel was the wrong colour. The refueller had finished the Friendship and continued on to fuel the helicopter from the same tank, i.e. with Jet A1 instead of Avgas. This could have been disastrous. I estimated we would have just been airborne when we would have had an engine failure due to the wrong fuel. The airport is surrounded by thick scrub, and the thought of doing an 'auto' into that with my two small sons on board was frightening to say the least.

This incident just should not happen, as surely someone who holds the responsible position of refuelling aircraft should have some idea regarding what type of aircraft takes what type of fuel. There is a big difference between Avgas and Jet A1 fuel; additionally, I was annoyed because the Hiller had two placards at the fuel tank, one on the side of the helicopter near the tank, and one on the filler flap and cap, indicating the fuel type, yet the refueller still put the wrong type of fuel in. He was sorry, but it's a bit late when you have an engine failure into trees. We had to travel to town, borrow some hoses etc. from a local fuel depot and completely drain the helicopter of its full tank of fuel. This was not only an expensive exercise, but it also delayed our flight until the next day.

Another mistake I made was the reluctance to report the occurrence with a 225. This incident happened approximately 18 months ago, and the more I think about it, the more I realise I should have reported it straight away. A timely report may prevent the same refueller from doing the same thing again and causing a serious accident.

The two main points I would like to make are the importance of water checks at all times and the use and value of 225s.

* * *

Comment

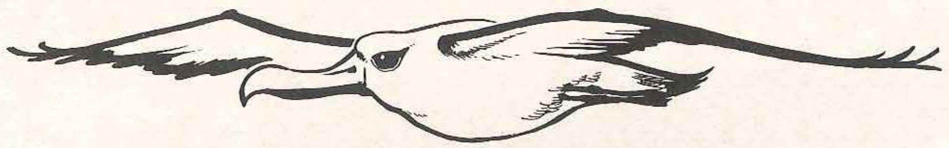
The pilot's anger with the refueller is understandable as this incident was attributable solely to negligence. At the same time, pilots must appreciate that, in the final analysis, whatever gets pumped into an aircraft's tanks is the pilot-in-command's responsibility. It is a sound practice always to look at the tanker as it pulls up, read its decals to ensure that it contains the type of fuel you want, and check the colour of the liquid as it first comes out. Don't be shy—it is a fact of life that refuellers do occasionally make mistakes, and it's your hide you are looking after by taking a few simple precautions.

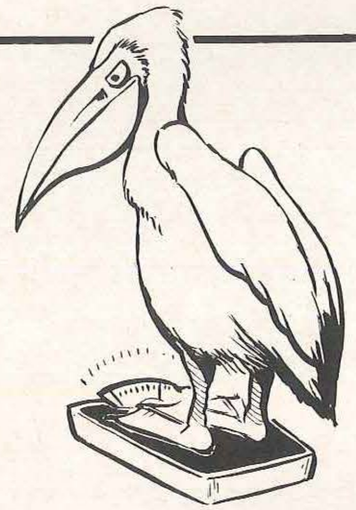
The matter of submitting a 225 is fully endorsed by the *Digest*. Reporting a safety occurrence is not 'dobbing' someone; on the contrary, as this reader commented, it may be a means of saving someone else's life ●

Strike one – you're out!

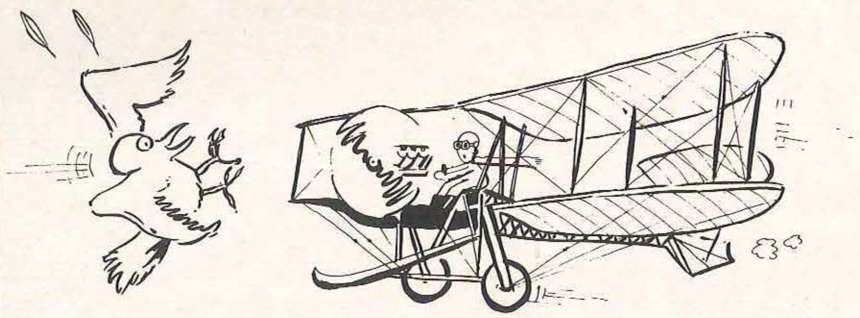
Have you ever wondered what is going through a bird's mind when it finds itself eyeball to eyeball with an object many times larger, thousands of times heavier and travelling, oh . . . 20 times as fast? We can't really answer that because we haven't yet learned how to plumb a bird's mind. But we do know something about those feathery creatures with which we have to share the sky, and with which we occasionally have traumatic and even fatal (for both parties) encounters. Herewith, then, are a few things you ought to know about birds, if you are going to share their domain – and try to reduce the birdstrike hazard.

