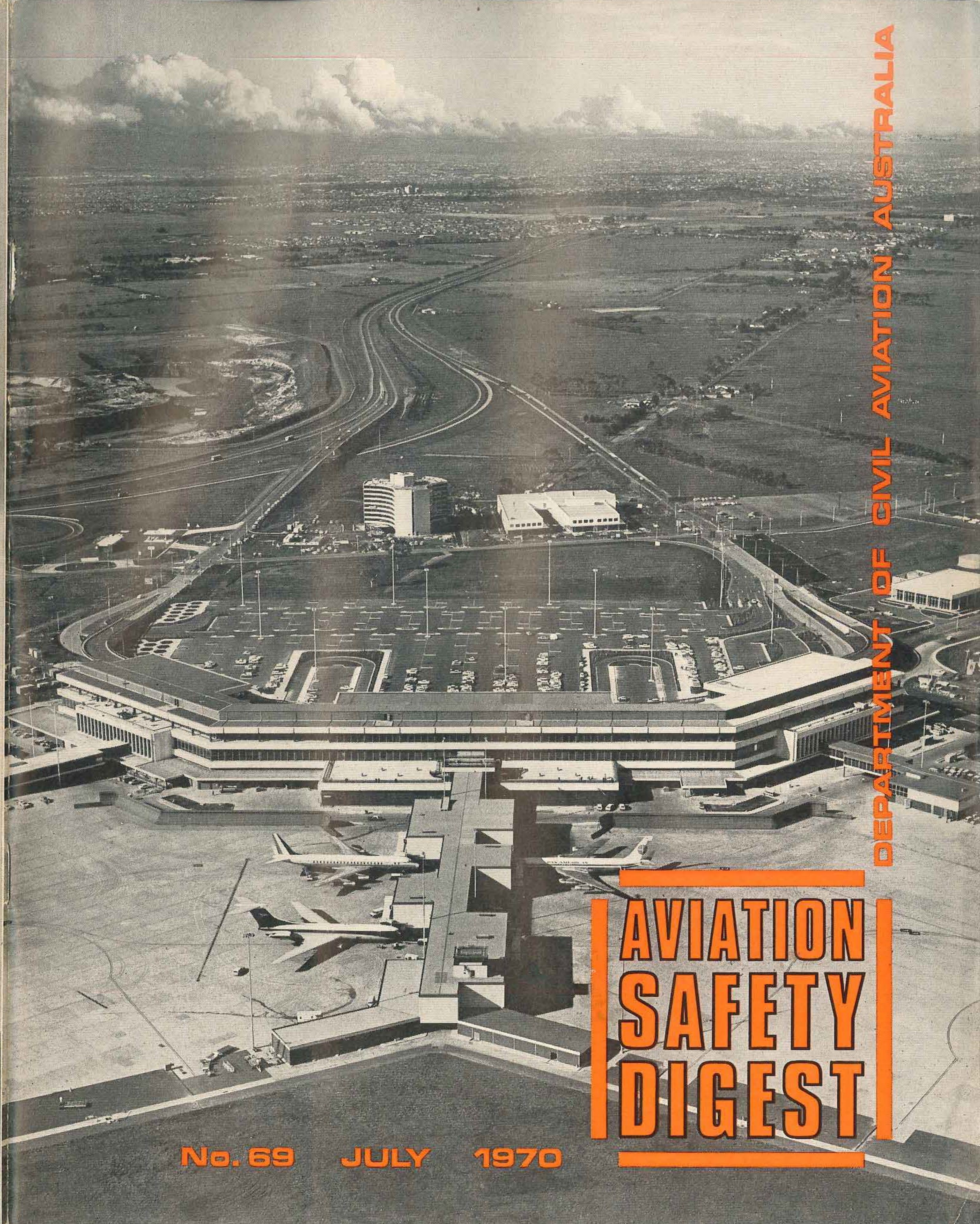

DEPARTMENT OF CIVIL AVIATION AUSTRALIA

AVIATION SAFETY DIGEST

No. 69 JULY 1970

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DEPARTMENT OF CIVIL AVIATION, AUSTRALIA

Contents

FRONT COVER: With the freeway linking it to the city and suburbs in the background, the terminal building and apron of Melbourne's new International Airport forms a striking pattern as seen from the air shortly after the official opening ceremony on the first day of this month.

BACK COVER: A VC-10 climbs away after taking off from Melbourne Airport's runway 34. The control tower is situated away from the terminal area on the far side of the airport.

—DCA PHOTOGRAPHS BY T. MARTIN

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FATAL SEQUEL

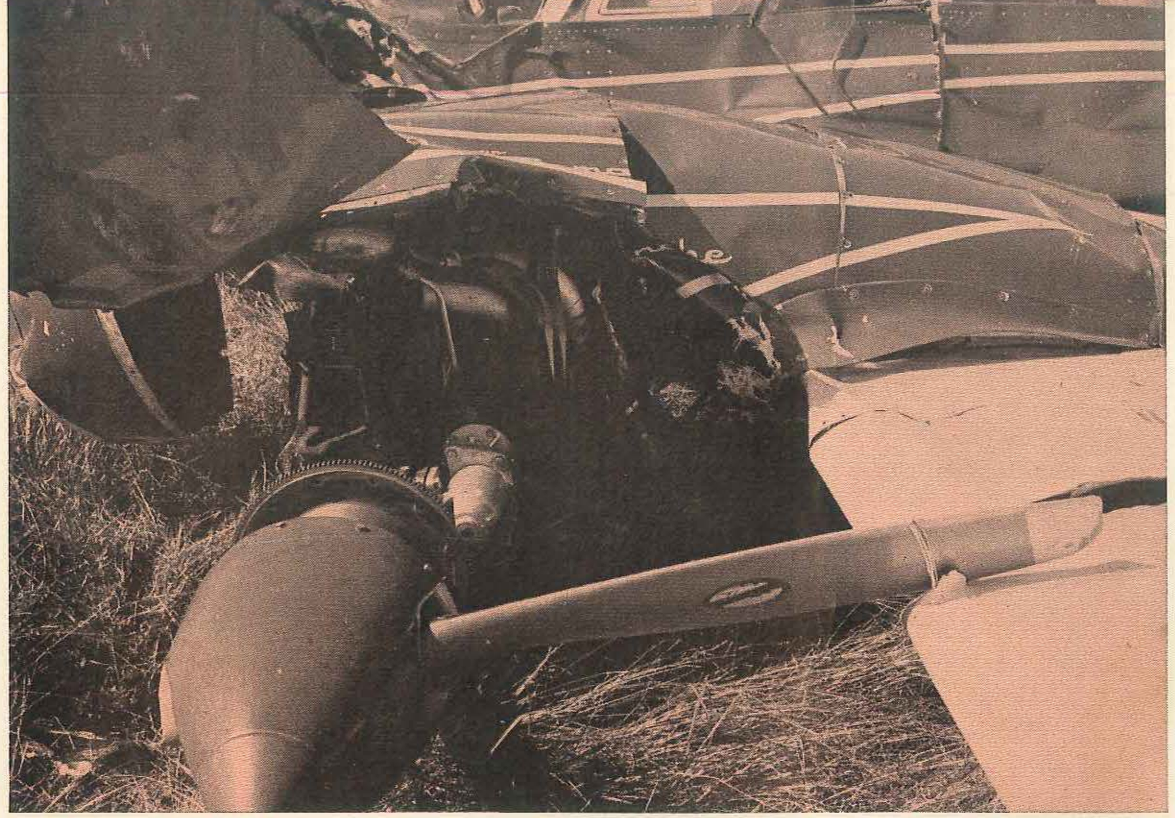
to loss of propeller blade

Seventeen minutes after a Piper Twin Comanche had departed from Dubbo N.S.W., on a positioning flight, the pilot was heard to transmit a series of three MAYDAY calls in quick succession. The calls did not indicate the nature of the distress.

At about the same time, the attention of a grazier and a housewife, located on different properties close to the aircraft's track, was attracted by an unusual banging noise which persisted for about three seconds. Looking up, they each saw the aircraft descending vertically in a flat spin. The spin appeared to continue unchecked until the aircraft passed from their sight behind trees.

The wreckage of the aircraft was subsequently found lying in open country close to the intended track, some 50 miles from Dubbo. The pilot, who was the sole occupant, had been killed.

Before departing from Dubbo, the pilot had submitted by telephone to the Dubbo Flight Service Unit details of his proposed flight. The flight was to be made to Tottenham, 63 miles west of Dubbo, to pick up an injured man and convey him to Dubbo for medical attention. The flight was to be conducted below 5000 feet in both directions and the estimated time intervals were 25 minutes each way. The aircraft took off normally and reported its departure at 1335 hours. Nothing more was heard from the aircraft until just after 1352 hours when the pilot transmitted the first of his three MAYDAY calls, the second and third following at intervals of five and nine seconds respectively. Apart from being received by the Dubbo Flight Service Unit, the calls were heard by a number of aircraft operating in the area. All these subsequently confirmed that the MAYDAY calls



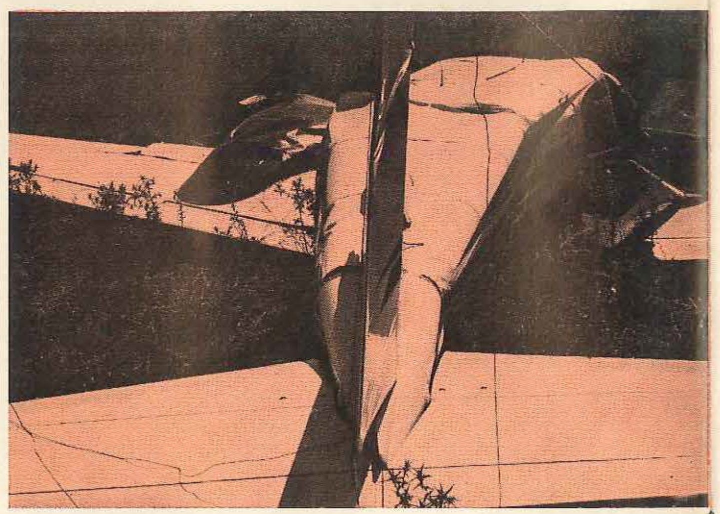
Above: The port engine, partially dislodged from its mountings, as it was found at the accident site. The intact propeller blade has cut through the upper and lower wing leading edge skins almost back to the main spar.

Right: Rear view of the wreckage as it came to rest. Distortion of the fuselage and impact marks indicated that the aircraft struck the ground in a fully-developed flat spin to the left.

were the only transmissions made and that none of them had indicated the nature of the aircraft's distress.

Immediately the MAYDAY calls were received at Dubbo, the Distress Phase of Search and Rescue was declared and emergency procedures were instituted. Calls were made to the Police and to the Narromine Airport Fire Service to pass details of the emergency and to advise that the aircraft's estimated position was in the vicinity of Dandaloo, 50 miles west of Dubbo and 30 miles from Narromine. Other Police Stations in the area were contacted and telephone calls were made to properties in the Dandaloo area. Meanwhile, the Narromine Airport Fire Service despatched a fire tender to the Dandaloo area to await further instructions.

