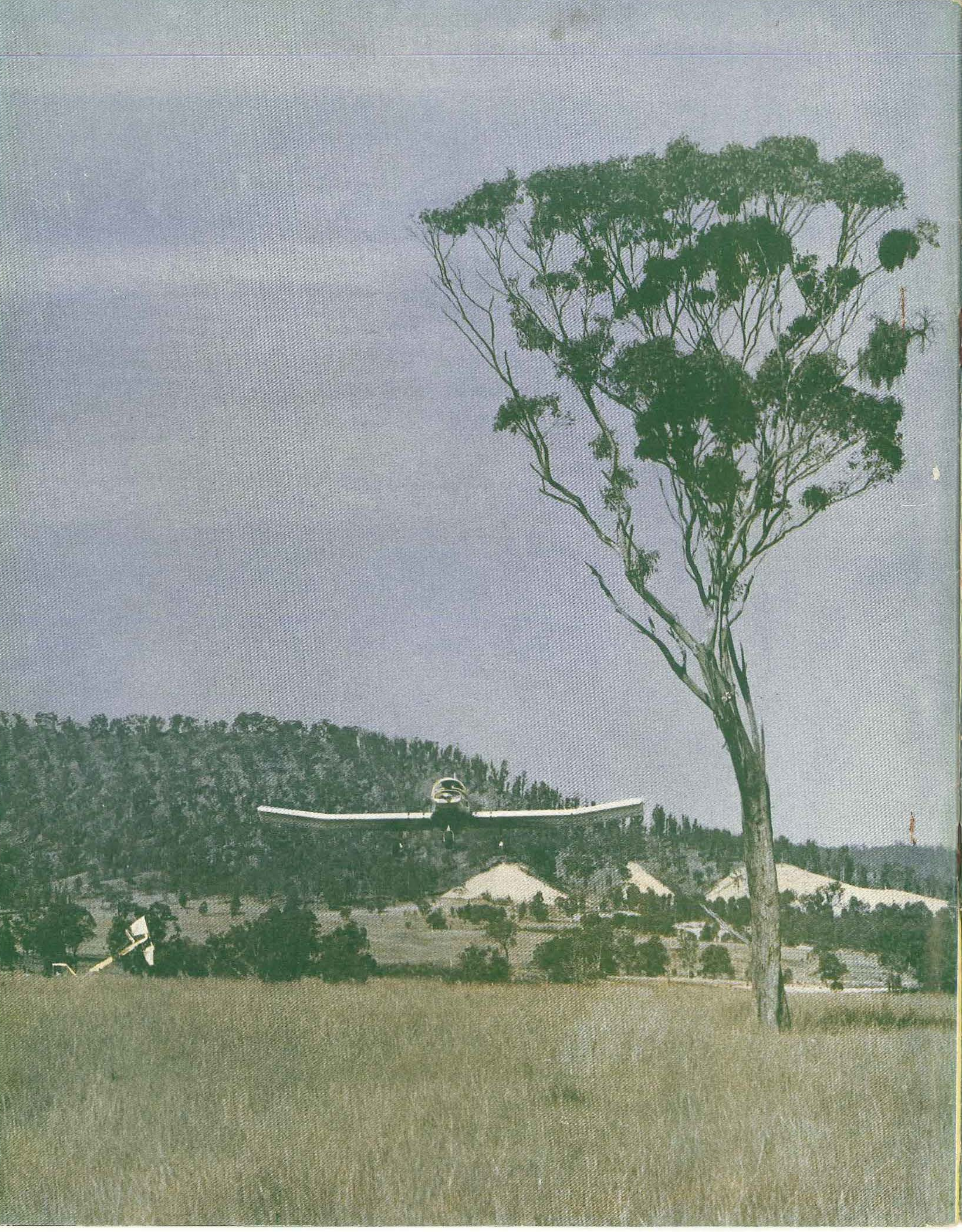
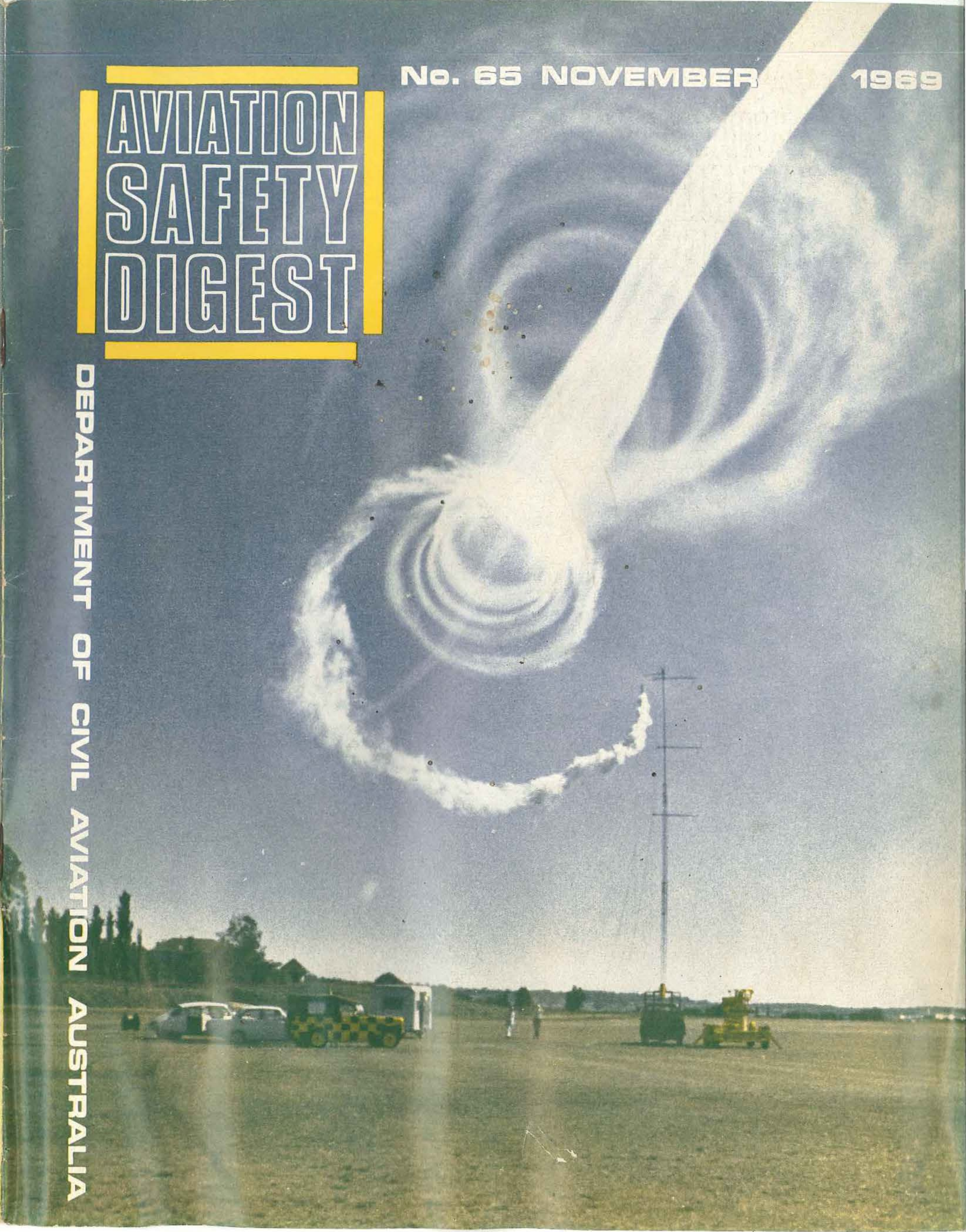


No. 65 NOVEMBER 1969

AVIATION SAFETY DIGEST

DEPARTMENT OF CIVIL AVIATION AUSTRALIA



AVIATION SAFETY DIGEST

No. 65 NOVEMBER, 1969

DEPARTMENT OF CIVIL AVIATION, AUSTRALIA

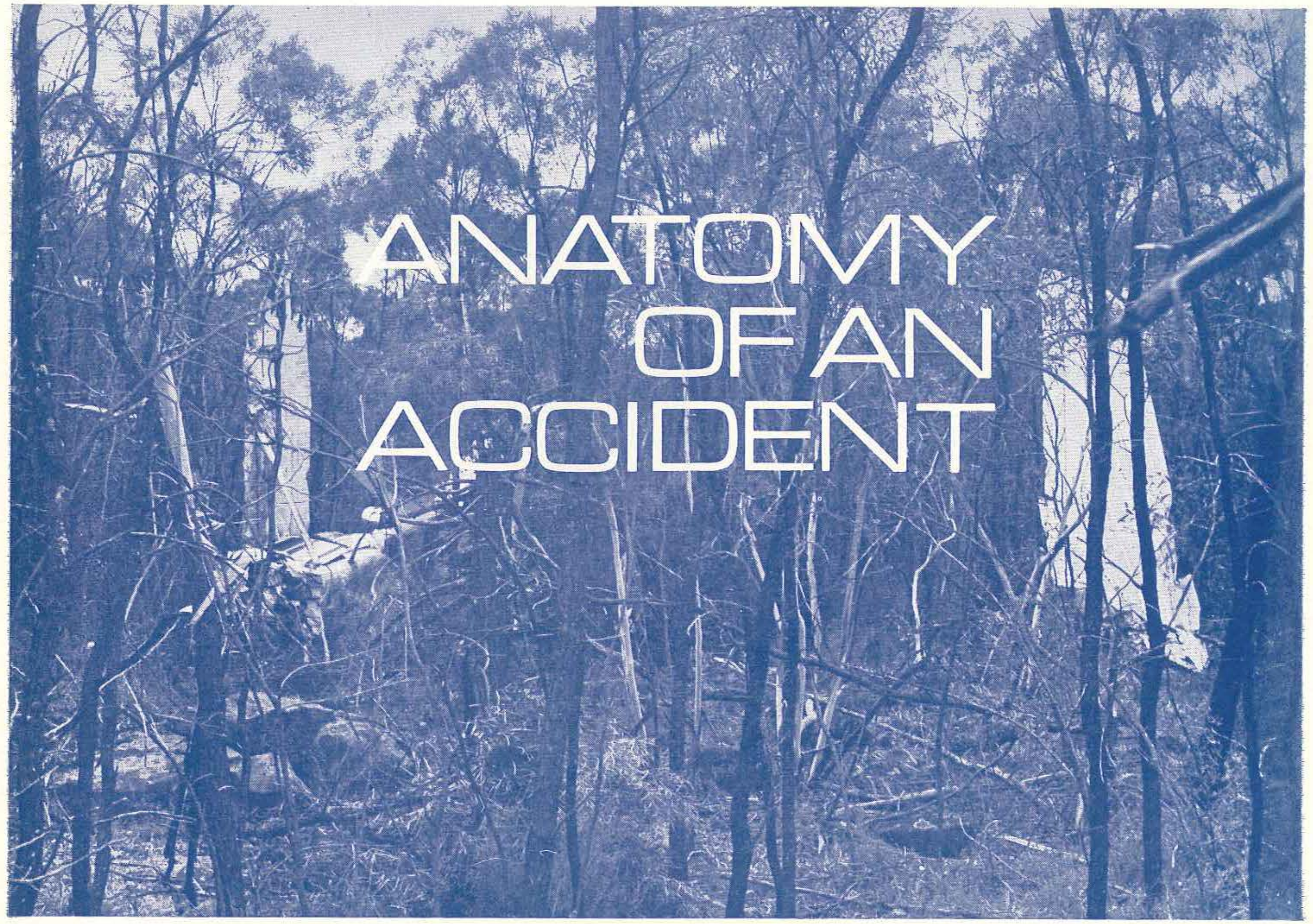
Contents

COVER: This remarkable picture was taken by a research team from the University of Sydney at R.A.A.F. Station, Richmond, N.S.W. during a study of wake turbulence made for the Department of Civil Aviation. The smoke released from the generator on the mast has been caught up into the vortex from the port wing tip of a Lockheed Hercules which, at low level, flew past the tower and away from the camera, shortly before the picture was taken. The compact spiral character of the vortex is evident from the smoke filled core. The larger, open, concentric smoke spirals surrounding the core itself, appear to be in the induced airflow resulting from the rapid rotation of the vortex core.
An article on Vortex Turbulence appears on page 16 and further information may be obtained from the new Aviation Safety Digest pamphlet on the subject.