- The bird with the longest wingspan is the wandering Albatross with a wingspan of 12 feet.



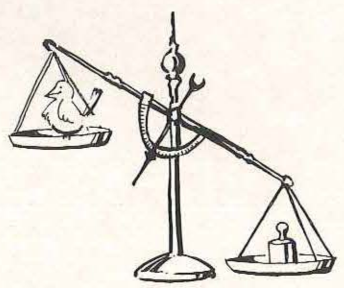


- The heaviest Australian birds that fly weigh in excess of 8 kilograms and include pelicans, swans and bustards.

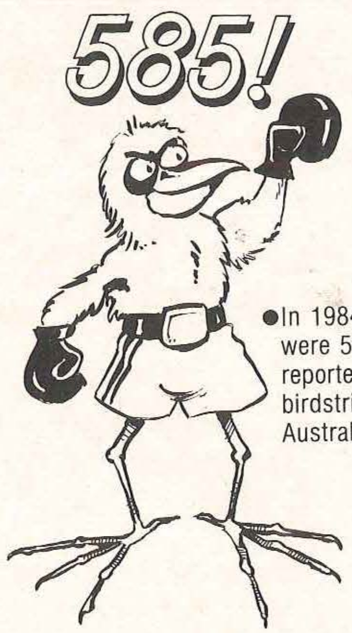


- The first recorded birdstrike accident occurred in 1912. A seagull got caught in the aircraft control cables. In the resulting crash the pilot was killed.

- Many small birds migrate at night.



- Even a single bird of about 500 g is capable of destroying a jet engine.

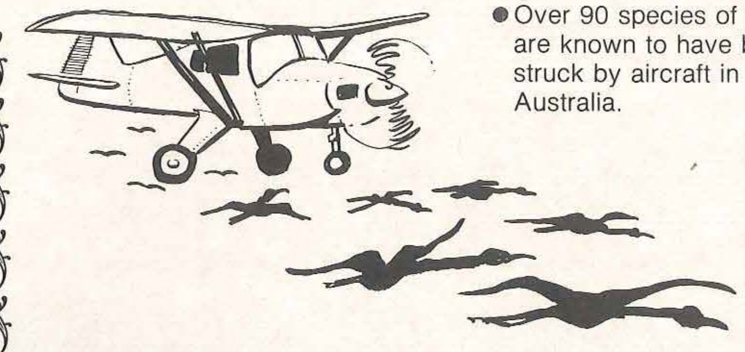


- In 1984 there were 585 reported birdstrikes in Australia.

- The longest migration route for any bird is that of the arctic tern, (12 000 miles . . . arctic to antarctic).

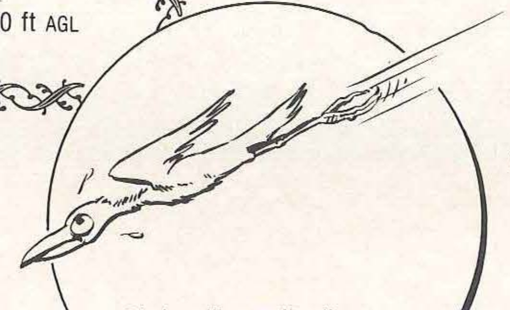
Odd Strikes

- A snake at 3000 ft AGL
  A chicken at 800 ft AGL
  A mouse at 8000 ft AGL
  A flying squirrel at 5000 ft AGL

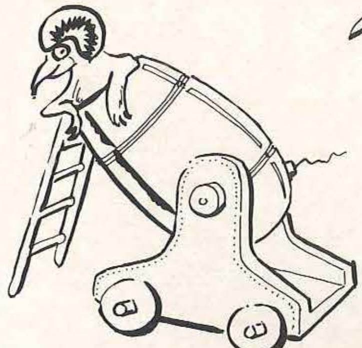


- Over 90 species of birds are known to have been struck by aircraft in Australia.
- About ten per cent of birdstrikes to civil aircraft result in damage costing an average of $1-2m each year.
- Most commonly struck birds include kites, hawks, gulls, plovers and galahs.