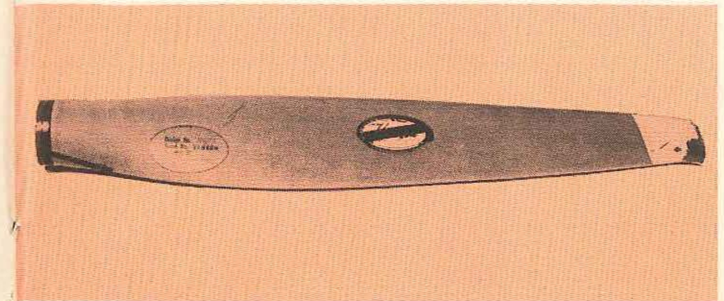
Within half an hour of the MAYDAY calls being received, an aircraft was despatched from Dubbo to search the Dandaloo Area. Shortly after it had departed, a report was received at the Dubbo Flight Service Unit that the crashed aircraft had been found on a property 10 miles east of the township. The search aircraft was advised and



some 15 minutes later, it reported sighting the wreckage and confirmed its position.

* * *

The site of the crash was in a large level paddock overgrown with thistles, nine miles east of the township of Dandaloo and four miles south of the aircraft's planned track. The disposition of the wreckage clearly indicated that at the time of impact, the aircraft was spinning to the left in a flat attitude with a high vertical rate of descent and almost no forward motion.

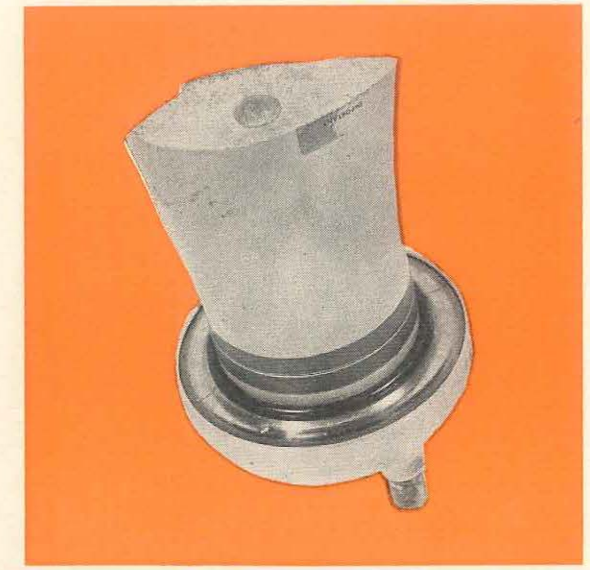


Intact blade of the port side propeller after removal from the wreckage for examination.

Apart from the damage which had obviously resulted from the impact with the ground, the most significant findings made when the wreckage was first examined were that one blade of the port propeller was missing and the port engine had been grossly displaced from its normal position. Ground impact marks and the nature of the damage to the port engine cowlings clearly showed that this damage had occurred before the aircraft struck the ground. The port engine, though still attached to the firewall by the broken and distorted engine mounting, was in an inverted position with the propeller spinner pointing outboard and its axis of rotation parallel with the leading edge of the wing. The remaining port propeller blade was embedded in the surface of the wing.

It was clear from the wreckage examination that one blade of the port propeller had failed in flight, close to its root end. The failure had resulted from normal operating loads applied to the blade after its strength had been greatly reduced by a fatigue crack extending over approximately 75 per cent of the cross sectional area of the blade-root. A strip examination of both engines and propellers disclosed no defect which would have prevented them from operating normally or have resulted in any unusual vibration, and the history of the failed propeller contained no record of any previous damage.

There was no evidence that the detached blade had struck any part of the structure of the aircraft, but the sudden detachment of almost the whole of one blade would have produced an out-of-balance load greatly exceeding the design strength of the engine mounting. A structural failure of some sort would thus have been almost inevitable before the engine could be shut down. Even if the pilot had been able to shut down the engine immediately, it would have still continued to produce very large out-of-balance forces while it was decelerating. The evidence indicated that the propeller had failed while the aircraft was cruising at about 155 knots at a height of about 4,500 feet



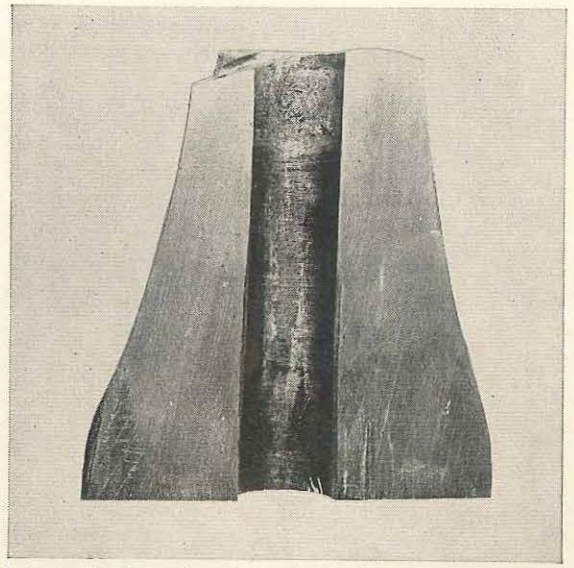
The failed propeller blade, with end of lead "wool" balance weight visible in the centre of the fracture surface. Fatigue cracks which led to the ultimate failure of the blade originated in corrosion pits in the walls of the balance weight hole.

and the investigation next considered the effect that the failure and subsequent displacement of the engine would have had on the controllability of the aircraft.

The Twin Comanche's V_{mc} at sea level conditions is 80 knots I.A.S. and at 4,500 feet would be somewhat less because of the reduction in power output with altitude. Calculations to determine the aerodynamic effect of the displacement of the engine showed that the theoretical effect of a simple increase in drag equivalent to that produced by the displaced engine would be to raise the aircraft's V_{mc} by only six knots at sea level. There would be a similar increase at 4,500 feet. These calculations could not however take into consideration the rolling and yawing moments which might have developed from any disturbance to the airflow over the port wing, and the movement of the centre of gravity which would have resulted from the displacement of the engine. It was not possible to determine the actual effect of the engine displacement on the overall aerodynamics of the aircraft.

Similarly, it was not possible to reconstruct the pilot's actions and the sequence of events after the failure of the propeller, but in the circumstances it is hardly surprising that control of the aircraft was lost.

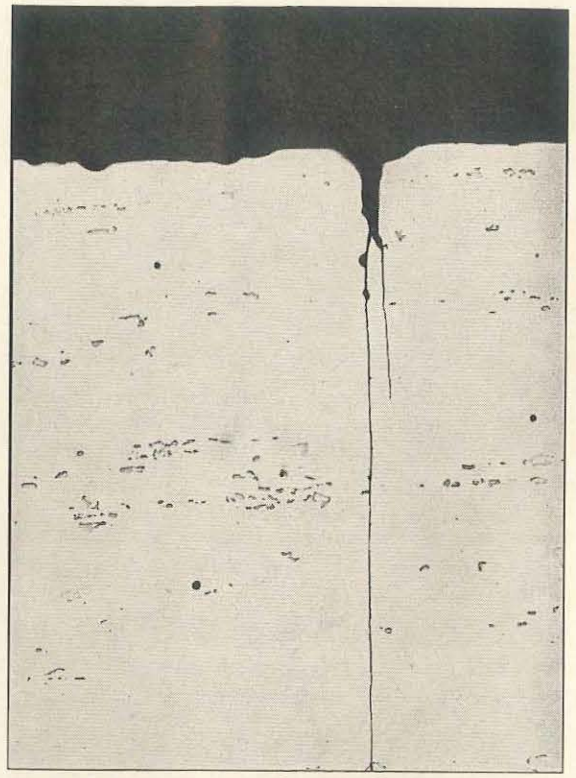
The detached portion of the failed propeller blade was not recovered until several months after the accident, but an examination of the



Longitudinal section through the balance weight hole of the failed blade. Note the white streaks of corrosion product and the dark coloured, corroded sides of the hole.

remaining root end by the Aeronautical Research Laboratories in Melbourne disclosed that the fatigue crack ultimately responsible for the failure had initiated internally at a corrosion pit in the bore of the balance weight hole, the sides of which were badly corroded. Corrosion products were found in the balance weight hole of the failed blade and on the lead "wool" balance weight itself. Although the hole had been closed by a tight fitting plug, it was evident that water had been present in the hole for a long period. The material from which the failed blade was made met the appropriate specifications and no casting defects were found in it.

The section of the propeller blade where the failure occurred is normally subject to comparatively low stresses, and the small cross-sectional area remaining before the final failure indicated that no abnormal stress condition had existed. Other small fatigue cracks discovered in the bore of the balance weight hole were also found to have originated from corrosion pits, but none had developed in uncorroded areas. It was thus apparent that the presence of corrosion was the primary cause of the development of the fatigue cracking and probably contributed to a rapid crack propagation. It was not possible to determine the absolute rate of propagation of the crack, but this would probably have been very rapid once the crack extended to the outer surface of the propeller blade. It seems most unlikely that the crack would have been detectable during a pilot's pre-flight inspection.



Another section through the balance weight hole and fracture surface, magnified 200 times, showing a large crack and corrosion pits in the walls of the hole.

From the overall investigation, the sequence of events that led to the accident thus emerged. At some time during the history of the propeller, moisture evidently became trapped in the balance weight hole of one blade. Corrosion developed as a result, causing pitting of the surface of the balance weight hole. From one such corrosion pit a fatigue crack developed which ultimately progressed to the point where the blade failed under normal operating loads. The resulting out-of-balance condition of the propeller dislodged the engine from its mountings and the pilot was unable to maintain effective control of the aircraft.

As a result of this accident, an Airworthiness Directive* was issued by the Department requiring certain propellers of this type to be dismantled and the blades inspected for signs of corrosion in the balance weight hole. Any blade in which evidence of corrosion is found within the lower inch and a half of the balance weight hole is to be retired immediately. To date four such propeller blades have been found to be affected by corrosion in this way and have been withdrawn from service.

* See Airworthiness Directive DCA/PHZL/27

HS.125 DESTROYED

during training flight

(Summary of Report issued by Board of Trade, United Kingdom)

Shortly after a HS. 125 had taken-off from Luton Airport, U.K. in the course of a night training exercise, the engine noise ceased. The aircraft was seen descending in a level attitude and, after it had disappeared from view, witnessess heard engine power being applied, but almost immediately there was the flash of an explosion as the aircraft crashed through the roof of a factory. An intense fire followed and both occupants of the aircraft were killed.

The night flying exercise was being conducted to complete the conversion training of one of the pilots to the aircraft type. The trainee occupied the left hand seat and a training captain was in the right hand seat.

In requesting a clearance for the take-off on which the accident occurred, the training captain informed the tower that the next exercise was to be an engine failure after take-off, followed by an asymmetric approach, a touch and go landing and then a single engine landing. It was dark at the time and there was intermittent light rain with three-eighths of cloud at 1,400 feet and five-eighths at 2,000 feet. The surface wind was blowing from 230 degrees at 20 knots.

The aircraft took-off from Luton's Runway 26 which is nearly 8,000 feet in length. The high intensity runway lighting was switched on and the take-off was made towards the lights of the town of Luton. Witnesses on the ground saw the aircraft become airborne and make a steep, though normal, climb to a height of about 300 feet. At this point the engine noise ceased as though both engines had failed or the power had been reduced by retarding both thrust levers. After maintaining level flight for two or three seconds, the aircraft began to descend, still in a level attitude, until it disappeared from view into a valley to the west of the aerodrome. The witnesses then heard the noise of engine power being applied and almost immediately saw the flash of the explosion.