BACK COVER: A Fletcher FU-24 takes off on a top-dressing sortie from an agricultural strip in hilly country near Scone, N.S.W. The telephoto lens has foreshortened the apparent distance between the aircraft and the tree in the foreground.

AUSTRALIA

Printed by The Ruskin Press Pty. Ltd., 39 Leveson Street, North Melbourne



ANATOMY OF AN ACCIDENT

THE photographs on these pages show how an intended charter flight ended on a mountain top in New South Wales after the pilot continued into weather conditions in which he could not maintain visual flight. The circumstances of the accident and the operational lesson it provides are by no means new. It is a theme that has been repeated tragically time and again and the safety message it contains has been presented in the Digest through the medium of the reports of such accidents on many occasions. What **is** unique about this particular accident is the fact that all four occupants survived to tell us what happened. This fact, far from blunting the edge of the further object lesson in air safety that this accident provides is, of course, the very factor that enables us to derive the maximum benefit from it. By examining as it were, an "accident in the making" we see how very simple the ingredients of tragedy can be.

The aircraft, a Cessna 205, had been chartered by a group of businessmen, at Griffith, N.S.W., for a flight to Sydney and return to enable them to attend a one-day conference in the city. Three passengers were to make the flight from Griffith and a fourth was to join the aircraft en route at West Wyalong. It was accordingly arranged that the aircraft would depart Griffith at 0600 hours for Bankstown Airport via West Wyalong.

On the morning of the accident, the pilot telephoned the Flight Service Unit at Wagga to obtain a weather forecast. The area forecasts read to him over the telephone were not particularly favourable, but the cloud bases were expected to be high enough above terrain to enable the flight to be conducted in Visual Meteorological Conditions. The pilot then passed details of his flight plan to the Flight Service Officer on duty at Wagga.

While the pilot was still speaking on the telephone at Griffith Aerodrome, his three passengers arrived and, after he had rung off, they told him that the fourth passenger would not now be joining the aircraft at West Wyalong. Nevertheless as there was little extra distance involved, the pilot decided he would still make the flight in accordance with the plan he had already submitted, and overfly West Wyalong.

The aircraft duly departed Griffith in fine and clear weather but as it flew east at about 2,000 feet, the cloud cover above this height gradually increased.

After passing over West Wyalong the weather deteriorated and the pilot was obliged to descend to remain below the lowering cloud base. There were also isolated showers, and after the pilot had transmitted a position report, he was passed details of a SIGMET, which warned of an active thunderstorm area east of a line between Armidale and Wagga. At this stage of the flight, although the aircraft's altimeter was indicating some 1,400 feet, the aircraft's clearance from the ground was only a little over 500 feet.

Several minutes after passing abeam Caragabal, twenty-seven miles east of West Wyalong, the pilot was confronted by an area of fog extending from the cloud base almost to ground level. Still maintaining about 500 feet clearance from the ground, the aircraft penetrated the fog area, but soon afterwards the pilot commenced a shallow turn to the left, with the intention of regaining visual reference. After turning some forty degrees, the pilot, through a break in the cloud, saw trees on steeply rising ground immediately in front of the aircraft. He raised the nose up sharply, levelling the wings and applying power at the same time. With the stall warning sounding the aircraft climbed steeply, clearing the trees on the upper slopes of the ridge itself. Beyond the ridge however, the thickly timbered terrain continues to rise, though less steeply and, still in a climbing attitude at low airspeed, the aircraft's starboard wing struck a tree just beyond the ridge line. The impact tore the wing strut away from its fuselage attachment. Rolling to the right as its starboard wing folded upward, the aircraft continued up the slope for a further 120 feet, before it again descended into the tree tops and crashed to the ground amid dense timber.

* * *

The site of the crash was close to the top of the main ridge of the Weddin Range, 38 nautical miles east of West Wyalong. Approaching it from the west, the thickly timbered range rises steeply out of open farming country. The highest point of the range is 2,374 feet above mean sea level or approximately 1,500 feet above the surrounding, generally flat, countryside. The crash occurred at an elevation of 1,750 feet A.M.S.L.

The occupants of the aircraft were fortunate not only to survive the impact itself, but also in that the aircraft's approach and the noise of its impact were heard by a farmer whose property lies at the foot of the western side of the mountain. The farmer said later that at the time he heard the aircraft, fog extended right down to the foot of the mountain which could not be seen from his house. The farmer was one of two men who first reached the site of the crash, some two hours after it had occurred.

Examination of the accident site, both from the air and on the ground, together with the evidence of the occupants and the disposition of the wreckage, enabled the sequence of events leading to the accident to be reconstructed in some detail. It was evident that the area of low cloud and fog that obscured the mountain extended west of it for about four or five miles.

The pilot was not able to remember accurately

Below: The Weddin Range as seen from its western side. Note how steeply it rises from the surrounding terrain. The arrow indicates the crash site.

The main wreckage as it came to rest on top of the thickly timbered ridge, looking in the direction of impact.

the events leading to the accident, but he recalled descending after passing West Wyalong to remain below the cloud base, and then approaching a cloud or rain shower which seemed to extend to the ground. At this stage, the pilot believed the aircraft's clearance above the terrain was still adequate. As soon as the aircraft began to enter the area of cloud, the pilot said, he began a turn to the left to avoid it. The aircraft then seemed to be in a valley with areas of rain on rising ground on either side. Suddenly, the pilot said, he saw the ground ahead and climbed steeply to miss it, but he was unable to avoid the trees.

One of the passengers in the aircraft said that, as they approached the area of the accident, there was no sudden variation in the cloud base. Rather, there appeared to be an area of rain ahead, but when the aircraft entered it, he saw they were flying in swirling grey cloud. Shortly afterwards, the passenger said, the cloud suddenly grew darker and it was very turbulent. At the same time, the pilot "gunned the motor" and climbed the aircraft. Then they seemed to level out for a moment before the nose dropped and he heard the sound of breaking timber as the aircraft struck the tree tops.

The passenger's reference to a "darker cloud" just before the impact was undoubtedly the vegetation on the mountain range which was considerably darker than the generally cleared terrain over which the aircraft had been flying, and the "turbulence" would most likely have been the result of the pilot's violent manoeuvre in the unsuccessful attempt to avoid the trees. When the pilot first observed the trees, the aircraft was in a gully on the mountainside. Turning left, the aircraft could only have impacted heavily with the side of the gully, and the pilot's action at that point, to raise the nose sharply and to level the wings and apply power, was the only action available to him.

*   *   *

In the situation in which the aircraft was placed, flying in cloud below the height of the rising terrain in its path, a catastrophe was virtually inevitable and it is extremely difficult to understand how any pilot could be so unwise as to place himself and his passengers in a situation so fraught with risk. Not only did this pilot hold a valid commercial pilot licence and have considerable experience in charter operations, but he also held a fourth class instrument rating for Night VMC flights in the private and aerial work categories. Although this should not have encouraged the pilot to operate the aircraft in any but Visual Meteorological Conditions during a VFR charter flight, it should at least have ensured that he had a thorough understanding of the terrain clearance philosophy governing flights in any but Visual Meteorological Conditions.

There is no doubt that the pilot was aware of his position shortly before the accident. He had in fact noted on his flight plan the aircraft's actual time of arrival abeam Caragabal, only 12 miles west of the accident site at 0702 hours. The Weddin Range, with two spot heights of 2405 and 2374 feet, is clearly shown on the Sydney (3451) World Aeronautical Chart that covers this area, but the pilot had not flown this particular route previously and it can only be concluded that he had given but scant attention to the track as plotted on his chart.

Although the cloud in the area where the accident occurred was lower than indicated in the forecast the pilot obtained before departure, the area further to the west was actually better than forecast and the progressive deterioration in weather conditions as the flight continued eastwards should have been clearly evident. As well as this the SIGMET the pilot received just after passing West Wyalong should have been a further indication to him that the weather ahead was deteriorating.

Taking all factors into consideration, it seems probable that the aircraft's seemingly adequate clearance above the level ground before it entered the cloud, the pilot's ability to control the aircraft by reference to instruments, and his belief that the low area of cloud may have been an isolated one, combined to influence him to try and continue the flight. Whatever his actual motives for doing so, there is no doubt that the accident would not have occurred if the pilot had remained in visual meteorological conditions. The area of low cloud was avoidable and the pilot could quite easily have taken appropriate avoiding action before reaching it.

Some idea of the deceleration forces during the impact is conveyed by the damage sustained by this tool box. Two tie-down pegs contained in the box have penetrated its steel sides to a depth of three inches.

. . . and still it happens!

AFTER a period of upper air work, a student pilot flying solo in a Beech Musketeer returned to Jandakot Airport from the light aircraft training area, intending to carry out several touch-and-go landings. The weather was fine, with an eight knot south-westerly wind producing a crosswind component of three or four knots from the left on the duty runway.

The pilot conducted one successful touch-and-go landing and then made another approach on to the same runway. This second approach was with full flap, and the landing was quite normal until after the pilot applied power again to take-off. The aircraft remained straight for a short distance as the throttle was opened, but then veered sharply to port. Although the pilot applied back pressure to the control wheel and attempted to correct the swing he was unable to regain control and the aircraft left the runway, ran across a drainage ditch and came to rest with all three undercarriage legs collapsed.

This sequence of events follows a pattern which has been repeated many times in landing accidents involving low-wing, tricycle undercarriage aircraft. Control difficulties can develop during the take-off roll if backward pressure is not maintained on the control wheel as full power is applied. In these circumstances, if the speed is at all high, a large percentage of the aircraft's weight will be transferred to the nosewheel and the main wheels may even lift clear of the ground. This effect which the Americans aptly term "wheel-barrowing," places the aircraft in a highly unstable situation requiring only a slight deviation in heading, caused by either a wind gust or steering effects, to induce a ground-loop type manoeuvre.

A series of tests conducted in a similar aircraft after this accident clearly showed that, while a swing readily develops if the main wheels are allowed to leave the ground, it is just as easily controlled by prompt recovery action. The initial swing, however, can be quite severe and there is little doubt that it is the abruptness of the heading change which catches the pilot unawares. Naturally, the main wheels will leave the ground more readily if the control wheel moves forward as engine power is applied, particularly with the flaps fully extended. This of course is a situation that can very easily arise in touch and go landings.

In the case of this Musketeer accident, it is apparent that the pilot's action in not maintaining back pressure on the control column as take-off power was applied, resulted in the main wheels leaving the runway prematurely and the slight cross-wind component existing at the time probably initiated the swing off the runway.

A detailed article on the causes of ground-loops in nose-wheel aircraft and the appropriate recovery action to be taken was published in Aviation Safety Digest No. 63 of July, 1969. This article has now been reprinted as a separate pamphlet, and copies may be obtained by writing to the Editor.

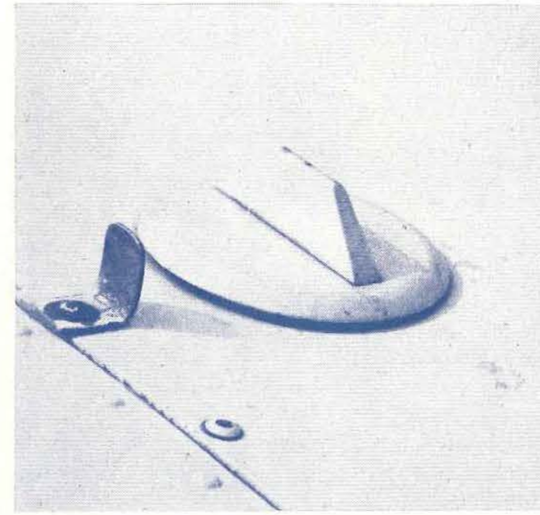
DUST DAMAGE

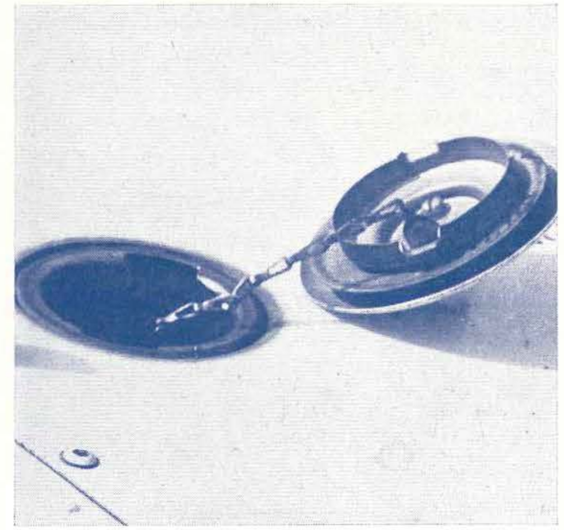
ALTHOUGH dust is frequently unpleasant and a nuisance in the bush, it is not usually regarded as a menace to flight—apart from navigational difficulties that dust storms can sometimes cause. But it is important to remember that dust itself can be very damaging because it is a very effective abrasive. In time it can even wear down mountains. Or, in the case of engine components, cause wear to the point where the "mountains" become "hills", and the components are worn out!