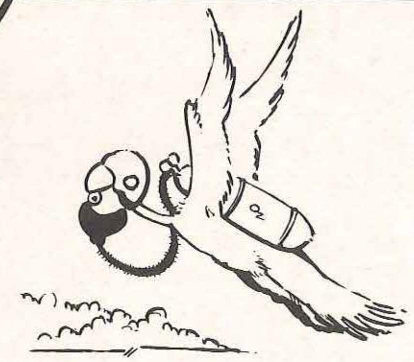
- Even a few small fragments of feather can be sufficient to identify the bird species involved.



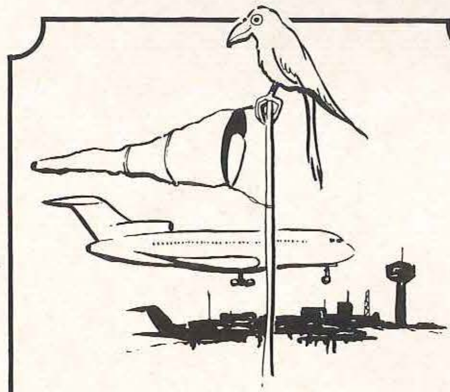
- Birds will usually dive to avoid collision with aircraft.



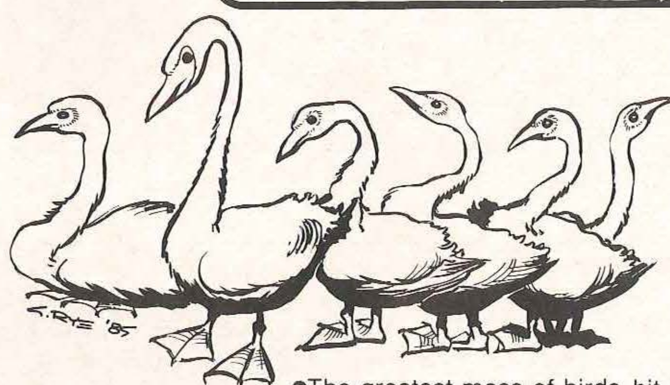
- The impact force of a 2 kg bird at 135 knots is 3.8 tonnes.
- Australian airlines report about one birdstrike per 2000 aircraft movements.



- The highest recorded birdstrike occurred at 37 000 feet.



- Ninety-seven per cent of reported birdstrikes occur on or in the immediate vicinity of aerodromes.



- The greatest mass of birds hit by an aircraft in Australia was 6 swans – approx. 34 kilograms!

Please report all birdstrikes – remember, without accurate and comprehensive data the birdstrike hazard reduction program cannot be effective ●

What is to be done?

Several years ago a PA23-250E was involved in a fatal accident at Fua'amotu International Airport at Tonga following an emergency landing. The Aztec pilot had been unable to extend the landing gear safely - the nosewheel would not lock — so he elected to make the landing on the mainwheels. On final approach he feathered the propellers in accordance with the advice in the aircraft owners handbook that: 'The propellers should be feathered and stopped in a horizontal position prior to contact with the ground'.

When the aircraft touched down, the nosewheel collapsed, the PA23 overturned, and one of its passengers later died from injuries received.

Apparently the Aztec's propellers were still rotating when it touched down. Because they were almost feathered, they were less prone to bend following contact with the runway, and so substantially increased the PA23's tendency to overturn once the nose landing gear collapsed.

This raises the question of whether the propellers should in fact be feathered before an emergency landing in which the undercarriage is suspect. That question is discussed in this article. Note that the discussion is restricted to two-blade propellers: under the particular circumstances there would be no point in feathering a three-blade propeller.