Units of the airport's fire and rescue services were immediately dispatched to the scene of the crash, which was found to be in a motor car factory in the town. The aircraft was completely destroyed and considerable damage was done to the factory building and machinery before the fire could be extinguished.

Inspection of the scene of the accident showed that the aircraft had first struck the roof of the factory building with its starboard wing tip and had then turned through about 90 degrees, coming to rest in an upright attitude in the roof structure. The point of impact was 1,020 feet to the right of the extended centre line of runway 26 and 2,700 feet from its western end. The ground at this point is about 100 feet below the runway height. After a preliminary inspection at the site of the crash, the wreckage was removed to a hangar where a detailed examination was undertaken.

It was found that at impact the undercarriage was locked up, the flaps were up, the air brakes were in and the aircraft was trimmed normally. The intensity of the fire had destroyed most of the flight deck, but no evidence was found of any pre-crash defect or failure. Examination of the fuel system showed that the tanks were intact and no obstruction was found in the remaining fuel feed pipes. The port engine High Pressure Cock, with its associated hydraulic shut-off valve, and the Low Pressure Cock and thrust lever were open. The HP cock and shut-off valves for the starboard engine were closed, as was the thrust lever, while the LP cock for this engine was 90 per cent open. Because of impact and fire damage however, the position of these controls and valves could not be accepted as reliable evidence.

Examination of the engines, both of which were extensively damaged by fire, showed that although both were rotating at impact, the port engine was running at higher power than the starboard. There was no evidence of bird ingestion or any pre-impact failure in either engine. Weather conditions at the time were not conducive to engine icing and there had been no reports of icing conditions in the vicinity of the airport on the day of the accident.

The aircraft was fitted with a flight data recorder and the record medium was recovered undamaged. All flight parameters had been recorded throughout the flight and showed that the aircraft had become airborne after a take-off run of 22 seconds, and that shortly after becoming airborne, it reached a speed of 156 knots. In the next 12 seconds the aircraft climbed to 360 feet above the runway and the speed fell to 120 knots. This height and speed was maintained for about four seconds, when a slow descent began, with the speed reducing to 117 knots, which was the aircraft's take-off safety speed. After remaining at this figure for a further 16 seconds, the speed and height rapidly decreased as the aircraft stalled.

Flight tests were carried out in another HS.125 to establish the length of time that electrical power would be available to the flight recorder after shutting down the engines. When either the HP or LP cocks were closed at 120 knots with the thrust lever open, the generator was found to go off the line after an average lapse of seven seconds.

Further tests established that average time for the engine RPM to decay to windmilling speed after closure of the HP and LP cocks was 23 seconds. Similarly, it was found that it took an average time of 22 seconds to start a windmilling engine in flight and achieve full power. Tests were also carried out to determine the behaviour of the engines with the LP cock partially closed. It was found that an engine could be "throttled" to approximately 75 per cent of its maximum RPM by partially closing the LP cock but that it would not run smoothly at any lower power if the cock were closed further. It was also found that any movement of the HP cock towards the closed position immediately shut down the engine.

Before the accident, there had been a few reports of compressor stalls having occurred in this type of engine during landing approaches. The possibility of this having occurred on the flight in question was therefore investigated. Tests showed that slow movement of the thrust lever within a critical engine RPM range (75 to 77 per cent) could, on occasions, result in instability in the blow-off valve system and cause compressor stalling which could in turn, result in a flame-out. Conversely, rapid movement of the thrust lever did not produce such instability or compressor stalling. The air/fuel ratio control unit is normally in command when either engine is accelerated from flight idle or intermediate speeds by rapid thrust lever movement, but as functional tests of these units were not possible because of damage, it could not be established whether calibration discrepancies were present which could have caused compressor stalling.

From energy calculations and other evidence, it was clear that both engines of the aircraft were operating at full power immediately after the aircraft became airborne. Although the possibility cannot be dismissed that either thrust lever was manipulated within the critical engine speed range after the aircraft left the ground, this was considered unlikely. In addition, the performance of the engine during previous flights on the day of the accident had not caused concern and the post-accident examination did not reveal the characteristic evidence of turbine overheating which could have been expected if compressor stalling had occurred.

The information obtained from the flight data recorder was used to prepare a graph of total energy against time, which showed how the thrust of the engines varied during the flight. Up to a little more than 25 seconds after the start of take-off, the thrust was normal with both engines working, but from that point onwards the thrust was very small, approximately the equivalent of one engine idling, and the aircraft then lost speed and height until it crashed. There was no sign on the graph of any restoration of power.

The training procedure employed by the operator stipulated that when engine failures are simulated during circuit training, the thrust lever of the appropriate engine should be closed to flight idle, but the engine should not be shut down. The training captain had followed this procedure during previous instruction he had given in asymmetric flying and there was evidence that the pilot undergoing training was aware of this procedure.

* * *

The fact that the flight recorder had continued to work for the whole of the flight was considered important evidence in that it indicated that at least one engine was running throughout the flight sequence at a speed sufficient to maintain the generator on the bus bar. From the tests carried out, it could be assumed that this engine would have been capable of fully responding to thrust lever movement.

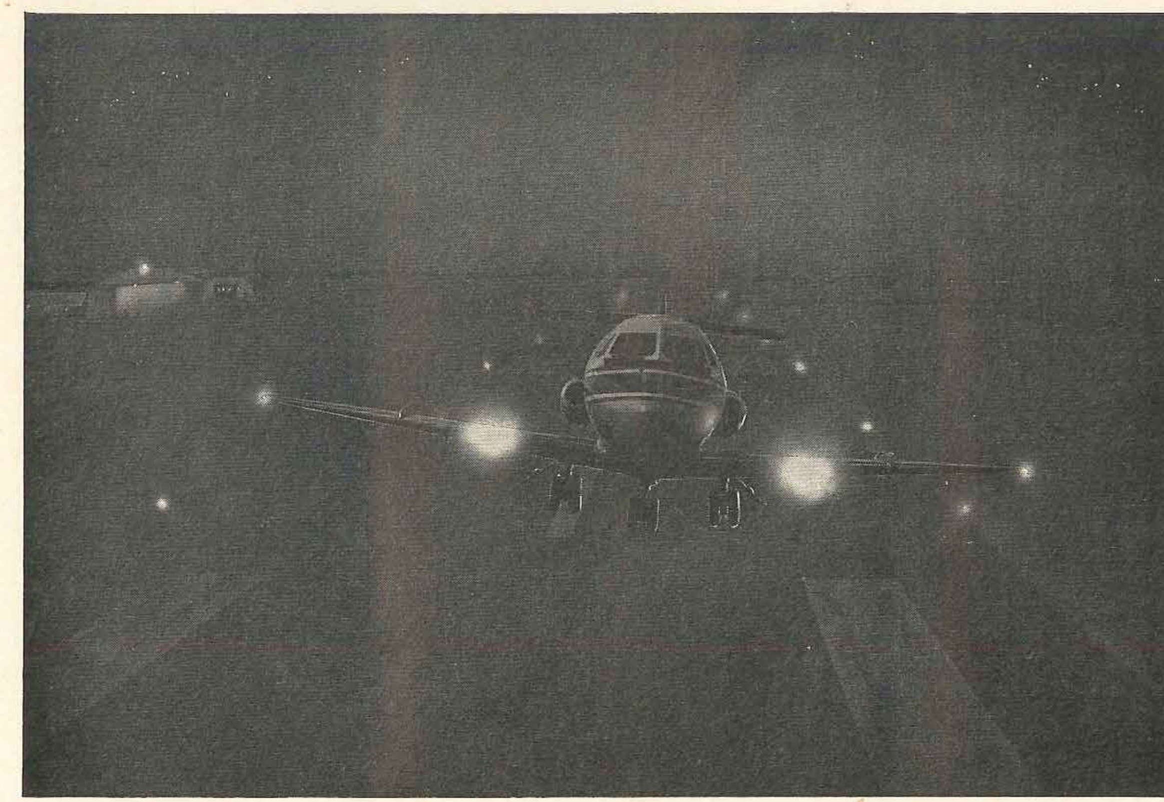
At some stage during the take-off, one of the thrust levers would have been closed to simulate an engine failure, and in the absence of evidence to account for the reduction in power of the other engine, a number of possibilities were considered. The most likely explanation is that, immediately following the closure of one thrust lever to simulate an engine failure, the other engine was inadvertently or mistakenly shut down, or lost power for some reason not determined. However, as the reduction in power of the engines occurred almost simultaneously, it is unlikely that one was deliberately shut down because of indications of a failure.

Whatever occurred, it seems that after the loss of power from the second engine, there was a delay of approximately 25 seconds before the pilot realised that the engine with the thrust lever open (i.e. the "good" engine) was not producing power. This may appear to be a long period of time, but during training exercises of this nature, confusion can arise in the unlikely event of another failure, or mishandling, because the training captain is pre-conditioned on the action he expects to see carried out.

On this occasion the flight recorder shows that rotation during the take-off was late, and very shortly after becoming airborne and at about the time the power of the engines was reduced, the aircraft had reached a speed of 156 knots (i.e. V_2 + 39 knots). This comparatively high speed enabled the aircraft to climb to 360 feet in 12 seconds, an average rate of climb of 1,800 feet per minute, by which time the speed had eroded to, and was then stabilised near, the correct take-off safety speed of 117 knots. During this exercise, the pilots would have expected a loss of performance but it is possible that the high speed and rate of climb masked the situation so that it was not at once appreciated that power was reduced on both engines. From the top of the climb only 13 seconds remained before the onset of the stall. Thus, even a small delay, resulting from some distraction or confusion, could have been sufficient to delay the application of power, which as the evidence shows, came too late to prevent the crash.

Cause

The accident was caused by an almost total reduction of engine power, which was not restored in time to prevent loss of control. The reason for this has not been determined.



HELICOPTER PILOTS . . . could you cope with a tail rotor failure?

TAIL rotor failures have been responsible for many helicopter accidents, some of them fatal, others with consequences little more dire than an autorotational landing. Possibly the most serious accident of this type in Australia occurred over Circular Quay in Sydney several years ago (See Aviation Safety Digest No. 53), killing all three occupants and demolishing the roof of a city building.

Frequently the outcome of a tail rotor failure depends entirely on the immediate reaction of the pilot to the situation. This article, which has been adapted from one published recently in the Bell Helicopter Company's News sheet, "Rotor Breeze", stresses the importance of reacting correctly to an in-flight failure of the anti-torque system of a helicopter and discusses the procedures that must be followed if the helicopter is to be landed safely.

Though other types of anti-torque system failures can occur, it is the two most severe in-flight occurrences, loss of drive to the tail rotor, and loss of tail rotor components, which are of primary concern and which require the most rapid detection and corrective action if the situation is to be saved. In both cases corrective action must be very rapid indeed if an immediate and total loss of control is not to occur. Pilots should therefore make it a cardinal rule, for any occasion on which an anti-torque failure is suspected, to immediately reduce power until the type of failure can be determined. An airspeed which will provide the best possible directional control in the circumstances must also be maintained. This best airspeed will vary with different types of helicopters, but, for Bell helicopters, will usually be between 52 and 60 knots. With these two very important and basic rules in mind, let us now consider the symptoms of each type of failure and the corrective action to be taken in different phases of flight.