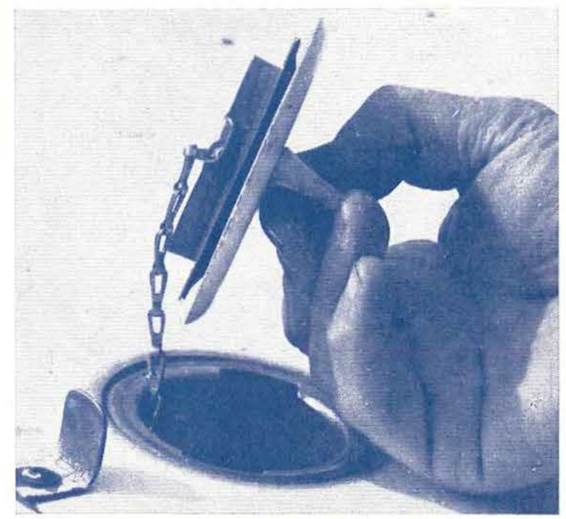
An example of the damage that dust can cause was demonstrated in a recent incident in which a PA.32 Cherokee Six, departing from Alice Springs on a flight to Mount Isa, was forced to return because of fluctuating fuel pressure. When the defect was investigated it was found that the fuel injector was faulty and that the malfunction had been caused by the gradual wearing effect of dust in the fuel. The aircraft had been operating for some time in the Mt. Isa area in dusty conditions but even so, how could enough dust to cause the damage have found its way into the fuel system? Very simply:

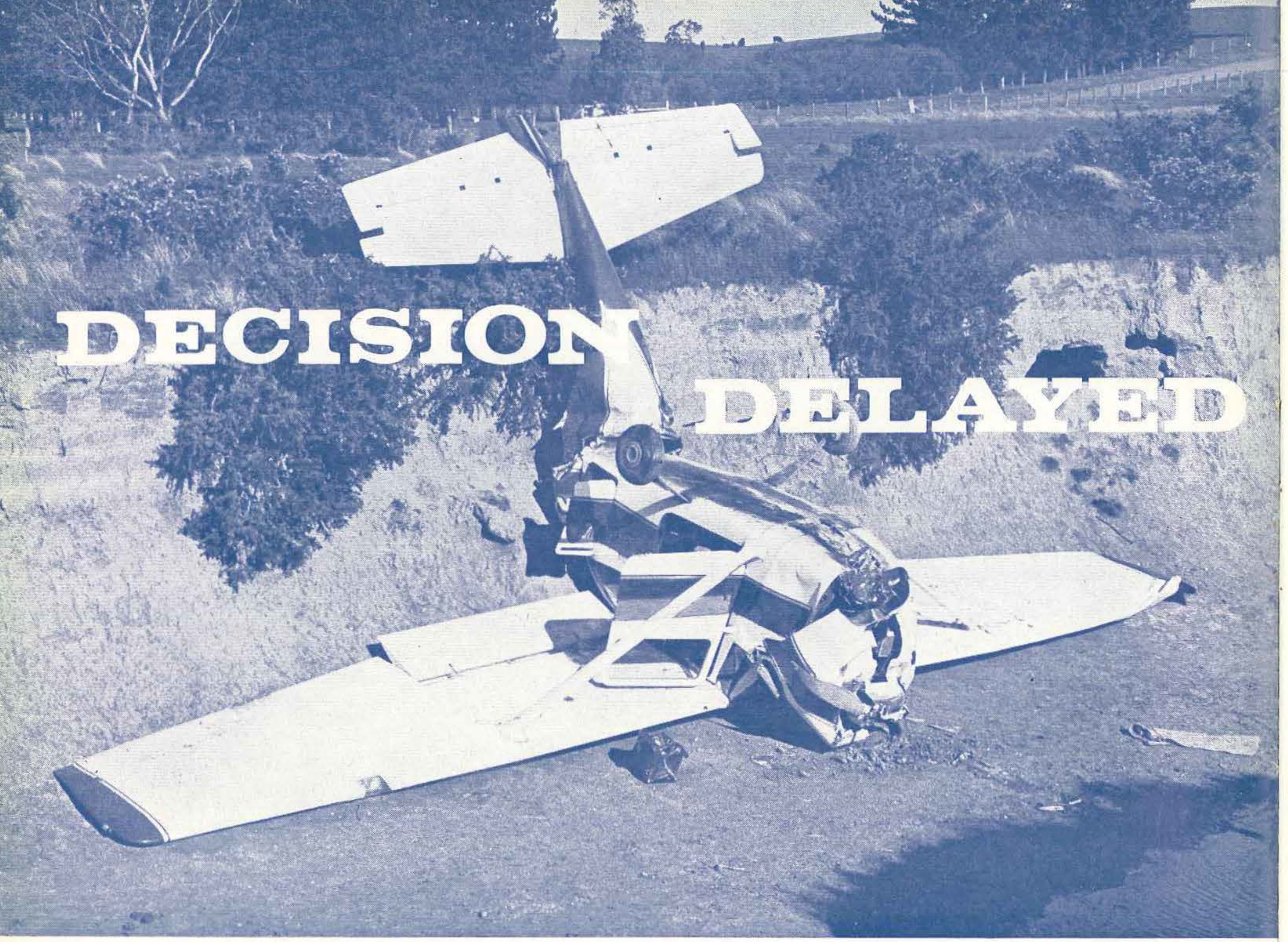
Those of us who fly Cherokee 140s, 180s or Cherokee Sixes will know that the fuel cap fits directly on to the neck of the fuel tank and that, because there is no lip on the tank, the opening is on the same level as the surface of the wing. In dusty conditions when the aircraft is on the ground, dust can collect on the wing under the edge or "overhang" of the fuel cap. Consequently, when the cap is taken off, it is almost impossible to prevent the dust falling directly into the fuel tank. In the aircraft involved in this case, enough dust had apparently fallen into the tank in this manner over a period of time to cause the damage to the fuel injector.

In practice, there is a very simple way to overcome this problem — by blowing around the fuel cap before removing it. As there is a small clearance between the cap and the edge of the filler neck, it is quite easy to blow the dust away from around the cap. So, when operating in dusty conditions, remember: **Blow First — Then Remove the fuel cap!**









DECISION DELAYED

AT Whittlesea, Victoria, a student pilot was receiving dual instruction on circuits and landings in a Cessna 172. After two uneventful circuits in which fully-flapped approaches were made, the instructor asked the student to make the next approach and landing without flaps. The student nominated that the landing would be to a full stop.

The strip in use was 2,620 feet long with a grass surface, but because of the recent passage of a rain squall, it had become very slippery. When the rain cleared, the wind, which had been gusting earlier to 20 knots, had dropped to about five knots but as it was now blowing approximately at right angles to the strip, there was virtually no headwind component in the landing direction.

Quite early on final approach, the instructor saw that the aircraft was both high and fast, and from this position, taking into account the conditions on the strip, he realised that a full stop landing would not be possible. However, in order to demonstrate the effect of the slippery surface on the aircraft's braking ability and to test the student's reaction to the situation when he realised that it would be impossible to stop in the distance available, the instructor allowed the student to continue the approach.

After a prolonged float, the aircraft touched down approximately 1,000 feet beyond the threshold and the student immediately applied the brakes. As expected, they had little effect on the wet grass, and the aircraft continued along the strip for several hundred feet without slowing to any appreciable extent. The student made no attempt to go around and when the aircraft was only about 250 feet from the far end of the strip, still travelling at between 40 and 45 knots, the instructor realised

he would have to act quickly and took over the controls. Lowering some 15 degrees of flap, he applied full power, but by this time the aircraft was less than 200 feet from the end of the strip. It failed to become airborne in the distance remaining, and struck a low embankment a short distance beyond the end markers.

The impact dislodged the nosewheel and the aircraft dropped on to its nose and slid for a further 100 feet before it plunged into a steep-sided creek bed, where it somersaulted and came to rest inverted against the far bank. The student pilot received serious injuries and the aircraft, as is clearly evident from the photographs, was damaged beyond repair.