Feathering factors

There are a number of points to consider. In relation to the accident mentioned above, the most crucial safety aspect was that of the possibility of overturning. A feathered propeller which is not horizontal presents its strongest section to the direction of impact: the force needed to bend the propeller should it dig in is tremendous. Because of this, if the undercarriage does collapse and a blade does dig in, the probability of the aircraft overturning is considerably increased. Even if the aircraft does not capsize, a serious loss of directional control may occur. On the other hand, if the propellers are left in the fine pitch position they will more easily bend on contact with the ground, so the overturning or yawing force will be minimal.

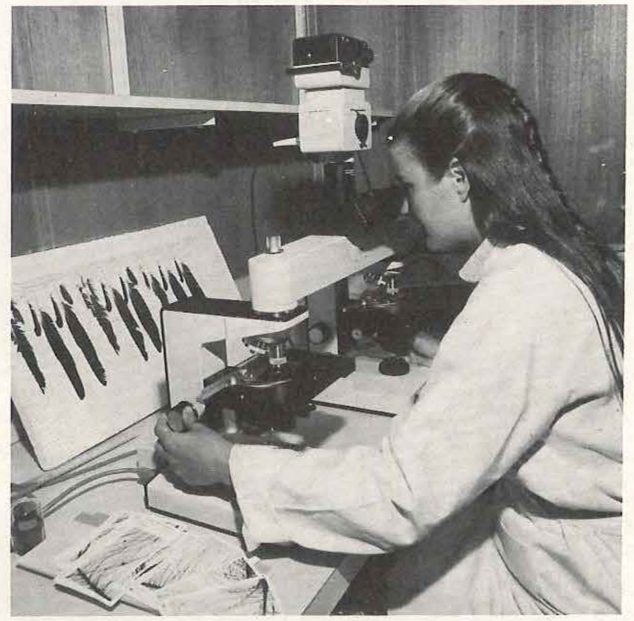
Pilot workload is another factor to consider. The action of feathering a propeller, and then trying to motor it to the horizontal position, can cause a highly undesirable diversion of attention from the primary task of effecting a safe landing. Any pilot carrying out an emergency approach will already be under some pressure. The last thing needed is to have to divert attention to an action which is not essential. There is no point in turning an emergency landing into a forced landing in the case of a single, or an asymmetric landing in the case of a twin, by shutting one down in the air.

As far as asymmetry is concerned, experience has shown that the propellers of light twins may not always feather. Even if they do, it is rarely simultaneous. Unexpected yaw may result, the pilot may be taken by surprise by this occurrence, and so problems may mount . . .

If the propellers do feather as advertised, the somewhat sudden reduction of drag can cause unexpected problems. This was the experience of a Seneca pilot who carried out an undercarriage-related emergency landing at Moorabbin several years ago. As he later stated, 'I learned a valuable lesson here . . . I was a little hot when I feathered them and the aircraft accelerated'. The PA34 in fact floated a considerable distance before the pilot was able to put it on the ground.

Finally, once feather action has been taken, the option for a missed approach has been removed. As wheels-up (and possibly flapless) landings are not practised, a misjudged approach must always be likely. In any event, it is not difficult to imagine numerous circumstances which could necessitate a late go-around. If, however, you have already stopped the propeller/s from going around, then you have burnt your bridges.

Birdstrikes – a scientific approach



With the opening of a new laboratory in Canberra, the Department of Aviation has been able to use science more effectively to reduce the hazard of birdstrikes to aircraft.

Birdstrikes remain a serious problem which requires constant vigilance and effort to keep birds away from airports. Any loss of engine power or obstruction of the pilot's vision during takeoff or landing due to birdstrike on an engine or windscreen can have serious consequences.

As well as the safety aspect, birdstrikes are often expensive. The cost to operators in repairs and lost revenue in 1984 exceeded $1 million; while in one accident alone in 1982, $1.5 million worth of damage was done to a Boeing 747 when it flew through a flock of pigeons at Melbourne Airport.