* * *

LOSS OF DRIVE TO THE TAIL ROTOR

When this occurs, rotation of the nose to the right and an accompanying nose-down attitude can be expected. Airspeed, cabin-loading, centre of gravity, power being used, wind conditions and density altitude will all affect the intensity or severity of the helicopter's initial reaction to the failure.

LOSS OF TAIL ROTOR COMPONENTS

This is the most severe type of tail rotor failure. Helicopter reactions are similar to those experienced with loss of drive to the tail rotor but will be more precipitous. The nose will pitch down and to the right as a result of the change in centre of gravity and torque effect.

CORRECTIVE ACTION FOR BOTH TYPES OF FAILURE

Immediately cut the power, i.e. reduce both collective pitch and throttle to near minimum positions. DO NOT SHUT OFF ENGINE at this stage unless a landing is imminent with no time or altitude to attempt a partial recovery. Immediately establish a glide speed slightly in excess of the normal autorotational approach speed for the helicopter type (This of course does not apply to failure during low altitude hover).

If altitude permits, with airspeed of about 60 knots, a gentle application of throttle and pitch may be attempted to determine if some degree of powered flight can be resumed. But if any adverse yawing is experienced, autorotation must be resumed and the descent continued to a landing. Shut off the engine once committed to a landing to minimize the fire hazard on touchdown.

PROCEDURES IN PARTICULAR FLIGHT SITUATIONS

Hovering. Cut the power immediately and make a hovering autorotational landing. A slight rotation can be expected on touchdown.

Climb. Cut the power, lower collective pitch immediately and establish a gliding speed slightly in excess of the normal autorotation approach speed. If a turn is required, make it to the right as power from the engine is available for a right turn. Once lined up for landing, this heading should be maintained in the following manner:

If the helicopter is turning right with power off, "pulsing" the collective pitch may help to keep it straight. ("Pulsing" means moving the collective pitch lever rapidly up and down. This technique should not be used at low altitudes and at no time should the rotor RPM be allowed to decay below minimum limits in the pulse.)

If the helicopter is turning left with power off, a slight addition of power should arrest the turn. A further increase in power will result in a further right turn response. Because the helicopter will be very responsive to any increase in power, extreme care must be taken in its application.

Level Flight Cruise Or Power Dive. Cut the throttle and reduce collective pitch immediately. Attain an airspeed slightly above the normal autorotative gliding speed. If altitude permits, a right or left turn may be accomplished as already described.

Descent (Low Power Or Power Off). If the throttle is not off at the time of the failure, it should be taken off. The descent should then be continued as described above.

Zero Ground Speed Landings. You may find yourself in a situation in which it is necessary for the landing to be made at zero ground speed. If this is the case, follow the appropriate techniques already described, but make the flare steeper and the collective control input more abrupt. Because the flare will be steeper, it will be necessary to spill the flare so as to land as near level as possible. Both the flare and collective input should be executed as close to the ground as possible. The tail boom clearance during the flare should be the limiting factor, but remember to put it as close to the ground as possible — the one thing you don't have to worry about at such a time is a tail rotor strike! Both the steep flare and the abrupt use of collective will accelerate the nose in a turn to the left, so the quicker the helicopter can be placed on the ground, the less this rate of turn will be. DON'T TRY TO CORRECT THIS TURN WITH THROTTLE. A power application is too sensitive an input, with too rapid a response, for a pilot to manage properly at this stage of the flight.

BASIC RULES TO REMEMBER

- Cut the power immediately an emergency develops.
- Hold the airspeed slightly above the normal autorotational speed.
- The nose will pitch down as a result of the change in centre of gravity that occurs when tail rotor components are lost. But provided the helicopter is loaded within limits, ample aft cyclic control should be available to arrest this nose-down pitching.
- Collective "pulses" during autorotational descent may help to bring the nose to the left, but should be applied rapidly and with caution.
- Slight power increases help swing the nose to the right. THIS IS A VERY RESPONSIVE CONTROL INPUT, SO USE IT WITH EXTREME CARE.
- Shut the engine off prior to landing.

REPEAT THESE BASIC RULES TO YOURSELF, AND READ AND REREAD THESE INSTRUCTIONS UNTIL THEY WILL COME INSTINCTIVELY TO MIND IN THE EVENT OF AN EMERGENCY.

WHAT CAN HAPPEN IF THE RECOMMENDED PROCEDURES ARE NOT FOLLOWED

- If power is not reduced immediately the emergency develops, the helicopter can exceed safe slip angles and may rotate so that it will be in rearward flight at a high speed, from which a recovery may be impossible.
- The use of power during the final stages of a landing can result in over-controlling and spoil what might have been a successful landing.
- The use of power to reduce the rate of descent on landing will tend to rotate the fuselage, rather than the rotor, and this can cause the pilot to become disoriented, experience vertigo, and crash the helicopter. Some pilots have the incorrect idea that it is safe to reduce the horizontal velocity while still relatively high (i.e. more than 3 to 5 feet) above the ground and then apply power to reduce the rate of descent. This is not so and such a landing technique should not be attempted.

OTHER TYPES OF FAILURE

Let us now consider the two other types of anti-torque system failures in helicopters, locked control pedals and failure of the anti-torque system control linkage. With failures of this sort, although rapid action by the pilot is still required, there is not usually the degree of urgency demanded by the more serious failures already discussed. It is not usually necessary to cut the power and landings can be made with controlled power. The recommended techniques for accomplishing safe landings in such situations are discussed under their appropriate headings. As before, the speeds quoted are those applicable to Bell helicopters.

LOCKED CONTROL PEDALS: This type of failure is caused by jamming of the anti-torque control linkage in the pitch change mechanism of the tail rotor. In general, the following precautions should be observed in any situation in which the control pedals become locked while in forward flight:

- An airspeed of about 57 knots should be maintained to help stabilize the helicopter in flight while a suitable landing area is selected.

- The landing area should be level, smooth, and preferably hard-surfaced.
- The landing approach angle should be shallow.
- The landing should be made into wind.

Right Pedal Forward of Neutral

In this situation, power should be reduced to maintain engine RPM within upper half of green arc, which will assist in stabilising the helicopter in flight. A shallow to normal landing approach should be made, maintaining the same RPM, at an airspeed of about 52 knots. At 50 to 75 feet above the ground, a slow deceleration should be commenced, aiming to arrive at the intended touch-down point at about 30 knots. When about three feet from the ground, slowly reduce power to compensate for the yawing effect and allow the helicopter to settle. Ensure that the helicopter is aligned with the landing strip at touch down and once on the ground use collective pitch and throttle as necessary to keep it straight and reduce the ground roll. If the helicopter begins to swing off heading during the ground roll, position the cyclic as necessary to follow the movement until the helicopter comes to a stop.

Left Pedal Forward of Neutral

Reduce power and maintain engine RPM within the green arc. Normal turns can be safely maintained under these conditions, although the helicopter's nose may be displaced to the left, depending on how far the left pedal is forward. Maintain about 52 knots during the initial part of the landing approach. About a third of the way down the approach leg, reduce throttle to the minimum operating RPM and simultaneously begin a slow deceleration to arrive at a point about two feet above the intended touch-down area, as effective translational lift is lost. Collective pitch should then be applied, still maintaining minimum operating RPM to arrest the rate of descent and forward speed, and to align the helicopter with the intended landing area. If the helicopter is not aligned after the application of collective pitch, increase the power to assist the alignment. After touching down, keep the helicopter straight with throttle.

Pedals Locked In Neutral

Reduce power and maintain engine RPM within the green arc. Normal turns and flight can be safely maintained under these conditions. Execute a shallow approach, holding about 52 knots initially.

At a height of 50 to 75 feet, begin a slow deceleration to arrive at the intended landing point at about 30 knots. When about three feet above the ground, slowly increase or decrease throttle as necessary to maintain alignment with the landing area and overcome yaw. Allow the helicopter to settle until alignment is assured, then effect a touchdown. After the helicopter is on the ground, use collective pitch and throttle as before to reduce forward speed and to keep it straight. Position the cyclic as necessary to follow any tendency to turn until the helicopter has come to a complete stop.

Pedal Lock During Hover

If the pedals should lock in any normal position during a hover, a landing can be accomplished with greater safety under power than by cutting the throttle and autorotating. Some rotation of the helicopter can be expected during the descent and touchdown, depending on the position of the pedals when the locking occurs.

FAILURE OF THE CONTROL LINKAGE

With this type of failure, caused by a break in a control cable, a break in a control chain or failure of a push pull tube, the tail rotor will assume a blade angle as determined by the various dynamic and aerodynamic forces acting on the rotor. Corrective action, depending on the yaw change experienced, is the same as those described for locked control pedal situation. It is important to note that power should not be cut unless a severe right yaw occurs.

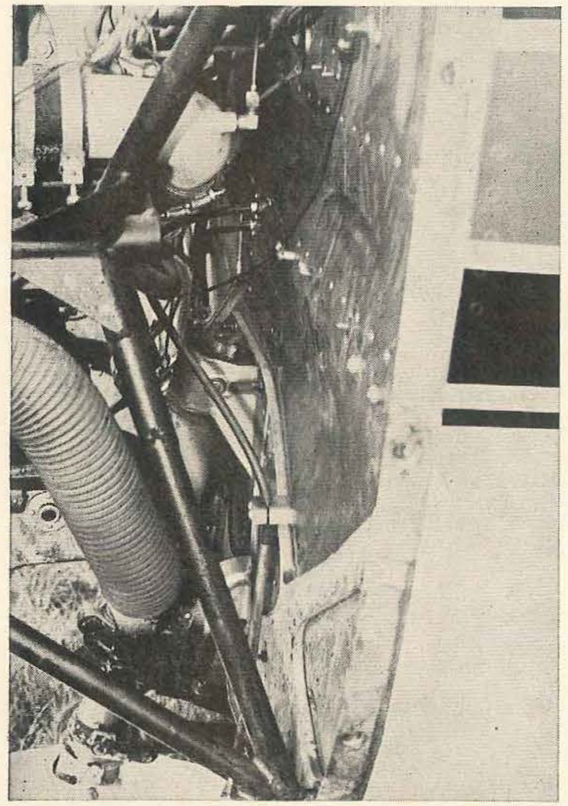
SUMMARY

The worst types of anti-torque failures, described in the first half of this article, place a helicopter in a very critical situation. The pilot's reaction to them must be immediate and correct if a catastrophe is to be averted. A thorough knowledge of the basic rules set out in this part of the article will go a long way towards making the correct response, should such an emergency occur.

The latter portion of the discussion considers the less critical types of anti-torque system failures. Although failures of this type can be handled while still maintaining sufficient power for flight, they must still be regarded as very delicate emergencies. But successful powered approaches to safe landings are possible if the techniques described are properly followed.