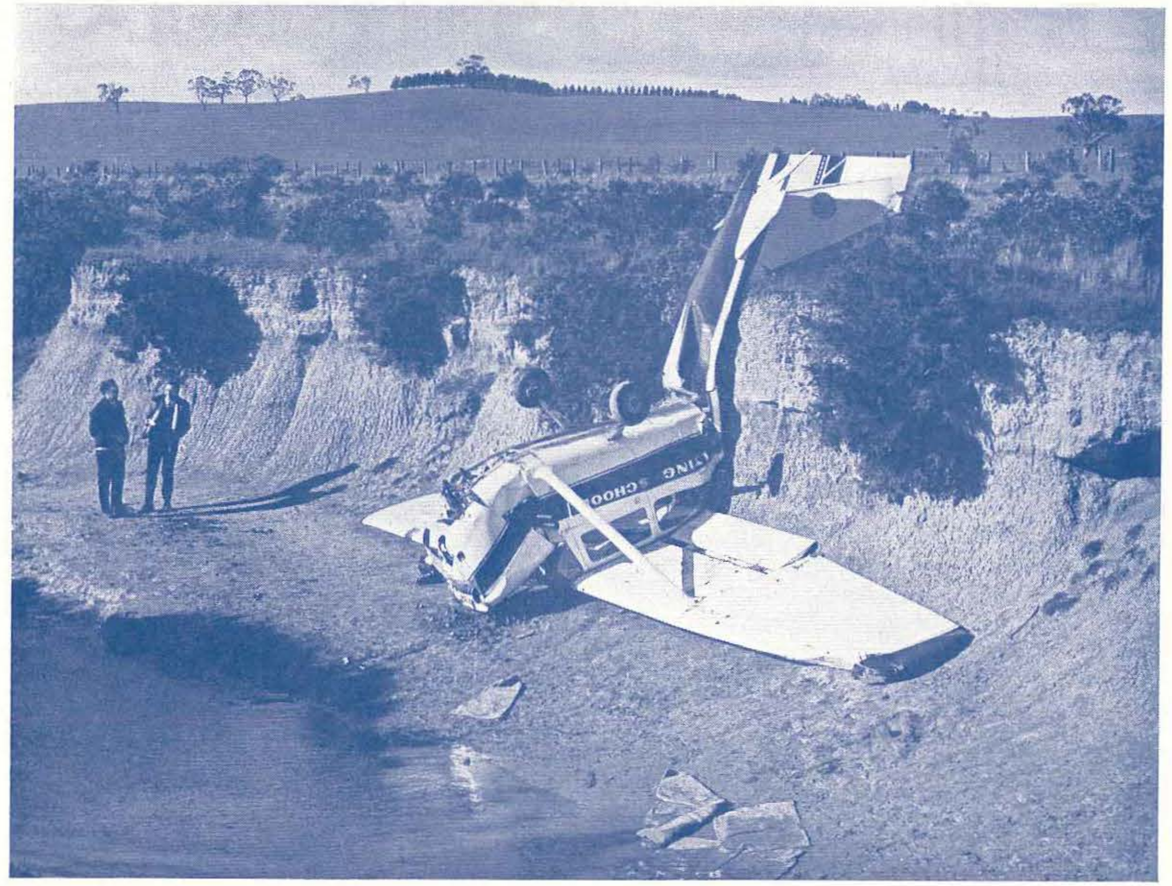
* * *

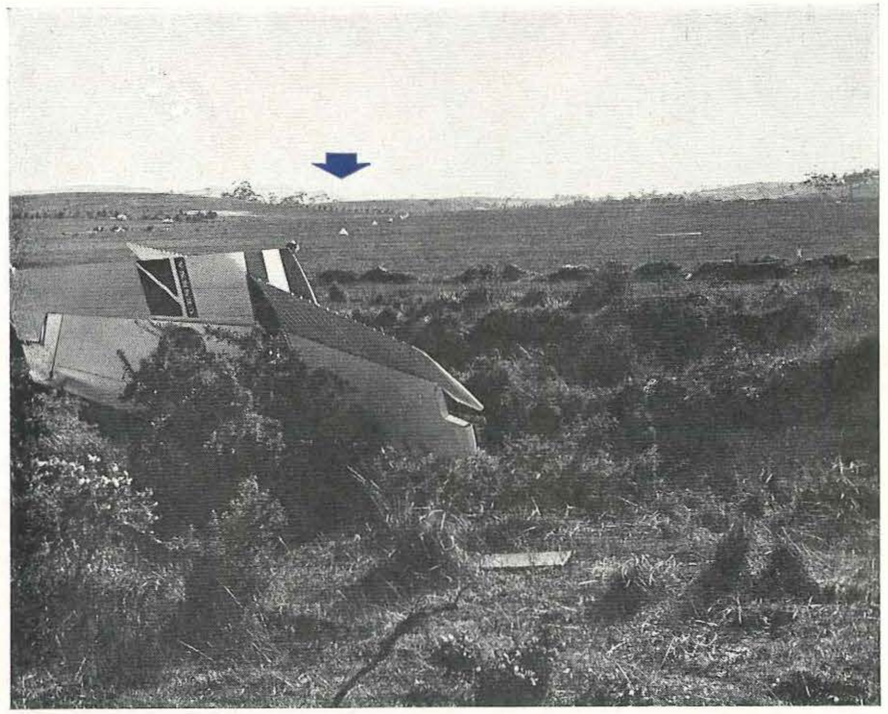
Examination of the wreckage did not disclose any evidence of a malfunction in the aircraft, its engine or its systems which could have contributed to the accident. Both the occupants of the aircraft and observers on the ground adjacent to the strip said that the engine appeared to operate normally when full throttle was applied to go around.

In view of the outcome of the attempted go-around and in the absence of any mechanical failure in the aircraft, it was evident that the manoeuvre had been left far too late for it to have any hope of success. Investigation into the reasons for the instructor not taking over the controls earlier revealed that, while he was intending to demonstrate the poor braking effect on the wet grass, he also anticipated that the student, of his own accord, would recognise that the aircraft would be unable to stop on the strip and initiate the overshoot himself.

As it was, the student pilot realised that all was not well shortly after they touched down. He had been briefed earlier in his training that if his aircraft was on the ground before it reached a particular group of markers midway down the strip, it would be possible to stop in the length remaining. Although on this occasion the aircraft appeared to

The wreckage after somersaulting in the creek bed, lying against the far bank.





View looking back along the strip from just beyond the creek. The "go around" was commenced, only just before reaching the cone marker arrowed. The marker is 180 feet from the end of the strip.

touch down normally some distance before reaching these markers, the student became alarmed when he lowered the nose wheel to the ground and realised that the speed was much higher than on previous landings and that the brakes were ineffective. He became even more apprehensive as the end of the strip rapidly approached but, apart from considering a deliberate ground loop, he took no action to remedy the situation. In his own words, he " . . . had nominated a full stop landing to the instructor and was relying on his (the instructor's) better judgement to initiate the go around if necessary".

During this period of uncertainty, in which each pilot was evidently waiting for the other to initiate an overshoot, the aircraft passed beyond the point of decision on the strip and an accident of some sort thus became inevitable.

* * *

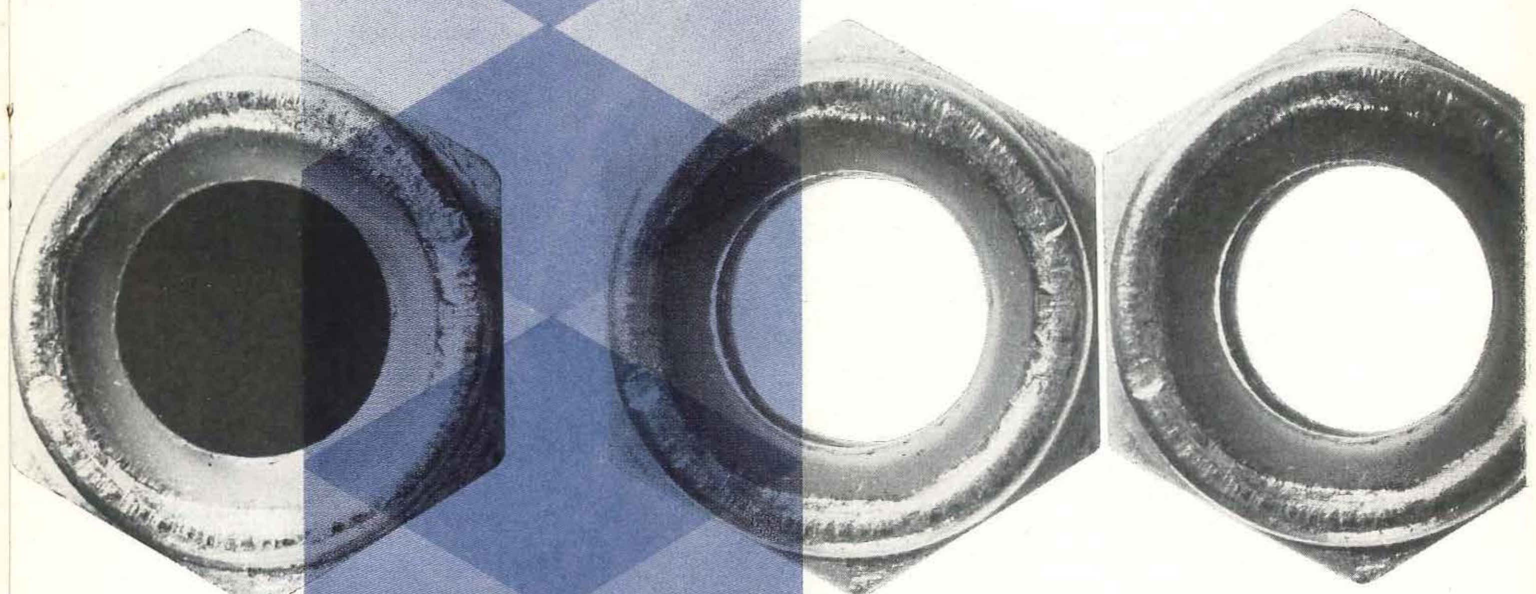
It was apparent from the investigation that the student pilot had appreciated more readily than the instructor that a critical situation was developing, but in the circumstances it is perhaps understandable that he would have been relying on the instructor's greater experience to prevent the aircraft getting into serious difficulties. The instructor, on the other hand, was placed in the situation where, in order to permit the student to develop and display the ability to extricate himself from a potentially dangerous situation, he had to resist taking corrective action too early if much of the benefit of the exercise was not to be lost on the student. Judgement in such a situation comes mainly from experience, but an instructor must always assess the benefit a student is likely to gain from making such a decision against the possibility of jeopardising the safety of the aircraft and its occupants.

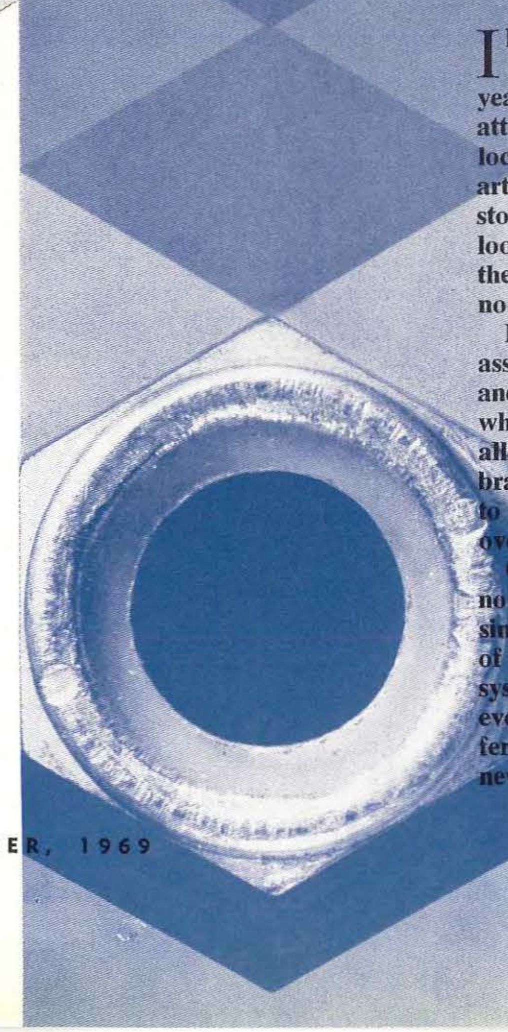
On this occasion, the instructor had adequate time to correctly assess the situation that was developing during the landing ground roll. Furthermore, he was aware, long before touch down, that the aircraft would be unable to stop on the strip and should have been alert to the need for assuming control in adequate time to make a successful go around. It was thus evident that the instructor had erred in his judgement by delaying the initiation of a go around to the point where the situation was irretrievable.

Cause

The cause of the accident was that the instructor, as pilot-in-command, did not take timely action to initiate a go around.

Stop Nut (False) Economy





IF in doubt throw it out! These were the words we used to head an article in the Digest last year (see Digest No. 56, May, 1968) which drew attention to the need for care in reusing self-locking type nuts in aircraft assemblies. As the article pointed out, the self-locking qualities of stop nuts deteriorate with repeated tightening and loosening and this must not be allowed to reach the point where the self-locking characteristic is no longer effective.

Recently in Western Australia, the tail wheel assembly of a Piper Super Cub fell off in flight and was lost. It was quite evident that the tail wheel yoke retaining nut had worked off in flight, allowing the assembly to fall out of its mounting bracket. The nut's loss of torque was attributed to the fact that it had been used several times over.

On this occasion the aircraft landed safely and no great harm was done. But as we see it, a similar fate could just as easily have befallen one of the stop nuts on the primary flying control system or perhaps the engine controls. In this event, the outcome could have been a very different story. As we said in our earlier article—new stop nuts are cheaper than new aeroplanes!

BUFFETING IN REVERSE

PREPARING to depart from Sydney Airport, a light twin-engined aircraft was cleared to the holding point for the duty runway. When the pilot called the tower to advise that he was ready for take off, he was informed there would be a three or four minute delay, "due to arriving traffic".

In the meantime, a Lockheed Electra was also taxi-ing out for take off and reaching the holding point area, held position very close behind the light twin. Soon afterwards, a sudden, very strong gust, coming apparently from the rear caught the smaller aircraft's control surfaces, jolting them from one limit of travel to the other, despite the fact that the pilot's feet were on the rudder pedals and he was holding the control column.

The pilot advised the tower what had happened and explained that he would now have to inspect his aircraft before departing. He was cleared to enter the runway and to turn off into a vacant taxiway, where he shut down the engines and carried out an external inspection, checking the control cable attachments, hinge points and the condition and movement of the control surfaces themselves. All seemed to be in order, so the pilot started the engines again, obtained a fresh airways clearance and subsequently carried out an uneventful flight to his destination.

After the flight was completed however, a further inspection of the light aircraft showed that two rivets were sheared on the rudder near the lower rudder stop and that part of the rudder skin was wrinkled.

The pilot of the Lockheed Electra said that while taxi-ing out to the holding point, he had moved the power levers back to the ground idle range to prevent the aircraft gaining speed without having to "ride" the brakes. He had parked close behind the small aircraft, not realising there was a wash of air going forward, and this, mixing with the light twin's own slipstream, had apparently produced the buffeting. The pilot added that during further flying of the Electra, he noticed that the No. 3 engine was leading appreciably into reverse thrust, and that this could have aggravated the condition.

In parking the large aircraft so close behind the light twin, the captain of the Electra apparently did not appreciate that there was a real possibility of buffeting the latter's control surfaces. Like the jet blast incidents that have occurred from time to time on airport aprons and taxiways, this episode serves as a useful reminder to always consider the "other fellow" when manoeuvring large and powerful aircraft in close proximity to other aircraft or equipment.