One of the key factors in attempting to minimise the bird hazard is that of determining what attracts particular species of birds to particular locations. The laboratory has added a new dimension to the Department's capacity to research this matter. It has also greatly enhanced the identification of bird types — birds can be identified under the microscope even from a few feather fragments taken from an aircraft engine. This, too, is a crucial aspect, as the first step in removing attractions around an airfield is to determine the types of birds present.

To a large extent, however, the safety program remains only as good as the information provided by pilots who have a birdstrike. In about 25 per cent of birdstrikes, especially those occurring en route or at night, there is no identification at all of the bird involved. This situation will improve only if all evidence of a birdstrike (e.g. feathers adhering to aircraft parts) is forwarded to the Bird Hazard Investigation Laboratory for examination. Such material can be forwarded through the Airport Safety Officer or Flight Service staff at any government aerodrome.

In 1984 the Department of Aviation received 585 reports of birdstrikes, most of which occurred near airports. The continued support of all pilots is essential if this important safety program is to be fully effective ●

What is to be done? *(continued)*

Conclusion

It is often unwise to be inflexible about operational procedures. Emergency landings have been carried out in the past in which the propellers were feathered, motored to the horizontal, and the approach completed with minimal damage to the aircraft. In such instances, the pilot has exercised his own professional judgment and skill in the prevailing circumstances.

However, in terms of generalised flight safety, it remains valid to discourage the average pilot from taking feathering action when faced with the type of emergency landing discussed here.

Those responsible for the various training organisations should consider an appropriate amendment to the current flight manuals concerned to allow the pilot-in-command to take a different course of action. One suggestion is to:

- Select the longest hard-surface runway available, into wind.
- Do not feather the propeller/s.
- Approach with the recommended flap configuration at the correct speed and with power on.
- When happy with the flare and hold-off, and just before impact, then, and only then, pull the mixture controls to idle cut-off. (This will offload the power being delivered to the propellers. As the propeller tips contact the ground they will stop turning instantly, and, being in fine pitch, the tips will usually bend back. With no power being delivered to the propellers, any damage to the engines is likely to be minimal.)
- Turn off the fuel and electrics when the aircraft stops ●

Excessive approach speed

Like many of the articles presented in the *Aviation Safety Digest* this one addresses a common problem which is essentially simple to resolve. Further, like many of those articles concerned with pilot technique, the solution is simple — observe the basics.

The accidents

After a routine flight a Mooney M20F arrived at its destination, a 750 metre homestead airstrip (Figure 1). The pilot did not see the wind indicator (which, as it happened, was giving an erroneous indication anyway) and assessed surface conditions as calm. In fact, there was a 5-8 knot tailwind component on the strip he selected.

A go-around was initiated on the first circuit from very short final approach when it became apparent that the Mooney was drastically overshooting the aiming point.

On the second attempt, even though the approach aspect appeared only slightly better than the first, the pilot elected to continue to land.

The M20 was flown onto finals at 80 knots, with the intention of reducing speed to 75 knots. This was excessive. For the particular landing configuration, the flight manual stipulates a speed of 68 knots; thus, the pilot was planning an approach in the order of 10 per cent faster than that recommended.

Touchdown was made about 200 metres into the strip. The Mooney began to 'porpoise' (i.e. bouncing from the nosewheel onto the mainwheels, then back on to the nosewheel, and so on), and did so seven times before the mainwheels settled on the surface. Heavy braking was applied for 50 metres and the aircraft skidded for a further 50 metres, at which stage the pilot decided to go around. This was unsuccessful. After over-running the strip the aircraft struck a number of obstructions and was substantially damaged before it came to rest.

* * *

In the second accident, a Cessna 172 was flying in to an 811 metre bitumen ALA. Landing weight was later calculated as being about 10 kg over the maximum limit. Surface wind velocity was about 8-10 knots from the right and was almost all crosswind.

Because he knew his aircraft was heavily loaded, and was concerned by the crosswind plus possible turbulence, the pilot selected an approach speed of 70-75 knots. This was more than 10 knots in excess of that recommended.

The touchdown was made a short distance in from the threshold but the aircraft skipped, floated and then bounced five or six times.