ELEVATOR CONTROLS DAMAGED IN TAKE-OFF ACCIDENT

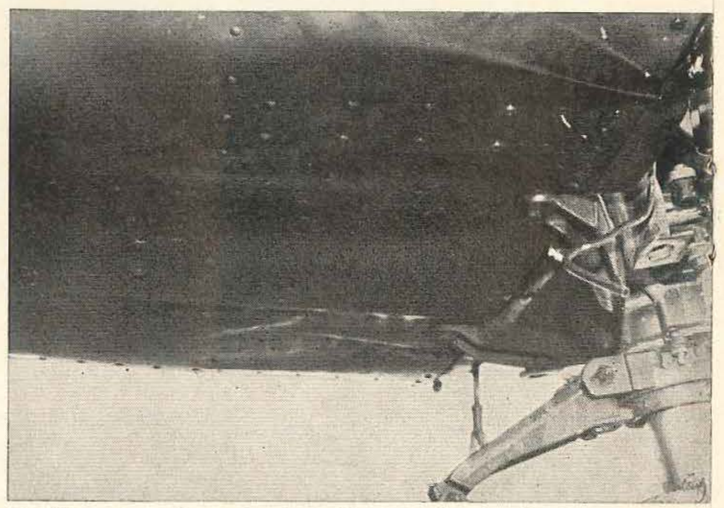
AT Minlaton on the Yorke Peninsula of South Australia, a commercial pilot had planned to conduct joy-riding operations in a Cessna 182 on the day of the local agricultural show. On the morning of the show, the pilot flew the aircraft to Minlaton and landed in a well-grassed paddock which he had inspected several days before and assessed as suitable. The paddock was level and, used diagonally, offered a take-off run of approximately 3,000 feet.



Deformation of the firewall, caused by the nose wheel striking a rock during take-off, is clearly visible with the engine cowlings removed.

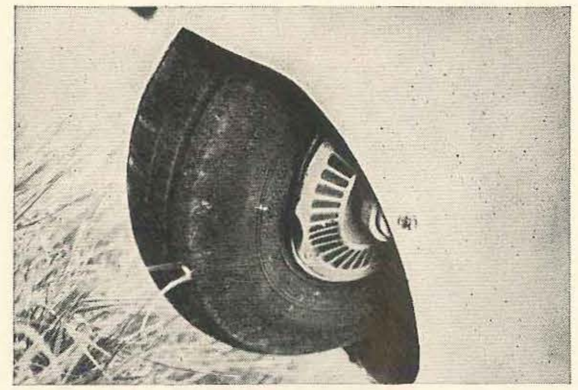
Before beginning his joy-riding operations, the pilot decided to take some friends for a brief flight around the town. The wind was calm, and with three passengers on board, the pilot began his take-off across the paddock in the direction of the longest run. But before he had time to advance the throttle fully, and when the aircraft had travelled only about 150 feet, the nosewheel collided heavily with an obstruction hidden in the grass.

The pilot closed the throttle and brought the aircraft to a stop. Shutting down the engine, he climbed out and inspected the nose wheel and oleo leg, and checked the engine cowlings. All appeared to be in order, so he boarded the aircraft and started the engine. After some further pre-take-off checks, but without again testing the movement of the flying controls, the pilot continued with the take-off.



Buckling of the lower fuselage skin immediately aft of the nosewheel strut.

Long grass in the paddock from which the aircraft was operating almost obscures the rock struck by the nose wheel.



The nose wheel raised clear of the ground to show the damaged rim.

The aircraft became airborne normally and the pilot climbed to 1,500 feet, but after levelling out at this altitude, he found there was an abnormal amount of free play in the elevator controls. Believing that he should land as soon as possible, the pilot selected another paddock and put the aircraft down safely.

Subsequent examination of the paddock from which the aircraft had taken off showed that the object struck by the aircraft was a mound of earth covering a limestone rock projecting some six inches above the ground. Amongst the grass in the paddock, which had grown to about the same height, the mound was almost impossible to see from more than 45 feet away. The nosewheel's impact with the mound had exposed a patch of limestone at the top of the mound which carried scars obviously left by the nosewheel's rim.

When the aircraft was inspected, it was found that the collision had forced the nose-leg rearwards slightly. This had distorted the lower section of the firewall and the underside of the adjacent fuselage, both of which support the elevator pulley cable attachments. As a result the elevator cables were slackened, producing an inch and a half of free play in the control column and five and a half inches of play at the trailing edge of the elevators. The rim of the nose-wheel was dented at one point and the tyre scuffed, but the nose-wheel fairing had escaped damage.

Although the damage to the aircraft was substantial in terms of repair costs, it was not immediately obvious unless the aircraft was carefully inspected. In the long grass the nosewheel rim and tyre were difficult to see beneath the speed fairing and the damage was not evident until the tail was pulled down to raise the nose leg off the ground, and the nosewheel rotated until the damage was visible. To a person standing near the front of the aircraft, neither the damage to the firewall nor the distortion of the fuselage would have been visible with the engine cowlings still in place. Had the pilot thought to inspect the underside of the fuselage immediately aft of the nose wheel strut however, the wrinkles in the skin would have been obvious to him. This would no doubt have led to a more detailed examination of the aircraft, which should have revealed the further damage and the slackness in the elevator control system.

It was evident that the pilot, though he had a reasonable amount of experience on the Cessna 182, was not aware that damage to the airframe, transmitted through the nosewheel strut attachments, can upset the rigging of the elevator control cables. This important fact was brought out in the article "And all because of a heavy landing", published eighteen months ago in Aviation Safety Digest No. 60. In that instance, the damage that resulted from a heavy landing on an island airstrip had such a serious effect on the controllability of the aircraft during the subsequent "go around" that the pilot ditched the aircraft in the sea. The possibility of this type of damage was also mentioned in Digest No. 63 in the article "Did You Report that Heavy Landing?".

It is true that all previously published references in the Digest to firewall damage and possible control problems resulting from nosewheel impacts have been related to damage sustained in heavy landings. In view of this, it is understandable that the likelihood of elevator control damage did not occur to the pilot during his inspection. The circumstances of this accident now demonstrate quite clearly that an impact of any sort, taken on the nosewheel strut, should be enough to render the airworthiness of the aircraft suspect until it has been thoroughly inspected for possible damage of the type described.

*Does this scene look FAMILIAR?

*Safety Poster from Digest Number 67, March 1970

. . . it nearly happened!

AT a private airstrip in a parachute jumping area, a Cessna 180 with its starboard door removed, took-off on the first sortie of the day's operations with four parachutists on board. Of these, one was an instructor, two others were students who were to make static-line descents, and the fourth was an experienced parachutist who had made over 150 free-fall descents. As the aircraft climbed through 2,000 feet, the parachuting instructor, sitting just behind the starboard door opening, released a drift marker to assess the wind effect. He watched the marker descend and, after a further circuit during which the aircraft climbed another 500 feet, he motioned to the pilot to turn into wind towards the selected exit point, preparatory to the first student leaving the aircraft.

A group of pilots and parachutists on the ground had watched the aircraft's take-off and initial climb, and looked up now as it lined up for the first jump run. As the Cessna approached the exit point over the strip however, they heard another aircraft and, turning around, were aghast to see a twin-engined aeroplane approaching the area at high speed on almost the same heading as the slower Cessna 180, which it was rapidly overtaking. Turning to port a few degrees, the twin passed several hundred feet directly beneath the Cessna, just as it reached the exit point, and continued on away from the area with no change in height or heading. After a small delay the first student left the jump aircraft normally, followed on subsequent circuits by the remaining parachutists and the exercise was concluded without further incident.

It was learned later that, because the twin had approached the jump aircraft from behind and slightly to port, it was not at first seen by the pilot or the parachuting instructor who was then preparing to despatch the first student from the doorway. They were alerted to the danger only when the experienced parachutist, who was fortunately sitting beside a window on the port side of the aircraft, happened to look down and to the rear as the Cessna neared the exit point. Realising that a serious hazard was developing he shouted to the instructor, who was able to delay the student's exit from the Cessna until the twin had passed beneath and flown clear.

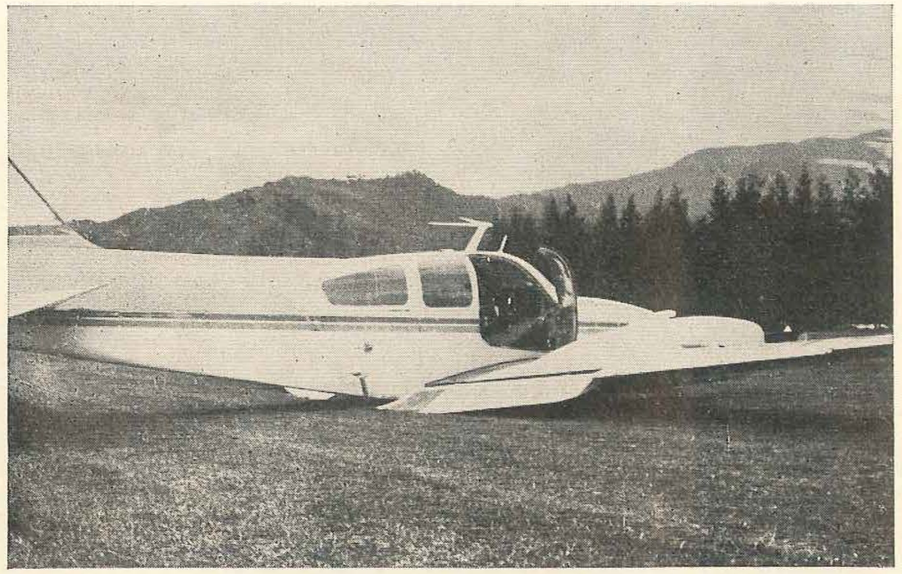
* * *

This incident is typical of literally dozens of others that have occurred at this one parachuting area alone over the last 12 months. Although the jumping area at which the incident took place borders a training area used by a number of flying schools there can be little excuse for such mass disregard for the fundamentals of good flying and airmanship. Like all other parachuting areas, the area is clearly marked on the appropriate Visual and Radio Navigation Charts issued by the Department, with the symbol indicating that parachuting may be taking place. Pilots operating in this particular training area should therefore be as familiar with its location as they are with the boundaries, height limitations and other features of the area as a whole. At the same time pilots conducting travel flights through this training area are expected, as always, to check for parachuting areas along their route in the same way as they check the positions of Prohibited, Restricted and Danger Areas in relation to their planned track.

There is nothing to prevent a pilot operating his aircraft in the vicinity of a parachuting area provided, of course, that he is constantly on the alert and can operate with safety. In the case of the incidents witnessed in this particular zone, however, it could hardly be claimed that such conditions were being met. Indeed in most instances, it has been obvious that pilots have blundered into the area without the remotest appreciation of the hazards to which they were exposing themselves and their passengers, not to mention parachutists using the area in the course of their legitimate activities.

Pilots must remember that parachuting areas marked on Terminal and En Route Charts may, at times, be very active indeed with descents being made from heights up to 10,000 feet. A deployed parachute canopy can be difficult to see from an aircraft at any time because of its lack of relative motion against a distant background, but such a small object as a free-falling parachutist, descending at such a high rate, is almost impossible to detect.

Even so, the onus of avoiding collisions in these circumstances can only rest with pilots. Pilots operating in the vicinity of designated parachuting areas should therefore, approach them with extreme caution or, better still, avoid them altogether. Parachute jumping is normally conducted over a relatively small area and the time taken to divert around such an area is insignificant compared to the dangers posed by incidents like the one described in this article. Parachutists themselves are hardly in a position to get out of the way of an aircraft!