RECENTLY, while a daily inspection was being carried out on a flying school's Chipmunk, both wings were found to be distorted just outboard of the undercarriage leg on each side, apparently as a result of excessive in-flight loads. Although the official report on the matter was endorsed "cause not established", little imagination is required to appreciate that the aircraft must have been subject to some particularly ham-fisted aerobatic flying.

The Chipmunk, of course, was designed as a fully aerobatic aeroplane. By comparison with today's non-aerobatic aircraft types, its airframe is particularly strong and the degree of mishandling that must have been necessary to inflict structural damage on an aircraft of this type is frightening even to contemplate.

Pilots should not attempt aerobatics unless they have been properly instructed in the manoeuvres to be performed and have been authorised to perform them solo. Also, frequent practice is necessary to maintain aerobatic competence. If you haven't done aerobatics for some time, a check with an instructor is the best and safest way of seeing what you are still capable of doing.

Incidentally, the damage to the Chipmunk gives some idea of the risks some irresponsible pilots sometimes take by indulging in self-taught aerobatics in non-aerobatic aircraft!

STATIC ELECTRICITY AGAIN . . .

ON several occasions in recent years, the Digest has had cause to report the destruction of aircraft in Australia as a result of fire breaking out during refuelling operations. In all cases, the refuelling was conducted without heeding the safety precautions laid down in A.N.O. 20-9.

Now another instance, this time in Canada, in relatively cold weather, shows again that static electricity is a factor that can be afforded no concessions while an aircraft is being refuelled.

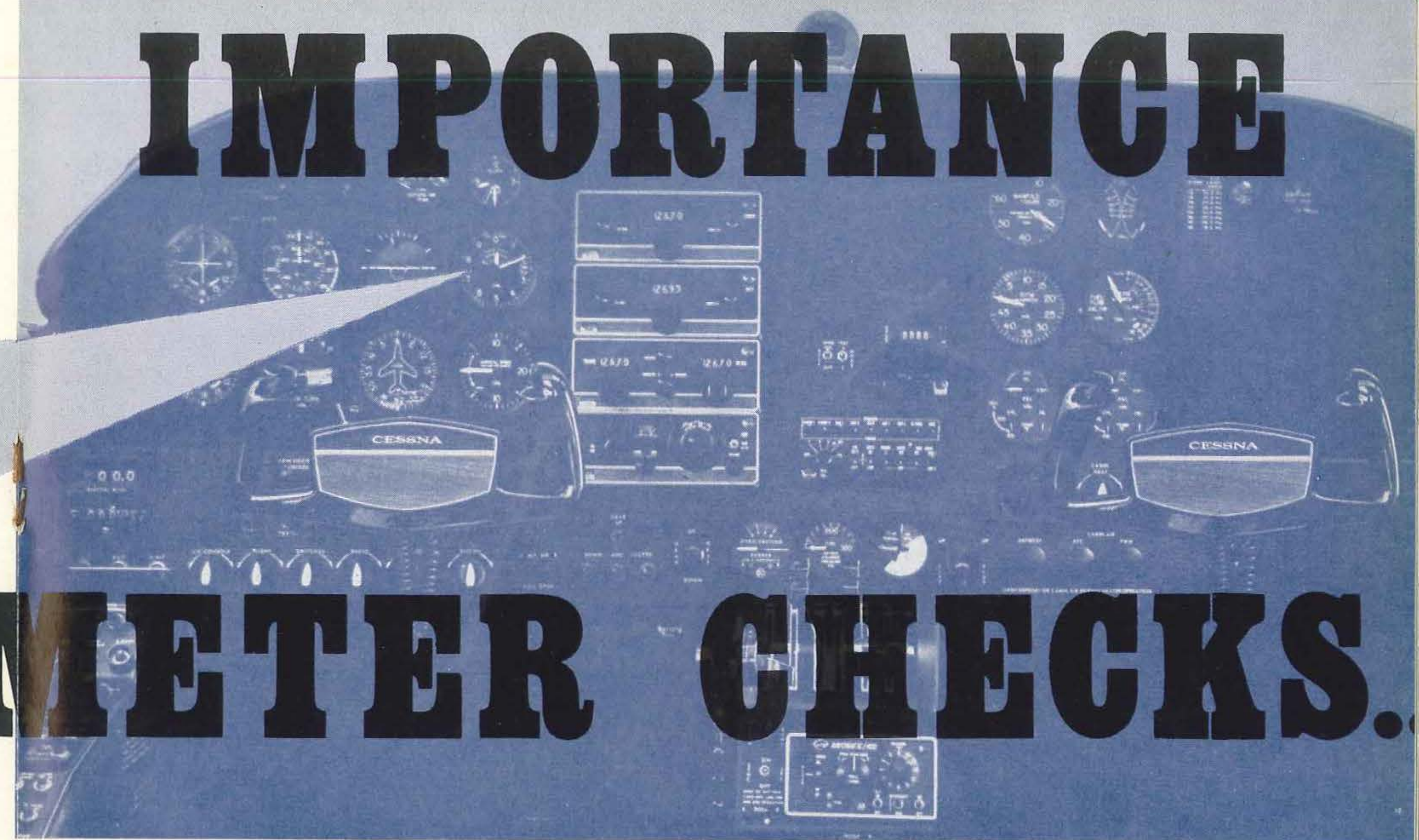
In this case, the aircraft, a Sikorsky S-55 helicopter, had landed at a dry and dusty airstrip to refuel. The weather was fine and almost calm, and the temperature was just under 10°C (49°F).

After landing, the rotor was stopped, but the engine was kept idling. After earthing the aircraft to the ground and bonding the refuelling nozzle to the airframe, an engineer began to refuel the helicopter using an electric fuel pump, with a funnel and filter. During the operation, the funnel moved and the engineer went to adjust its position. As he did so, the flowing fuel burst into flames.

Technical studies that have been published on static electricity indicate that the rotating fan on the helicopter engine could have generated a static charge and the dry, dusty soil would have provided only poor earthing. The investigation concluded that the fire was probably caused by a discharge of static electricity from an undetermined source.

THE IMPORTANCE OF ALTIMETER CHECKS...

THIS ALTIMETER



. . . reads as you would expect - for an aerodrome elevation of 170 feet AMSL where the QNH setting is 1021 mb.

Make sure your altimeter would read that way - not like the altimeters at right.

These faulty presentations were all discovered in flight. The possible consequences of errors like this, particularly in high-performance pressurized aircraft, should need no emphasis!

Faulty presentations must be rectified before flight by carrying out a co-ordination check on the ground. The barometric scale should be set to the aerodrome QNH and the reading checked to ensure that it equals the field elevation. The position of **each pointer** should be checked **in turn**, commencing with the 10,000 feet pointer. As the examples show, altimeter errors can go undetected all too easily!

L.A.M.E.'s should carry out ACCURATE co-ordination checks at regular intervals. Pilots should check their altimeter co-ordination before EACH flight.

THE INVISIBLE MENACE

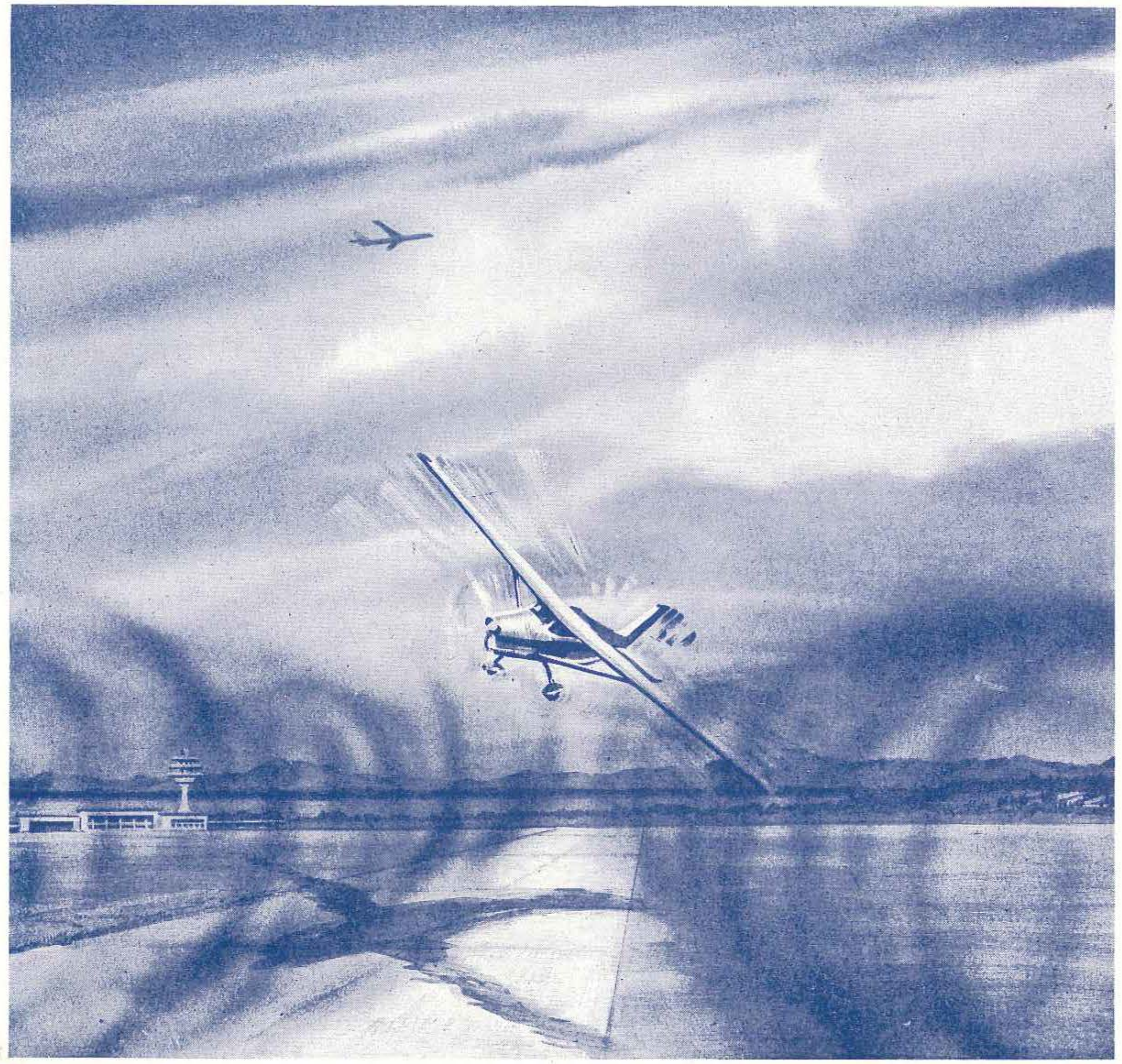
Some appreciation of the character of the normally invisible hazard of wake turbulence is spectacularly conveyed by our cover illustration, and the following article, reprinted from the latest issue of the "FAA Aviation News" provides a further timely reminder that wake turbulence can be a lurking menace to every light aeroplane that shares an airport with large aircraft. It also describes some of the measures pilots can take to reduce the chances of an encounter.

A full account of the nature of wake turbulence and the hazards it poses is available in a new Aviation Safety Digest pamphlet on the subject, now ready for distribution. Copies of this pamphlet may be obtained by writing to the Editor.

FRIDAY the 13th is usually considered to be an unlucky day, but for a 35-year-old attorney-pilot from Sherman Oaks, Calif., one such Friday turned out to be one of the luckiest days in his life. The pilot, with his wife and two friends, had gone up for an aerial tour of Los Angeles in his Cessna 172. It was a beautiful August day, with visibility 20 miles plus; temperature 80 degrees; and ceiling unlimited. The flight was enjoyable and uneventful until they encountered an invisible hazard in the final approach phase of their flight.

In his "Pilot/Operator Aircraft Accident Report," the pilot stated that after approximately 20 minutes of local flight, he entered the normal traffic pattern for Runway 15 (at Lockheed Airport, Burbank, Calif.), called the tower and turned downwind. The tower was clearing a Constellation number one on straight-in approach, and advised the Cessna 172 to extend downwind. His altitude was approximately 1600 to 1400 feet downwind and on wide base. On final the pilot noted that even though he was in a wide pattern he was high, so he put down 30 degrees of flap. As the Constellation taxied off the runway, the Cessna was cleared to land and was cautioned about wake turbulence.