As was the case in the Mooney accident, the decision to go around was left too late, and when the Cessna became airborne just before the end of the runway it was with the stall warning horn blowing continuously. The 172 was unable to clear the airport boundary fence and it, too, sustained substantial damage in the ensuing accident (Figure 2).

Discussion

One aspect of piloting which is always properly emphasised is that of not stalling an aircraft inadvertently. Obviously, one of the most important times to maintain a safe flying speed is during the landing approach: it is absolutely essential. Nevertheless, building in a 'few knots here' and a 'few knots there' in an attempt to compensate for perceived difficult landing conditions, but without reference to performance data, can lead to difficult control problems.

As the two accident briefs indicated, an excessive approach speed can sometimes culminate in 'porpoising'. When porpoising starts instant action is called for. The techniques required and options available to a pilot in this situation were covered in the article 'Bouncing to an accident' which appeared in *Aviation Safety Digest* No. 117/1983.

Another consequence of approaching too fast can be 'wheelbarrowing'. To prevent an aircraft which has landed at high speed from becoming airborne again, a pilot may deliberately hold it on the runway with a firm forward pressure on the control wheel. With the aircraft still travelling at high speed, the wings will continue to produce considerable lift, especially with flap extended, even though the wheels may be in contact with the ground. This effect, combined with down-elevator or 'stabilator' control, will tend to lighten the load on the main wheels and, if the speed is high enough, may even raise them clear of the ground. In these circumstances most, if not all, of the aircraft's weight is thrust on to the nose, resulting in the highly unstable 'wheelbarrowing' situation.

Wheelbarrowing often leads to loss of directional control, with the aircraft running off the side of the runway and, at the least, damaging the undercarriage.

Porpoising and wheelbarrowing are sufficient problems in themselves. However, perhaps the cardinal 'sin' associated with high speed landings is that of floating and over-running. An excessive landing float has all kinds of serious implications, including the demand for subsequent heavy braking and the hazards of possibly going off the far end of the strip. The Mooney accident cited above provides a good example of this.

The mathematics of landing with excess speed all work against the pilot. In general terms, double the speed will give four times the kinetic energy which must then be dissipated by braking, and which is clearly going to increase substantially the landing distance required. In the case of the Mooney, and taking into account both the excessive approach speed and the tailwind component, the pilot was flying about 35 per cent faster than his optimum approach speed. The implications for his landing distance required are obvious. On the other hand, had he been at the recommended approach speed and landing into wind, there should have been no