Unsafe undercarriage indications disregarded

ARRIVING over Liaigam, in the Western Highlands of New Guinea, after a charter flight from Mt. Hagen with three passengers, the pilot of a Beech Baron joined the circuit preparatory to landing. Reducing speed to lower the undercarriage, he began the pre-landing cockpit checks and, turning on to base leg, selected undercarriage "down".

Also on board the aircraft, occupying the front right hand seat, was another commercial pilot who had only recently commenced duty with the operating company. This pilot had been detailed to travel on the flight to observe features of the route and familiarise himself with the approaches to Liaigam.

Shortly after the aircraft had turned on to base leg, this second pilot glanced at the undercarriage warning lights and, under the impression that the green down light was not showing, drew the attention of the pilot-in-command to the fact. Suspecting that the lamp itself might have been unserviceable, the pilot-in-command pressed the bulb housing and, obtaining a bright green light indication, was apparently satisfied that the warning system was serviceable and that the undercarriage was down and locked.

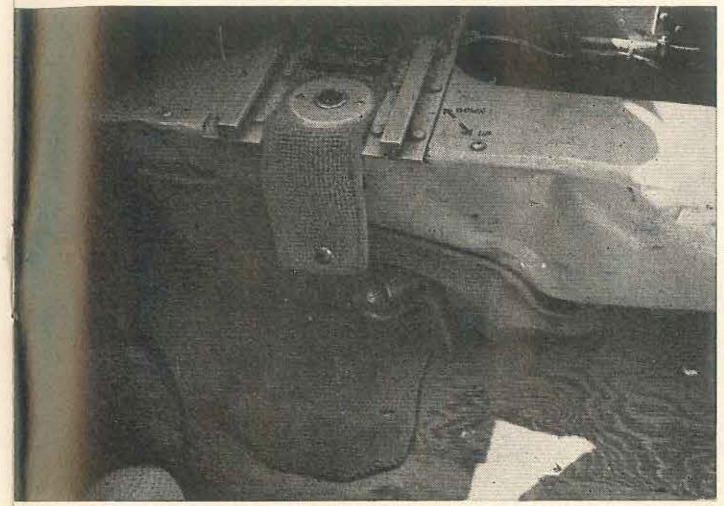
Continuing with his approach, the pilot-in-command lowered full flap and, as he flared the aircraft for landing, closed the throttles. Immediately, the undercarriage warning horn blew but the pilot, realising that the aircraft was by now very close to the ground and that from this position he would probably not be able to initiate a safe go-around, allowed the aircraft to settle on to the runway. As it touched down, the undercarriage, which had been only partially extended, collapsed, resulting in extensive damage to the propellers, flaps and undercarriage operating mechanism.

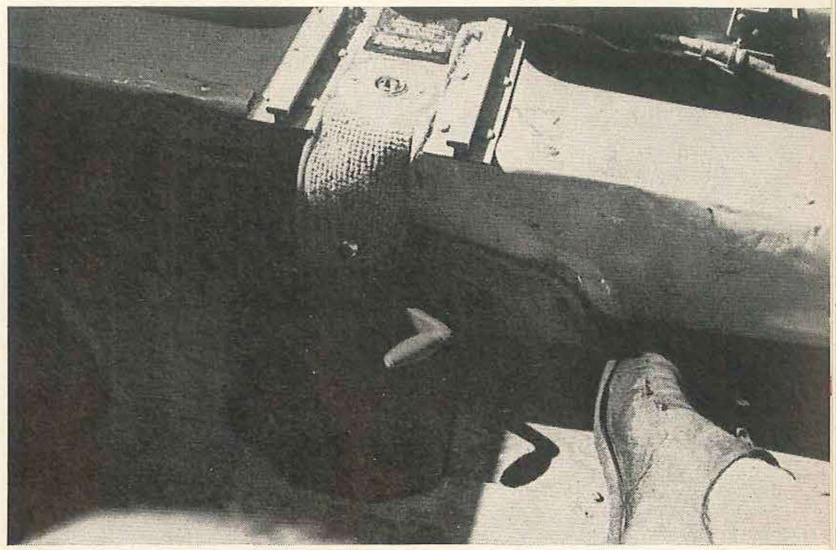
* * *

The reason for the collapse of the undercarriage quickly became apparent when the aircraft was inspected. In addition to the occupants of the aircraft, a small quantity of freight had also been carried between Mt. Hagen and Liaigam. This freight was loaded on the cabin floor in an area made available for the purpose by removing the right hand seat in the centre row. A cargo net had been placed over the freight, but no great effort appeared to have been made to tidy up loose ends or the pile of surplus netting that lay across the floor towards the feet of the passenger who had been seated immediately behind the pilot.

Speaking to the pilot-in-command after all the occupants had vacated the damaged aircraft, this passenger remarked that, during the approach, he had been conscious of some sort of movement near his right foot. Both men then returned to the aircraft and lifting aside the cargo net on the floor behind the front seats, the pilot saw that the emergency undercarriage extension hand crank, which was normally folded and stowed in the disengaged position, was engaged and had become enmeshed in the cargo net. Thus, when the pilot had selected undercarriage "down", the rotating handle had gathered more of the net around itself until it had jammed, preventing the undercarriage from fully extending. It was subsequently determined that this jamming of the extension handle permitted the undercarriage to extend only to about two thirds of its full travel.

In this aircraft, the standard canvas safety boot that fits over the handle and the shank of the operating mechanism was missing. To prevent accidental engagement, the operator had adopted the practice of binding the handle to the shank with a





Above: The emergency undercarriage extension handle in the stowed position. To prevent accidental engagement, the operator of this aircraft normally bound the handle to the shank of the mechanism with a strip of masking tape.

Above Right: The extension handle in the engaged position.

Lower Right: This picture shows the pile of rope and cargo net lying across the extension handle. When the undercarriage was selected down, the rotating handle became tangled in the netting and prevented the undercarriage from fully extending.

strip of masking tape, but no tape was found attached to the handle or nearby on the floor of the aircraft. During his pre-flight inspection, the pilot had not noticed that the tape was missing.

* * *

Perhaps the most striking aspect of this accident was not so much the manner in which the handle came to be obstructed by the net, but the number of warnings of an unsafe undercarriage condition that were overlooked or ignored. Quite clearly the passenger sitting behind the pilot could hardly have been expected to appreciate the seriousness of the situation when he had noticed the movement on the floor. He had, in fact, looked down but saw only what he thought was a pile of tangled rope or netting. Believing that the disturbance was somehow connected with the normal operation of the aircraft, he paid no further attention to it. At about the same time, however, three of the aircraft's occupants, including the pilot-in-command, noticed a burning smell in the cabin. Although sufficiently distinct for each person to detect it independently, none of the three mentioned it to any of the others and so its source was not investigated. As well as this the undercarriage circuit breaker "popped" and the red "voltage overload" light illuminated during the approach, both occurrences escaping the attention of the pilot-in-command. Late on final approach, the second pilot noticed the red overload light indication but did not take any action to follow up this warning.

Most difficult of all to understand however, was the reaction of the pilot-in-command to the apparent lack of a green "undercarriage safe" light after his attention had been drawn to its absence. His action in pressing the bulb housing served only to prove that the bulb was serviceable and in no way gave any indication of the actual position of the undercarriage. In view of the fact that it was another qualified pilot who drew the pilot-in-command's attention to the light indication, the latter's attitude is all the more surprising. He apparently took no positive or logical steps to clarify the situation and there was certainly no justification whatever for his conclusion that the undercarriage was safe for landing.

All these warning signs were apparent quite early in the approach, when the pilot was in no way committed to a landing and while he still had ample time to take whatever corrective action was required. If the pilot had made some effort to establish the cause of the electrical burning smell when it was first noticed, it is reasonable to assume that he would have seen the voltage overload light and the "popped" circuit breaker. This should ultimately have led to his finding the cause of the trouble. And while even the slightest doubt existed as to the true position of the undercarriage, it is only reasonable to expect that at the very least, he would have closed the throttles and checked the operation of the undercarriage warning horn as a means of verifying the light indications. But none of these checks were made. Finally, after all these warnings had gone unheeded, the sound of the undercarriage warning horn came too late on the approach to allow the pilot to take any effective recovery action.

Cause

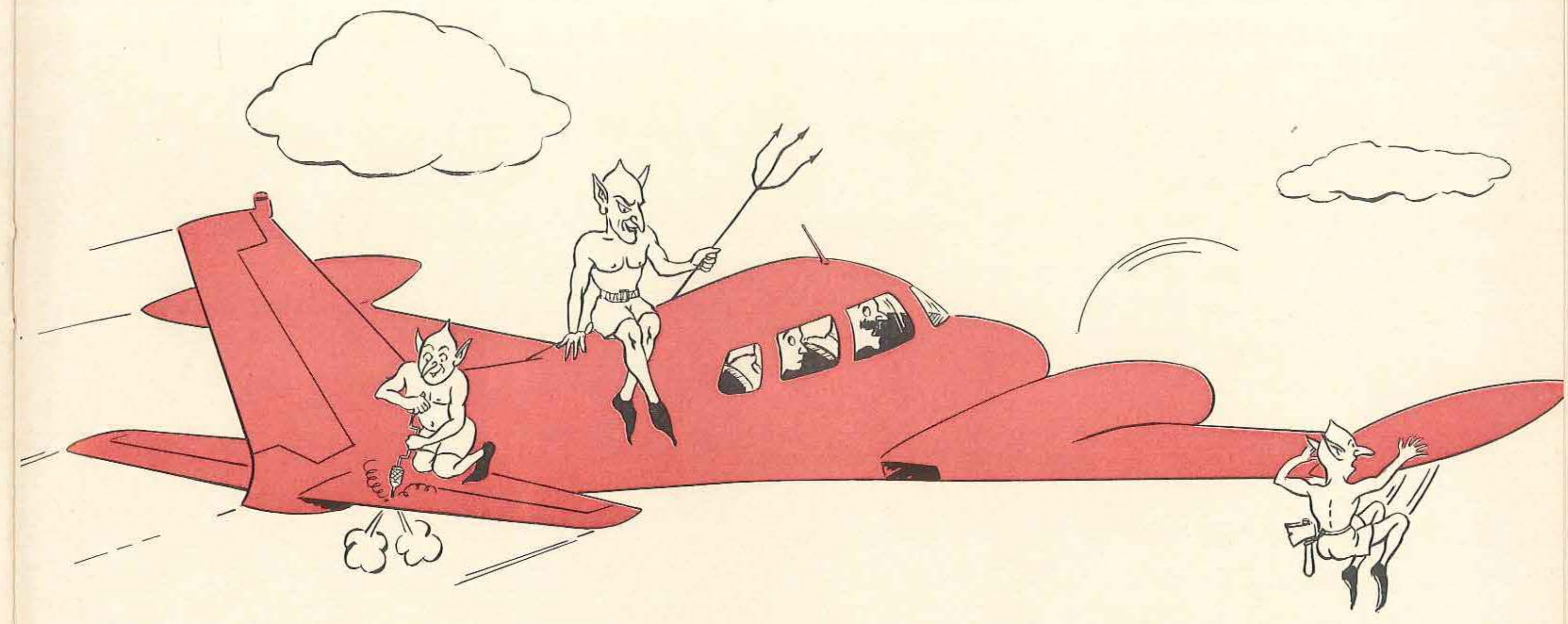
The cause of the accident was that, when faced with indications of an unsafe condition, the pilot did not carry out proper checks to ensure that the undercarriage was extended for landing.