Passing over the San Fernando Road (major



traffic artery passing close to runway threshold), the Cessna pilot encountered violent turbulence—wing tip vortices from the landing Constellation. His aircraft was turned approximately 45 degrees from the runway heading to 105 degrees, and entered a sharp descent. The pilot applied full power and righted the aircraft, but struck a tree with his left wing tip. He raised the flaps slowly, made a clockwise circuit of the field and landed on Runway 15 without further incident.

The pilot paid $460 in aircraft repairs for his encounter with wake turbulence, and could thank his lucky stars that no one was hurt. He was lucky indeed. Between 1966 and 1968, 62 persons were killed or injured in accidents where wake turbulence was a primary, if not sole, cause. Some of these tragic incidents might have been avoided if the pilots had realized that "cleared to land" means only that the runway is no longer in use by other aircraft. It is not an assurance that no other hazards, visible or invisible, are present.

Aircraft Weight is Decisive

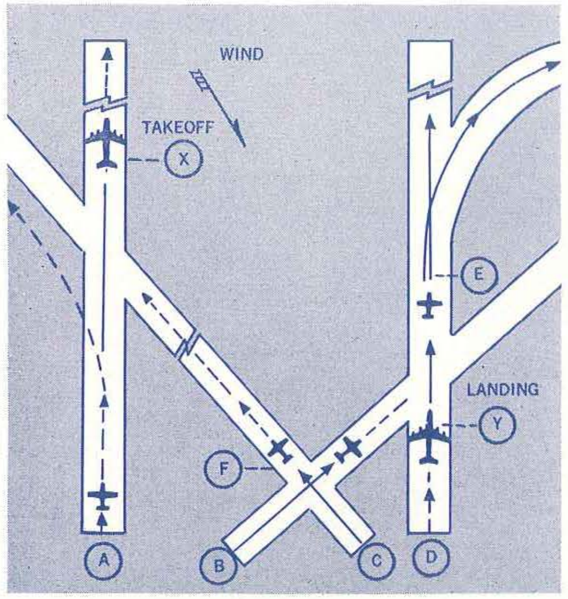
One invisible hazard is the turbulence found in the wake of aircraft. Also known as wing tip vortices, it is produced when an aerofoil (such as a wing) passes through a mass of air, creating lift and transmitting energy to the air mass. The air spills laterally over the wings and forms a horizontal vortex at each wing tip. The twin vortices settle downward and spread out to either side of the aircraft, whirling in opposite directions from each wing tip. Generally, the greater the lift, the greater the energy transmitted to the air mass in the form of turbulence. The intensity of the turbulence is directly proportional to the weight of the aircraft and inversely proportional to the wing span and speed of the aircraft.

Except where vortices are entwined with the contrails of high flying aircraft or the smoke trails from large jets, they cannot be observed. It is the "unknown" about this phenomenon that presents most of the problems to general aviation pilots. No one can tell you exactly where the vortices will be, how long they will last, or what effect they will have. Wind velocity, weather, temperature, the direction of the wind and other environmental factors make it impossible to predict the exact course of the dual vortices at any given moment.

But certain characteristics of wake turbulence are fairly well known. The whirling air settles below and away from the path of the aircraft, whirling in opposite directions. Avoiding an encounter with wake turbulence calls for following aircraft to make good a path above and well behind the flightpath of the leader. (Turbulence may persist for five minutes or longer after the passage of a large aircraft.)

However, it must be borne in mind that local turbulence or cross winds may alter the ideal dispersion picture, so that the light aircraft pilot must be always alert and ready to counter the effects of disturbed air whenever flying in the vicinity of similar or larger aircraft.

Wing tip vortices are present from the moment the weight of the aircraft is transferred from wheel support to wing lift. Since aircraft at altitude are usually not in close proximity, wing tip vortices normally are a problem only at airports. Nevertheless, light aircraft pilots should be wary of crossing the visible wake of jets (i.e., the trailing smoke particles) aloft since the invisible turbulence they create may be encountered—especially if a crossing is made at a right angle. When wake turbulence is still present, the greater the angle of crossing, the more severe will be the jolt received. When the telltale jet smoke is in the area, it is a good precaution to reduce speed and be alert for corrective action, since it is impossible to guess where the invisible vortices may have drifted.



When a large aeroplane is taking off at X, small aircraft could land or take off at A, B, C, or D. It should avoid taking off or landing at E, as the cross-wind could carry wake turbulence down-wind to this point. Similarly, when a large aeroplane is landing at Y, a small aircraft could land at A or B, but not at C or D. It could also take off at A, B. C, or E, but not at D.

Jets or large transports are by no means the only source of hazardous wake turbulence. If you are flying a single-engine aircraft, virtually any other light aircraft can, under some circumstances, generate enough turbulence to upset you if you follow too closely in its wake. Quick takeoffs behind aircraft flying touch-and-go practice can provide you with unpleasant surprises.

Airports constitute an environment where wake turbulence is always a potential and sometimes an unavoidable problem. However, solving the problem calls for pilot judgement, not mere reliance on airport or tower authorities.

When in Doubt, Ask

If a tower controller cautions you about wake turbulence, he is warning you that it may exist because of another aircraft that has recently made a takeoff or landing. He cannot tell you where it is, or if you will actually encounter it during your operation. When you receive such an advisory, don't hesitate to ask for more information if you think it will help you to analyze the situation and determine your course of action. Even though a

takeoff or landing clearance has been issued, if you believe it would be safer to wait to use a different runway, or to change your intended operation in some other way, ask the controller to approve a revised clearance.

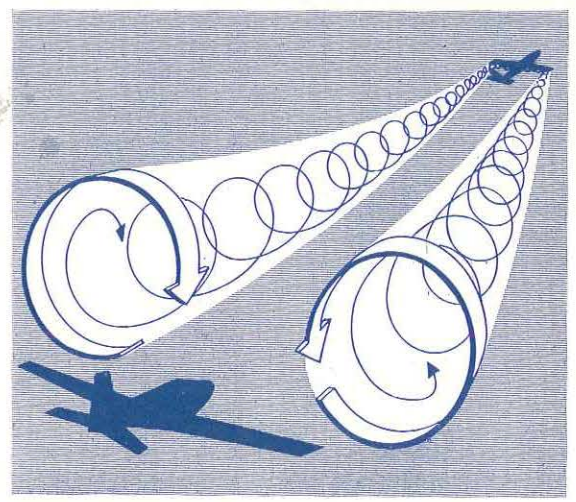
Sometimes clearances include the word "immediate," such as "cleared for immediate takeoff." Such communications are to be interpreted as meaning that if the pilot takes off at once he will have adequate separation from other aircraft. It is not an "order" to go. If you have any reason to believe you cannot proceed safely, it is your responsibility to decline the clearance. The controller's primary job is to aid in preventing collisions between aircraft, not to advise pilots on flight procedures.

It is up to the pilot to recognize potential wake turbulence at an airport, and to know what he can do about it. At least five options are open to him:

(1) For takeoffs on the same or parallel runway behind a large, heavy aircraft, plan to take off before the point where the larger aircraft left the ground. Remember that even in a "no wind" condition, a vortex from a departing aircraft on a nearby parallel runway could descend on your proposed takeoff route, so check out the takeoff point of that 707 on the runway next to you as well as the one that took off ahead of you.

(2) For takeoffs on intersecting runways, remember the basic rule is to stay above the flightpath of

Vortices are generated at each wing tip of an aerofoil whenever it is producing lift. The whirling motion is inward, but the vortices sink downwards and spread out laterally.

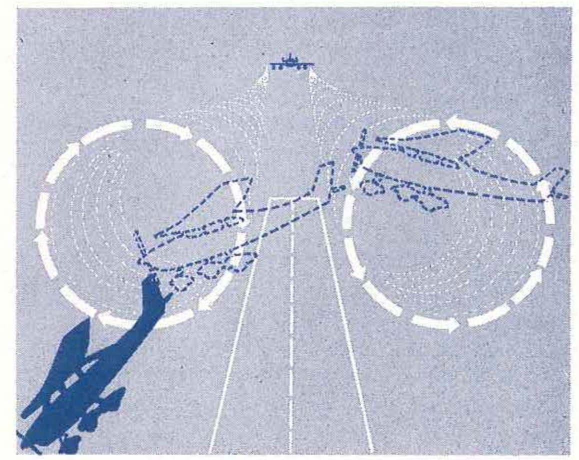


other departing aircraft. If the departing aircraft on the other runway was still on the ground well past your intersection, and your takeoff will permit you to climb approximately 100 feet or more before you reach the intersection, you should have clear air.

(3) When taking off after a larger aircraft has landed on an intersecting runway, make sure that it touched down before it crossed your intersection. If this is not the case, you may request a delay or an alternative runway.

(4) When landing behind a large, heavy aircraft, it is essential to remain above the flightpath of the aircraft you are following and to touch down well beyond the point where it landed. In this way, you will avoid encountering the turbulence which is settling behind and to either side of the larger aircraft.

A small aircraft caught in the wake turbulence of a large aircraft while crossing behind it would be flung violently up and then down by the whirling vortices.



(5) When landing after the takeoff of a larger aircraft, make a normal touchdown well within the approach end of the runway. Plan to set your aircraft solidly on the ground before the larger aircraft's point of lift off.

In this age of increasingly crowded airports, and with the introduction of new, heavier aircraft into the system, the responsibility daily grows greater for the pilot of the private aircraft to understand wake turbulence potential and to cope with it under varying conditions.

Comanche damaged during landing

Field length inadequate

After touching down in a paddock near Mt. Beauty, Victoria, a Piper Comanche did not decelerate as the pilot expected. To avoid colliding with the upwind boundary fence, the pilot attempted to turn towards rising ground, but the port main wheel fell into a rut and the undercarriage collapsed.

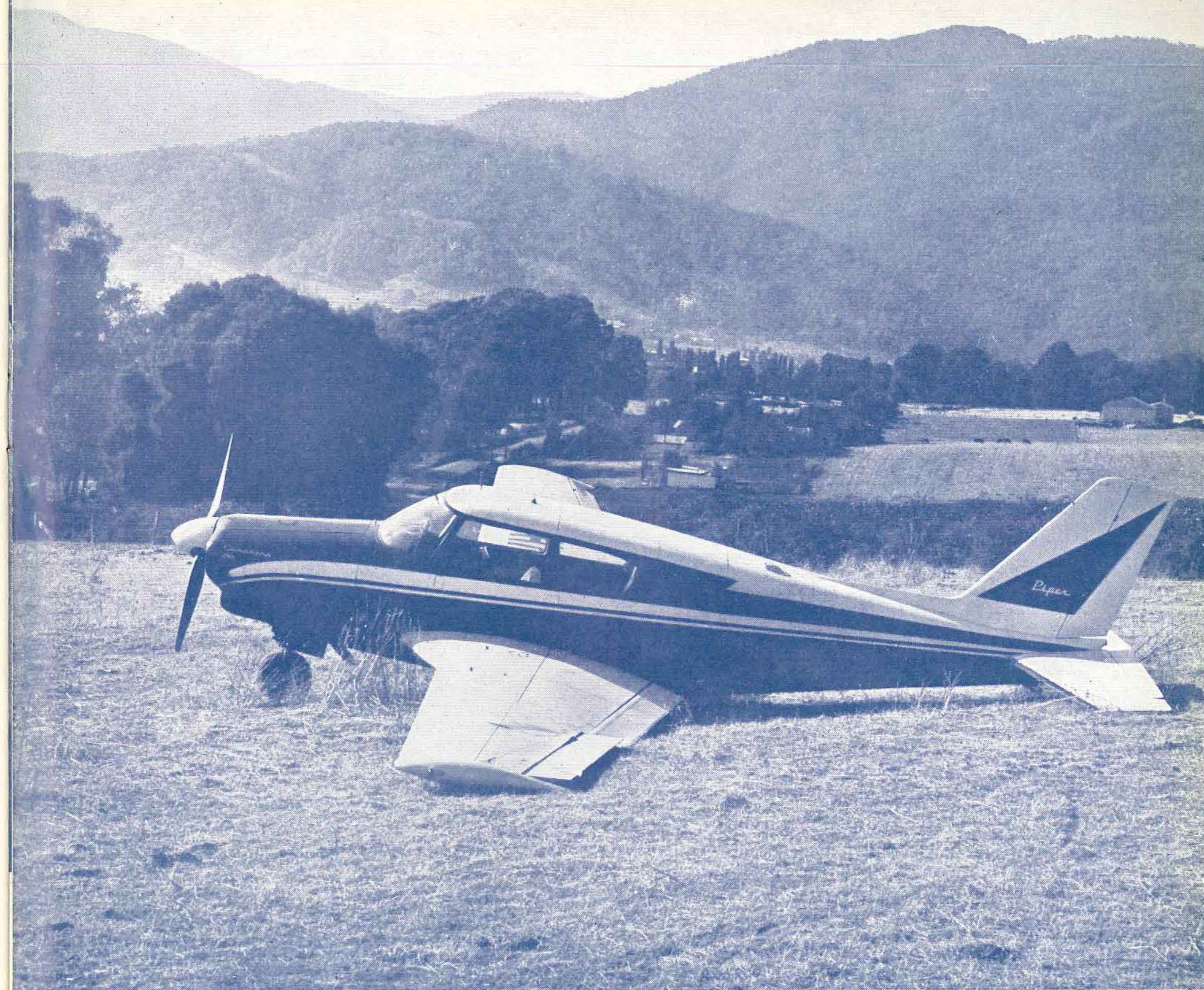
The aircraft belonged to a group of owners, one of whom had business appointments at Mt. Beauty, as well as in a town in southern N.S.W., and he had planned to use the group's aircraft for his trip. This member of the group was not a pilot himself however, and as no pilot-member was available for the flight, the opportunity to fly the aircraft was offered to a private pilot who was known to the owners. At the time of the offer, the private pilot was not endorsed to fly PA.24 aircraft and the offer was conditional upon his obtaining an endorsement for this type of aeroplane. The pilot therefore undertook conversion training and completed it only on the morning of the proposed flight to Mt. Beauty. His experience on the aircraft type then amounted to two hours fifteen minutes.