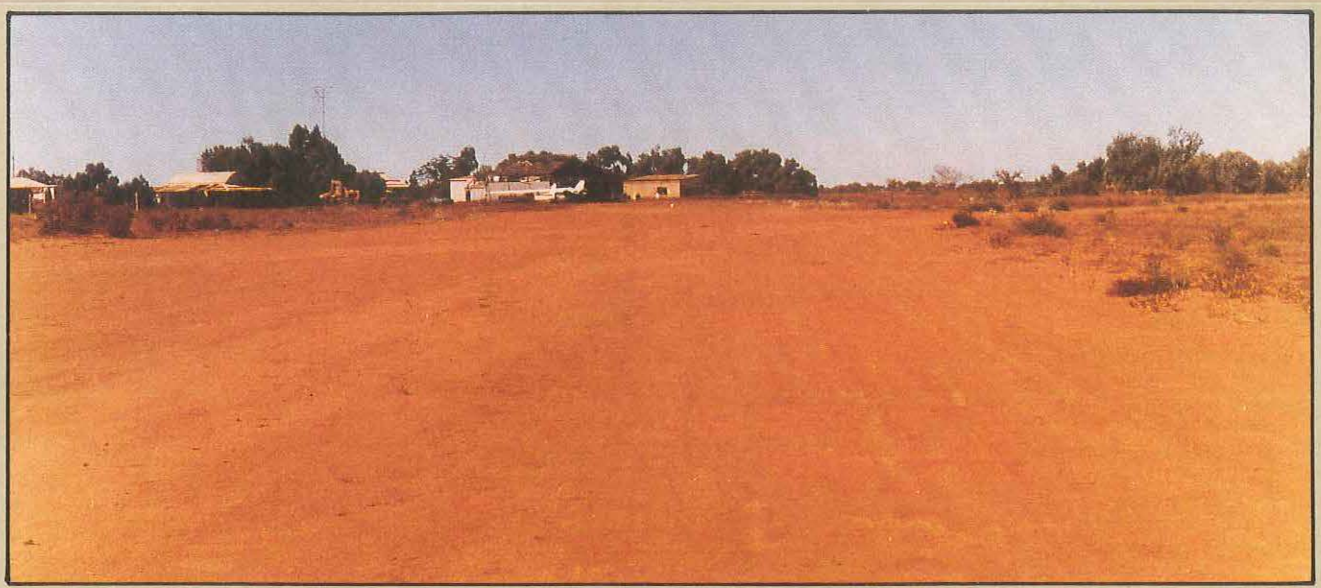


Figure 1

difficulty in stopping safely.

Advice in manufacturers handbooks regarding approach speeds can vary. For example, the Cessna 172N Information Handbook consulted during the preparation of this article advises that 'Slightly higher approach speeds should be used under turbulent wind conditions', but makes no comment on increasing speed in a crosswind. The M20 Operators Manual contains the advice that 'When high, gusty winds prevail, or when landing crosswind, approach at a higher airspeed'.

The only authorised performance data for Australian aircraft is that derived from the performance charts, contained in the official flight manual for each aircraft, issued by the Department of Aviation. Approach speeds given in those 'P-charts' for GA aircraft are based on '. . . an approach to land at a speed not less than 1.3Vs maintained to within 50 feet of the landing surface'. In other words, a margin of about 30 per cent over the stall speed is provided. Therefore, in most conditions pilots need only to fly that recommended speed accurately to achieve the correct, safe touchdown speed, with no fear of stalling.

This does not, of course, mean that approach speeds should never be increased to cater for difficult conditions. Gusty winds are the prime example; when they prevail it is often sound practice to add several knots to guard against the possibility of a sudden loss of airspeed.

However, it is not sound practice to increase airspeed to the extent that the types of problems described above are created. A number of factors should be considered, and will include

- the strength of the wind gusts
- crosswind component
- airstrip length
- the aircraft's certified crosswind capability
- pilot currency and experience.

If, after assessing those factors, landing conditions are still considered safe, then a generally accepted method for increasing the approach speed is to add 50 per cent of the gust factor to the normal approach speed. Thus, if the wind is 15 knots gusting to 25, the gust factor is 10 knots so the approach speed should be increased by 5 knots.

Figure 2

If circumstances are such that a pilot feels a large increase in approach speed is necessary to retain safe control of his aircraft, then perhaps it is time to reconsider the wisdom of even landing at the particular airstrip.

Conclusion

Flying an excessive approach speed can lead to serious aircraft performance problems. To avoid those problems, fly the recommended approach speed — *accurately*. If weather conditions and the particular aircraft's operating instructions indicate that, in some circumstances, a higher speed is desirable, then that increased speed must be determined carefully. If you believe it will be necessary to fly at a speed which is considerably in excess of the recommended figure, then perhaps you should consider going somewhere else. Other options may also exist; for example, if you were faced with an extreme crosswind and felt you were not in a position to divert, then it may be possible to declare an emergency and make a perfectly safe landing into wind on a taxiway. Sound judgment and a careful assessment of all factors would be necessary in considering this sort of option ●

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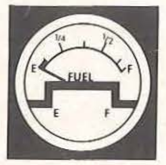

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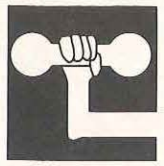

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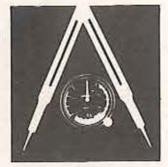

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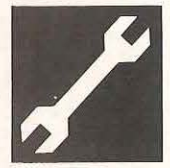

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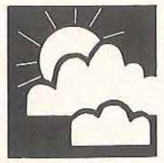

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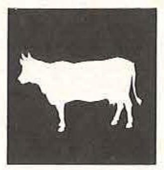

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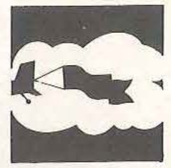

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