Comment

A number of incidents have occurred in the past, involving Beech 33, 35 and 55 series aircraft, in which unsecured emergency extension handles were somehow obstructed when the undercarriage was selected down electrically. At least one of these has been reported previously in the Digest (See Digest No. 55). As this earlier article pointed out, quite apart from the risk of the handle fouling an object and interfering with the normal operation of the undercarriage, there is a very real chance in these circumstances of the rapidly turning handle causing injury to passengers in the rear seats, while the electric undercarriage extension motor is operating.

A red canvas safety boot which fits over the handle and the shank of the operating mechanism is provided as standard equipment in these aircraft types, to prevent accidental engagement of the emergency extension handle. The boot is easy to remove and to replace and, when correctly secured, facilitates checking that the handle is properly stowed. The practice, adopted by the operator in this accident, of fastening the handle with masking tape should be considered only as a temporary arrangement. In some situations, such as where an aircraft is flown on training operations which include simulated emergency extensions of the undercarriage by means of the manual system, the use of tape is clearly impractical.

Correct stowage of the hand crank with the standard protective cover in place not only reduces the chances of interference, but minimises the possibility of wheels-up accidents of this type.



We are found everywhere — everywhere that there are human beings. We will always be found there, taking our toll, contributing misery and heartache, causing destruction and taking lives.

WE DON'T JUST HAPPEN

How do we begin? It's easy, really. A moment's inattentiveness, or a moment's carelessness on **somebody's** part, is all we need for a start. Oh, I know, a small error by one person may not seem sufficient to cause one of us all by itself, but you'd be surprised how often the original error is compounded by somebody else either not noticing it, or making another one. As I say, it's easy to be an accident gremlin. Sooner or later someone will come along to create you.

Admittedly, we gremlins don't have things all our own way. There's always somebody harping about prevention. Every paper you pick up has an editorial by some well-meaning citizen on how to forestall us. But we of the accident family do have **one** very powerful weapon on our side. That weapon is everyone's belief that accidents happen to or are caused by other people! This — and I must emphasize it, because it is all-important — is the main reason for our increase. Nobody, absolutely nobody, ever thinks that **he** is going to have, or cause, an accident.

There are of course, other things involved — fatigue, boredom, lack of training, failure to follow recommended procedures, hurry to get home, inadequate supervision, and lack of knowledge. These and many others combine to cause one of us. But the main reason is the belief that accidents happen to, or are caused by, someone else. This mythical "someone else" is usually depicted as an appallingly inept and incompetent bungler, steering a wobbly course from one accident to the next. But this is where we gremlins gain a slight edge in our struggle for survival. The incompetents **do** give life to a few of us, but usually such misfits are so obvious that their work is double — or even triple checked, and the spark of life which they have given us is snuffed out. No, the inept are not really on our side.

It might surprise you, but we really get our biggest help from the competent, the conscientious, and the hardworking. We sneak up on this model sort of worker on a day when, perhaps, he's not at his best. Perhaps his wife is in hospital, possibly his boss has just given him an uncalled-for dressing-down. Or he may have to leave the job to go to a meeting, or to get his pay. There are an unlimited number of possibilities, and we gremlins are opportunists; we take advantage of each one. No error is too small for us to consider.

Perhaps if I were to reveal to you my whole hideous history, it might prove illuminating. Although I am an aircraft accident gremlin, I could just as easily have been a traffic accident, industrial accident or household accident gremlin. We gremlins don't care!

I was conceived fully two months before my final destiny. A maintenance engineer, carrying out a pre-flight inspection on a visiting aircraft, noticed that a lock-nut was missing from the port undercarriage assembly, and that a fuel line in the port wheel well was chafed. But before he could effect any repairs, the pilot arrived. After some discussion, it was decided that the defects would be entered in the Maintenance Release, and rectified when the aircraft arrived back at its home base. I now had a foothold, albeit a precarious one.

My foothold was strengthened when the aircraft arrived at its home base, because the pilot, though he briefed the workshop foreman on the chafed fuel line, did not mention the missing lock-nut. I was still shaky, but I was gaining. I received some more help when the entry was transcribed from the Maintenance Release to the aircraft's worksheet. The transcription was made by an engineer of another trade, who did not realize the importance of the innocuous minor entry about a missing lock-nut.

After this, I grew rapidly, but it still wasn't all plain sailing. Every day, for seven weeks, the aircraft was "dailied". On some of these occasions I came perilously close to discovery, but I always managed to sneak through undetected. One inspection in particular brought me to the verge of extinction. I won't bother you with technical details, but the missing lock-nut, coupled with the normal vibration, had caused a few things to work loose. The loose parts were immediately detected, and I thought that my career was over. But, wonder of wonders, the LAME merely tightened the loose parts, without attempting to determine why they were loose. He did, however, make a Maintenance Release entry, and his work was subsequently inspected and passed by an experienced LAME — two experienced LAME's in fact — and **both** failed to notice the missing lock-nut! I was becoming more hazardous daily.

Subsequent to this "near miss", more dailies were carried out, but I continued my malevolent existence. Even though the minor entry acknowledging my presence was listed on the minor defect record for almost two months before the climax of my career, I was allowed to go undisturbed. The stage was now set — all I had to do was to pick the right time to happen! The opportunity was not long in coming.

The aircraft was nearing the end of a cross-country trip. I could see the faces of the pilots as they caught sight of their destination. They were content and satisfied as they thought of completing another successful flight. Downwind now. "Gear down," said the pilot, "Roger, gear down," echoed the co-pilot, as he reached for the selector. "Clunk," said I, as the port undercarriage actuating mechanism fell apart. The faces of the pilots now registered not contentment, but dismay. Dismayed or not, they still attempted all the recommended emergency procedures to get the port gear to lock down, but I had done my job too well. The port gear remained swinging gently to and fro in the breeze.

The pilots then decided to raise the undercarriage, but I had another nasty surprise for them. The eye-bolt that was supposed to be held by the missing lock-nut was now firmly entangled in the

chain sprocket, so that when the pilot said, "Gear-up," and the co-pilot answered, "Roger, gear up," I was again able to answer "Clunk".

You should have seen the consternation then! There they were, with the starboard gear jammed down, and the port gear swinging back and forth like a pendulum ticking off the last minutes of an expiring life. At this stage, I thought that I was going to be a really spectacular success. As I watched the aircraft flying around, I was able to envisage, at the very least, a vicious ground loop, with resultant bits of aeroplane and people being flung about.

Alas, I had not reckoned on the perseverance and luck of pilots. After they had flown the aircraft about for a couple of hours, the eyebolt which was jamming the chain-drive sprocket fell free, and they were at least able to raise the starboard undercarriage. Once the crew was able to get the starboard wheel locked up, they carried out a landing. As the aircraft hit, the port gear folded neatly into its well, and the aircraft slid along the foamed portion of the runway, and finally slewed to a stop. Although the aeroplane suffered some damage, no one was hurt.

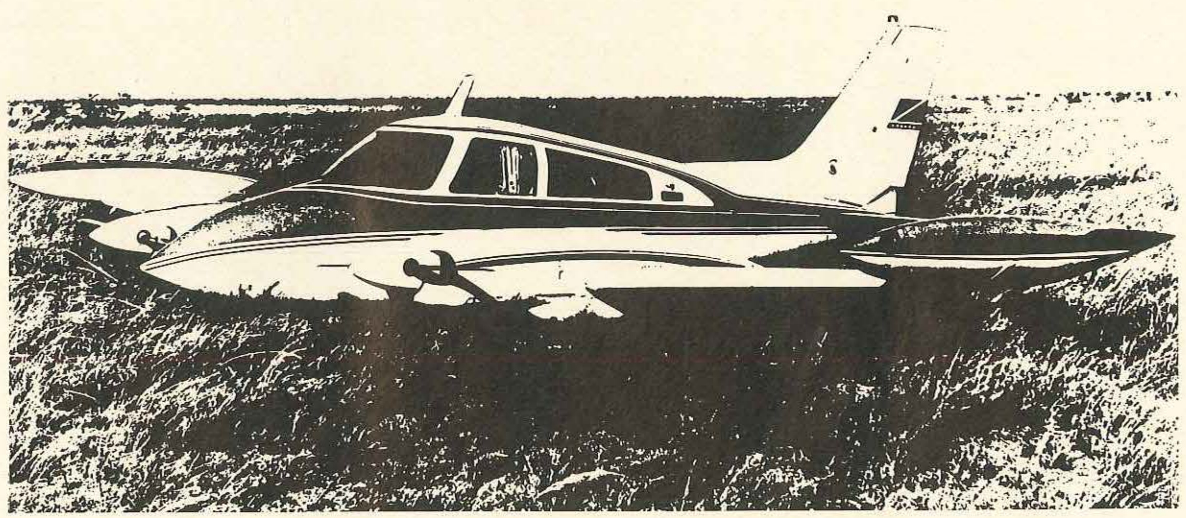
As accidents go, I wasn't a great success. Admittedly, I scared the daylights out of a couple of pilots, but I certainly didn't draw the big black headlines that some of my brothers have rated. Looking back on my career, though, I feel that I was lucky to get as far as I did. I could have been stopped a number of times, but somehow I always eluded capture. The omissions that sustained my life were not major. Any one of them, taken by itself, was not an accident cause, but their cumulative effect certainly was.

You can profit from me. You might well profit, because I've cost you something, and you should get something back for the cost. In a way, I am a perfect example. Look at me closely. You will find that I am made up of faulty procedures, poor techniques, insufficient supervision, and inadequate training. Does that sound familiar? It should, for I am only one of thousands.

You are perhaps wondering why I am so free with this advice, which, if followed, could only lead to my extermination. It is because we gremlins are formidable foes, and only the most vigilant organisation will finally defeat us. None of the things which caused me was original. Everybody was aware of similar accidents — but I still happened!

The worst thing for me and my family is a constant review of your own organisation, and the active elimination of safety hazards. You must be always alert for possible causes, because we strike hard, fast — and for keeps! What we really like to hear you say is, "Nonsense, things like that never happen in our organisation". If you adopt that attitude, just sit back and wait. We'll be seeing you!