Before the flight began, one of the other part-owners of the aircraft who was a pilot, briefed the pilot who was to fly the aircraft, on the position of a paddock at Mt. Beauty, which he had previously inspected from the ground and considered was a suitable landing area. The landing run was aligned north-south, with relatively clear approaches at both ends, and he now suggested that the landing should be made into the south. The owner's permission for the aircraft to land in the field had already been obtained.

Having completed his conversion training on to the PA.24, the private pilot prepared a flight plan for the route from Moorabbin to Whittlesea, 20 miles north of Melbourne, where he was to pick up an additional passenger, and thence to Mt. Beauty direct. Departing from Moorabbin, with one passenger at 1050 hours, the pilot completed the leg to Whittlesea uneventfully. The second passenger boarded the aircraft, and they departed for Mt. Beauty at 1150 hours. A little less than an hour later, the aircraft arrived over its destination.

The township of Mt. Beauty is in the Kiewa Valley, amid rugged, mountainous terrain, 120 miles north-east of Melbourne. The aircraft entered the valley from the west, and one of the passengers who had seen the proposed landing area on a previous occasion pointed it out to the pilot. The pilot lowered the undercarriage and one stage of flap, made a left-hand circuit, then descended with full flap to make a "dummy run" over the strip at low altitude. Applying power and climbing away again satisfactorily, the pilot decided he would land on his next approach. Establishing the aircraft on final approach for a landing into the south, the pilot lowered full flap and reduced the airspeed to between 55 and 60 knots, aiming to touch down on the crest of a rise, close to the beginning of the landing run.

Instead of touching down where the pilot intended, the aircraft overshot the crest and floated. The pilot was unable to place the aircraft in a "short field" landing attitude, and it touched down

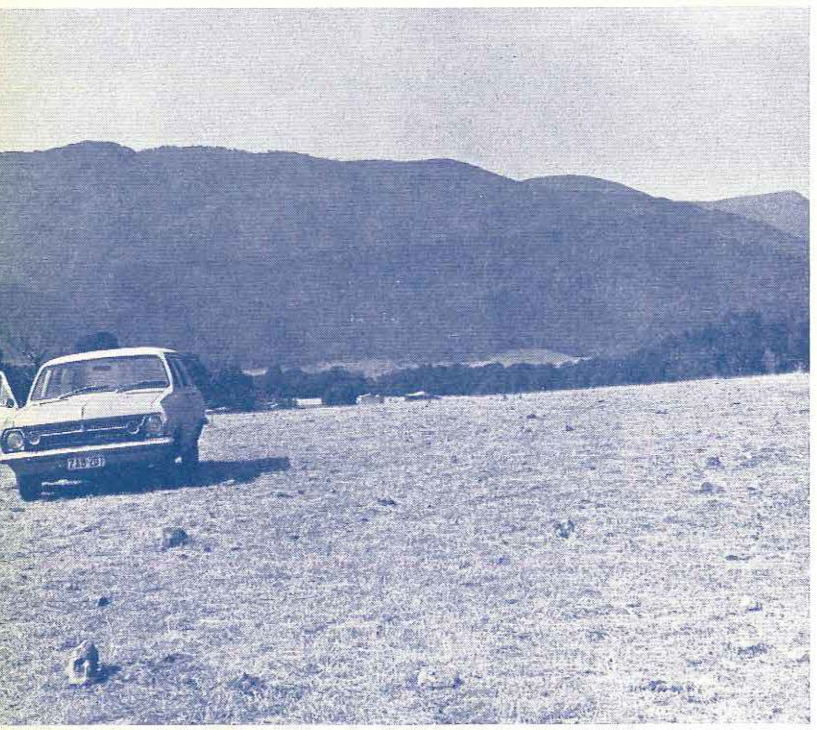


The aircraft, with port undercarriage collapsed at the end of the "strip". The picture is taken in the direction of the landing run. Note the steepening gradient beyond the aircraft.

nose-wheel first, 150 feet beyond the pilot's aiming point. The aircraft then skipped a further 30 feet and landed firmly on all three wheels. The pilot braked heavily and raised the flaps, but then realized the aircraft was not decelerating as he expected. He considered applying power and going around but, not confident of being able to do so safely in the remaining distance, wisely decided against it. The pilot weaved the aircraft from side to side in an attempt to reduce speed then, seeing that they would hit the upwind boundary fence if the aircraft kept going in that direction, he attempted to turn to the right towards a rise in the ground. He succeeded in turning the aircraft about 30 degrees, but then the port landing wheel encountered a rut in the paddock throwing a transverse load on to the port undercarriage. The leg collapsed, allowing the port wing to strike the ground, and the aircraft pivoted to the left and came to rest facing north-east. The pilot turned

Above: The approach path to the strip taken from the commencement of the usable landing area.

Below: View taken from the same point looking down the field in the direction of landing. The overall downward gradient is clearly evident.



off the fuel and switches and the three occupants escaped from the aircraft uninjured.

Investigation of the circumstances of the accident showed that the aircraft had been operating normally and that its loaded weight of 2,520 lbs. was well below the maximum take-off weight. The pilot said that no wind was blowing at the time of the landing and references to the landing weight chart for this model Comanche show that in zero wind conditions and at the weight to which it was loaded, a distance of 2,480 feet is required for a landing. Examination of the field in which the accident occurred, however, showed that because of a gully at its northern end, the maximum length of run available for landing or take-off was only 1,840 feet. Furthermore, in the direction used, the surface of the field was level for the first 140 feet but then sloped downward with a progressively steepening gradient. The slope over the final 800 feet was nearly $2\frac{1}{2}$ degrees and the overall downward slope of the usable landing area was approximately two degrees, or one in 30. By contrast, the maximum allowable longitudinal grade for an authorised landing area is one in 50.

The area on which the pilot attempted the landing thus did not meet the requirements of an authorised landing area either in respect to length or surface gradient. Calculations indicated that, in the case of this landing into the south, the overall gradient would have increased the landing distance by 350 feet above that indicated by the landing weight chart, which, of course, is computed for a level surface and does not take slope into account. Although the pilot's lack of experience on the aircraft type may have contributed to the severity of the accident, it was unlikely that even an experienced pilot could have landed safely in the direction used in zero wind conditions.

It is interesting to note that the pilot, before setting out on this flight, was given to understand that the length of the proposed landing area was "about 3,000 feet". The last issue of the Digest contained two articles on the dangers of underestimating the distances available or required for **take-off,** and emphasised the importance of using the performance charts incorporated in the aircraft's Flight Manual to ensure that the length available is adequate. The points made in these two articles have equal application to **landings** on areas other than Government or licenced aerodromes. The sobering list of examples of accidents in inadequate fields, quoted in Digest No. 58 of September last year, is also recommended to pilots who feel they need a further convincing on the dangers of "landing anywhere".

Q UEER N OTION OF H EIGHT ?

APPROACHING Canberra at the conclusion of a flight from Griffith, N.S.W., a private pilot flying a Cherokee was cleared to make a visual approach and to enter the circuit on downwind leg.

Soon afterwards, a somewhat startled tower controller sighted the aircraft flying the downwind leg, only 200 to 300 feet above the ground. Asked to report his altitude, the pilot replied "Fifteen hundred feet". The aircraft was then seen to climb back to a more normal circuit altitude and, after being cleared to continue the circuit, subsequently made a normal landing.

Asked to telephone the tower after he had shut down, the pilot said he had flown from Griffith at 7,000 feet on the Area QNH setting of 1011 millibars. When the tower controller pointed out that the elevation of Canberra Airport was nearly 2,000 feet, the pilot realized that, despite all his careful pre-flight planning, he had completely overlooked this fact and that his altimeter was not in error as he had first supposed. It was learned that although he had some 250 hours flying experience, nearly all of it had been flown from aerodromes in South Australia which have elevations close to sea level. He had never before landed at an aerodrome with any substantial elevation such as Canberra. Having set the Canberra QNH of 1014 on his altimeter when he began his descent from 7,000 feet, he subconsciously expected it would read near zero on landing.

Before continuing his flight the pilot was required to obtain further instruction in altimetry procedures from a local flying school to ensure that his knowledge was of a satisfactory standard. Doubtless however, the very effective object lesson which he unwittingly gave himself will be the one he will best remember!

'The One That Got Away'...

NO, this isn't a fish story. The escapee in this case is the dejected looking Chipmunk in the picture above. It ran away after being hand-started, demolished the wing of a nearby glider, and finished up in the ditch.

It all happened at an aerodrome in Western Australia during preparations for a day's gliding. After taking the Chipmunk from the gliding club's hangar, the duty tug pilot started the engine and taxied along the apron where he parked the aircraft in a position to commence towing operations. When he was ready to begin, he enlisted the aid of a student glider pilot to help him restart the engine. The student had no power flying experience so the tug pilot placed him in the front cockpit of the Chipmunk and gave him a comprehensive briefing on the starting procedures. The pilot then applied the brakes and went around to the nose of the aircraft to swing the propeller. When the student was ready, the tug pilot swung the propeller four or five times and the engine started. The tug pilot then began walking back to the cockpit.

As he reached the wing tip however, the engine gave a sudden burst of power and the aircraft started to move forward. The pilot shouted to the student to turn off the switches, but could not make himself heard above the engine noise. Gathering speed, the aircraft headed towards a parked Boomerang glider. Realising the situation was beyond him, the student switched off the engine, but too late, and the Chipmunk's still-rotating propeller hacked into the glider's port wing, and the aeroplane careered on through a fence at the edge of the tarmac and came to rest in a deep drainage ditch. The tug pilot immediately ran to the Chipmunk and turned off the fuel. Fortunately, the student, though badly shaken, was unhurt.

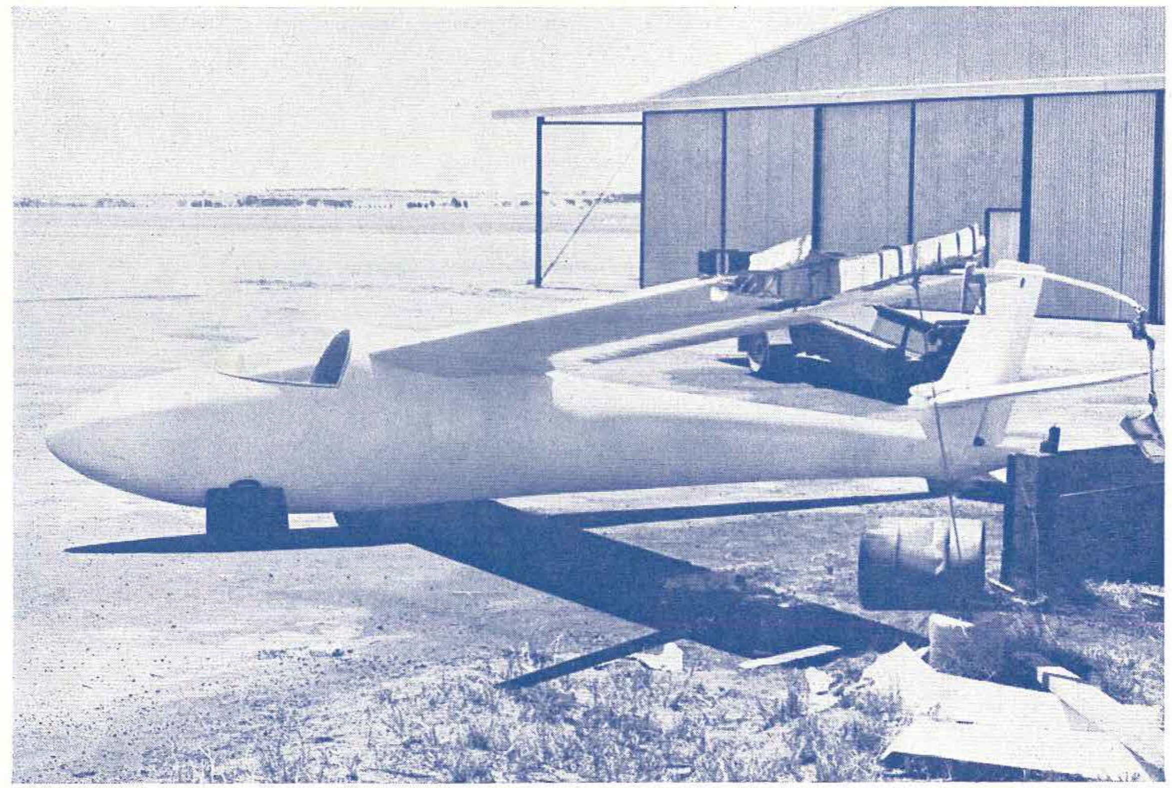
* * *

The briefing which the pilot gave the student was quite thorough, covering all the necessary points on engine starting. As many flying instructors would agree however, the error of moving the throttle the wrong way is not an uncommon one amongst students handling the engine controls for the first time. The confusion seems to arise mainly with persons who have had some experience of driving tractors, the throttles of which operate in the opposite sense to those of aeroplanes. In this case, it seems likely that the student glider pilot, possibly accustomed to the gliding club's tractor, instinctively moved the throttle lever forward in the stress of the moment when he attempted to reduce power after the Chipmunk's engine had "caught". It also seems probable that at about the same time, the student unwittingly knocked the brake lever, causing it to disengage and spring into the off position. This would account for the aircraft gathering speed so quickly before striking the glider.

The accident would almost certainly have been avoided if the pilot had taken the precaution of chocking the wheels, before starting the engine. It would also have been prudent of the pilot, seeing that this was the student's first experience in assisting with an engine start, to have someone, thoroughly familiar with the procedure, available to monitor the student's actions.

Numerous cases of aircraft "getting away" while they were being hand started have been reported in the Digest from time to time in the past. This accident is yet another reminder that hand-starting is an operation in which **nothing** may be safely left to chance.

The Boomerang glider with its port wing "sawn off" by the Chipmunk's propeller.



When correct recording counts

TAKING-OFF late in the afternoon from Ningerum in western Papua for a flight to Kiunga, some 30 miles to the south-east on the Fly River, the pilot of a Britten-Norman Islander had just begun a turn to set course when he felt the rudder pedals suddenly go slack and found he had lost rudder control.

Using the "Pan" emergency signal prefix, the pilot advised Wewak, Madang and Port Moresby of his predicament, mentioning that he may have also lost nosewheel steering and the nosewheel could be askew.

Asked by Madang would he consider diverting to Mt. Hagen where airport fire fighting equipment could be standing by for the aircraft's landing, the pilot chose to continue to Kiunga because it was late in the day and weather conditions on the ranges were unfavourable. Also by continuing to his planned destination, the pilot realised he would have adequate time before dark to make some low passes over the airstrip while the nosewheel was inspected from the ground.

Kiunga was contacted by passing a message through the ABC's broadcasting station at Port Moresby and a Cessna 180 on the ground at Kiunga came on the air and established communication with the pilot of the Islander. Arriving in the circuit area, the Islander made a number of passes over the Cessna pilot and it was apparent that the nosewheel steering was still functioning. Finally, the pilot of the Islander made an approach at low speed and landed safely.

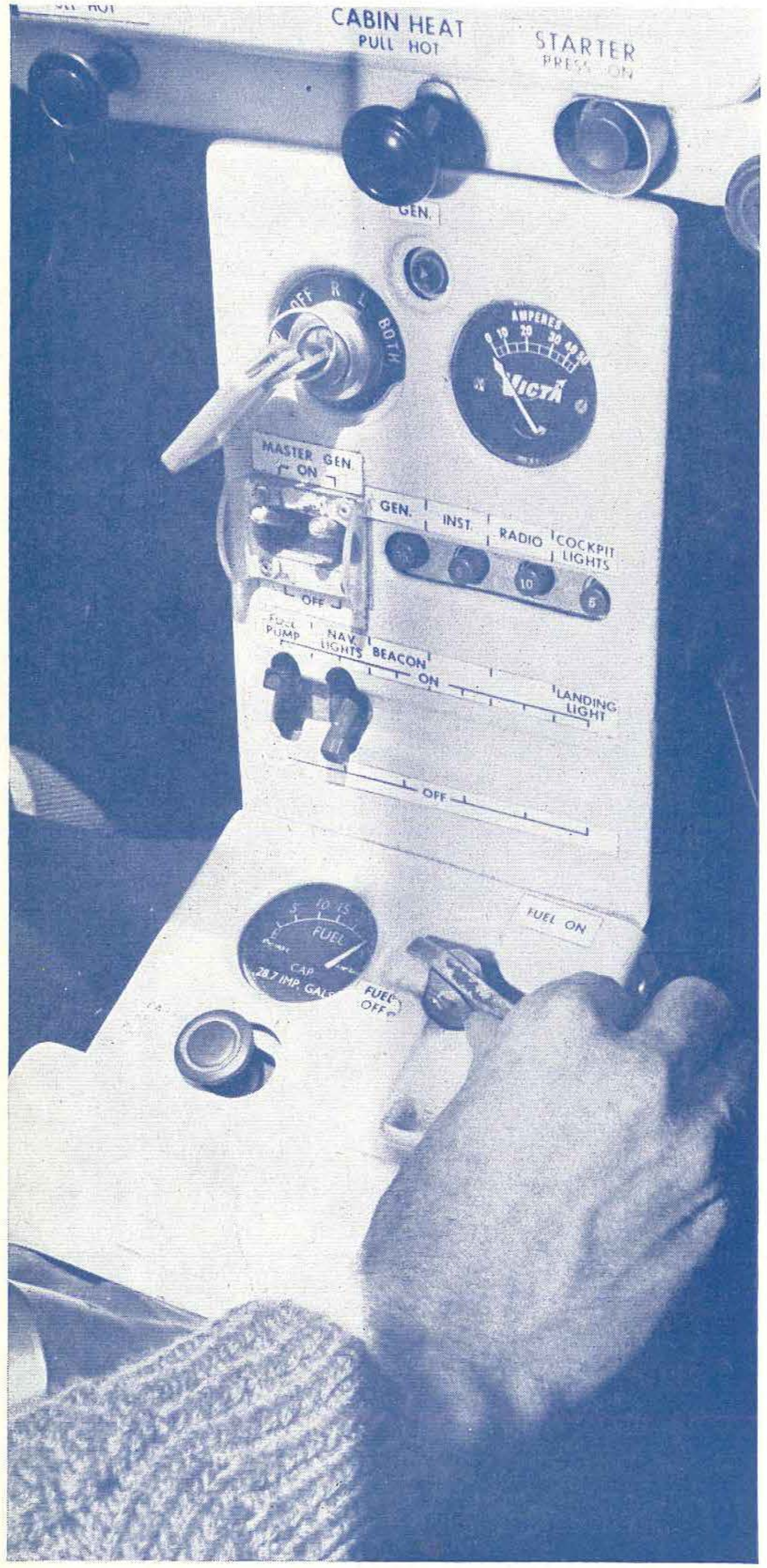
Inspection of the aircraft's rudder controls revealed that one of the rudder cable turnbuckles under the fuselage floor had not been lock-wired at a previous inspection. As a result it had gradually worked loose and finally separated. Further investigation established that 72 flying hours previously, the rudder pedal assembly had been removed from the aircraft for repair. To achieve this the turnbuckles in the rear of the fuselage were disconnected, as were all connections to the rudder bar assembly. This dismantling was recorded on work sheets. When the work was completed the required duplicate inspections were carried out independently by engineers licensed on the aircraft type, who checked all the items listed on the work sheets. No defects were found and the aircraft was signed out as serviceable.

In retrospect, it is evident that the locking wire on the turnbuckle that separated was also removed during the dismantling process, but this fact was not recorded on the work sheet. As a result this section of the control cable run was not checked by the engineers who carried out the duplicate inspection.

It was not possible to determine who was responsible for removing the locking wire without recording the fact. The engineers who made the duplicate inspections certainly did so adequately on all sections of the control run that they believed were affected, but in not checking the integrity of the whole control run, they must be held partly responsible for the control failure.

As a result of this incident, the operator has stipulated that any work performed on a primary flight control system will first of all be recorded as a defect on the operator's work sheets or, if being performed in the field, on the aircraft's maintenance release. The entry will be specific as to the exact location of the interference or disconnection to be made to the control run. As well, the engineers or pilots responsible for performing the duplicate inspection at the completion of the work will inspect the whole control run for security and correct locking, and not merely the section of the controls that has been disturbed. →

Airline workshop recording procedures leave NOTHING to chance. Light aircraft authorized workshops require no less a standard.



Rule-of-Thumb Cockpit Checks

WHILE taking off from Runway 24 at Jandakot Airport, Western Australia, the engine of a Victa Airtourer suddenly lost power at a height of about 200 feet. The pilot quickly completed a trouble check, but the engine did not respond and he was committed to a forced landing. The only suitable area within gliding distance was the over-run of Runway 30, and the pilot headed towards it, turning off the switches as the aircraft descended. The aircraft struck the ground heavily just to the right of the over-run, rolling the port main tyre off its rim but sustained no other damage. Neither the pilot nor the passenger was injured.

During the investigation of the incident, it was found that the owner of the aircraft normally left the fuel cock in the "on" position at all times. It is evident that the pilot flying the aircraft on this occasion, not being familiar with the owner's practice, had mistakenly turned the fuel cock to the "off" position during his pre-start checks, believing that he was turning it "on". It was also found that the fuel cock itself was defective and that this had the effect of concealing the pilot's error until the aircraft was airborne.

Because of a deteriorated moulded rubber seat in the fuel cock, sufficient fuel was able to flow through the cock in the "off" position to run the engine at low and medium power. It was only when full power was applied and sustained during the take-off that the engine lost power from fuel starvation.

The incident provides another lesson on the importance of being properly "tuned-in" when carrying out cockpit checks. Seldom these days do pilots actually forget their cockpit checks, but it is all to easy to complete a check in a purely mechanical way without actually thinking what one is doing. And even if one is thinking, it takes only a momentary lapse in concentration to miss a vital check as this pilot did. Both he and his passenger can consider themselves fortunate to have emerged unscathed from their experience.

SPECTACULAR FINALE ?

In these circumstances it might well be!

The thrill of low level aerobatics (particularly in front of an admiring audience) has been the downfall of many a seasoned and capable pilot.

It is just for this reason that ANR 131 (3) exists!

THOSE THAT DISREGARD THIS COMMON-SENSE REGULATION ARE USUALLY TEMPORARY AUSTRALIANS!