Adapted from RCAF "FLIGHT COMMENT"



Headphones cause control zone penetration

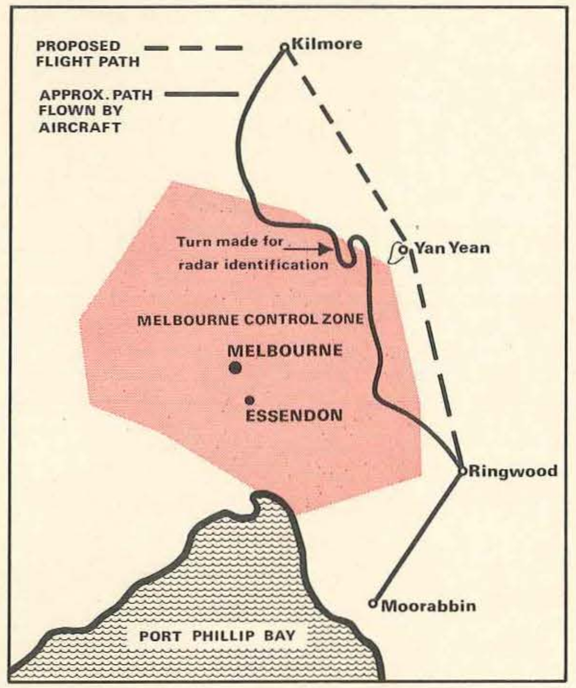
IMPOSSIBLE you say? Not so. In this case it was just the opposite. The reason for the penetration was that the pilot placed a pair of headphones on the coaming above the instrument panel, which induced an error of about 30 degrees in the magnetic compass!

The weather on the morning of the incident was by no means perfect, with visibility just above that required for VFR operations. But, as the weather briefing which the pilot had obtained indicated that his planned flight from Moorabbin to Echuca was quite possible in the existing conditions, he carefully made out a flight plan, nominating full SAR procedures, with reporting points at Ringwood, Yan Yean Reservoir, and Kilmore.

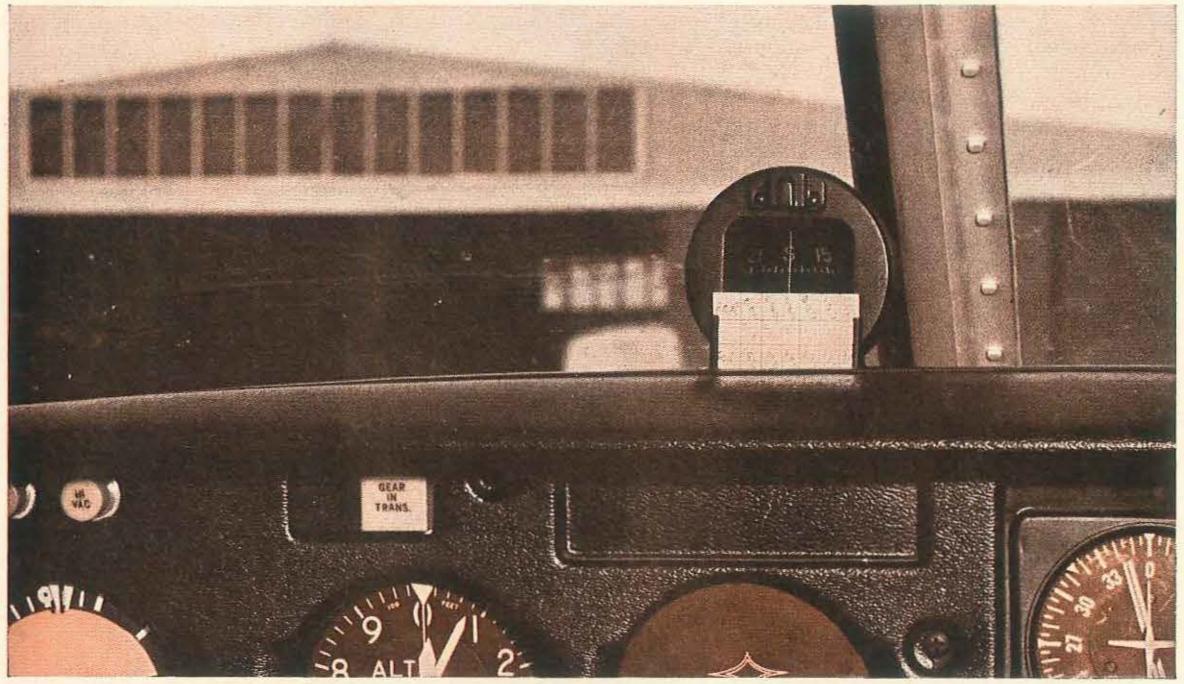
The pilot and his passengers then went out to where their Cherokee Arrow was parked and boarded the aircraft. The pilot started the engine, called the tower and taxied out towards the holding point for the duty runway. As he was doing so, to improve radio reception, he put on a pair of headphones carried in the aircraft. After a normal take-off and departure report, the aircraft was cleared from the Moorabbin Tower frequency and the pilot set course for Ringwood intending to track to the east of the Melbourne Control Zone.

Very shortly afterwards, Moorabbin Tower transmitted a general call advising that the airport was now closed to circuits and landings because of reduced visibility, but was remaining open for departures and arrivals. However, as the pilot considered he had at least three miles visibility, he continued the flight, and the aircraft duly arrived over Ringwood right on E.T.A. After transmitting a position report, the pilot decided the headphones would not be necessary for the remainder of the flight, so he removed them and placed them on the coaming above the instrument panel. He then altered heading for Yan Yean.

Visibility in the area was still generally poor, and after maintaining the new compass heading for three or four minutes, the pilot was astonished to see the Melbourne city skyline some distance ahead and only slightly to port. Realizing at once that he had unintentionally entered the Melbourne Control Zone, the pilot immediately looked around for the Yan Yean Reservoir and, sighting it well to starboard, turned towards it.

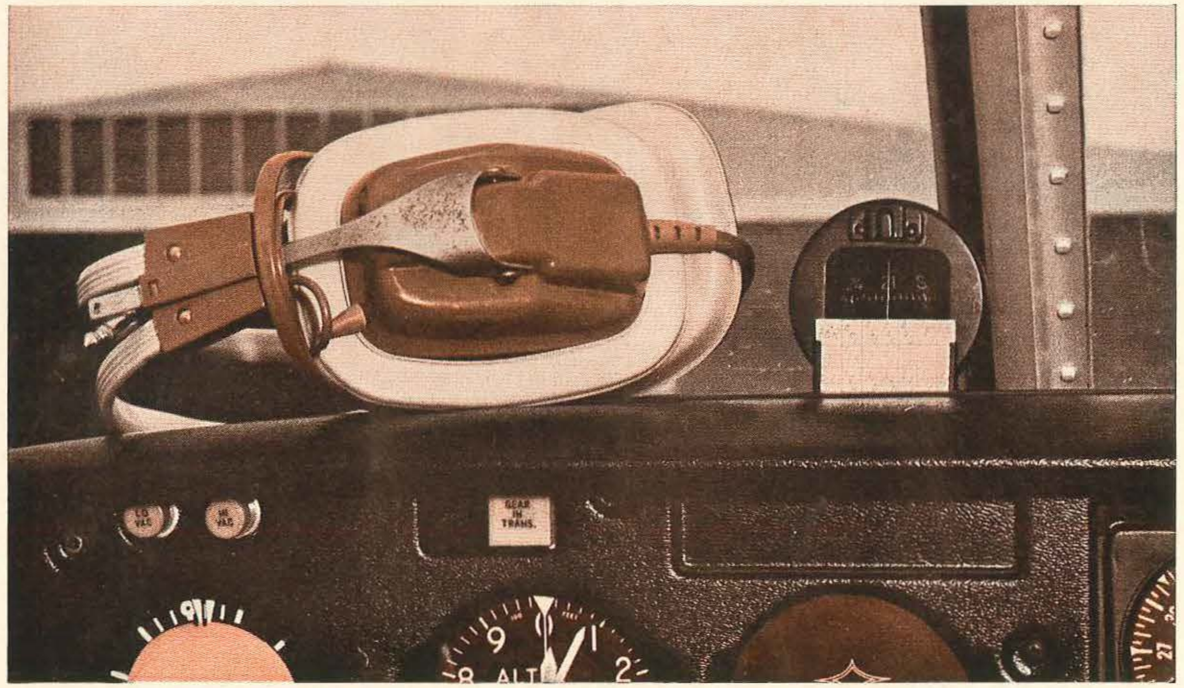


By this time, the approach controller at Melbourne Airport had spotted on his radar screen the echo of an aircraft that had obviously strayed into the control zone, and he contacted the Melbourne Flight Service Centre to see if they had any knowledge of it. The Centre informed him of the PA28's presence in the area and that this aircraft had reported six miles south of Yan Yean only two minutes before. The pilot was requested to call Melbourne Approach on their frequency. This the pilot did and, after being instructed to make a turn, first to the left and then to the right, for radar identification, was told to resume his own navigation on the flight planned track. Having now by-passed the Yan Yean Reservoir, the pilot turned on to and maintained what he believed was the correct heading for Kilmore.



Above: The magnetic compass of the Cherokee Arrow correctly reads 180 degrees.

Below: With the aircraft in the same position, an error of 30 degrees has been induced in the compass reading by placing headphones on the instrument panel coaming.



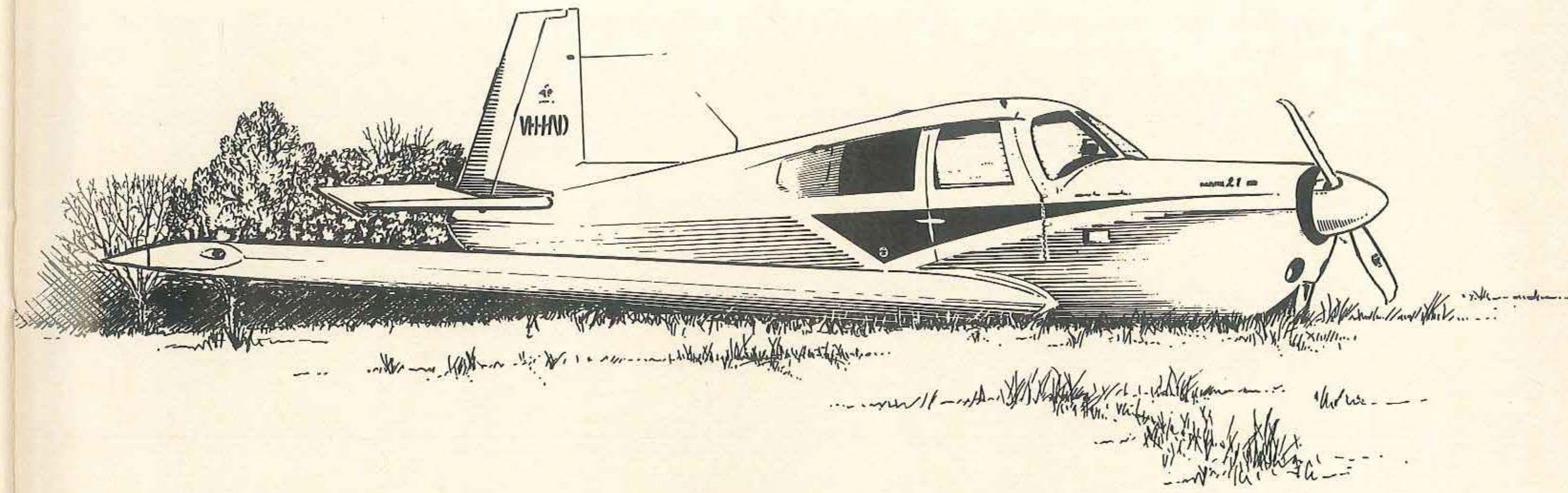
Shortly afterwards the Approach Controller again called the aircraft to request its present heading. The pilot reported "three zero six" and was then instructed "to turn right heading three six zero now". While complying with this instruction the pilot suddenly noticed that there was a discrepancy of about 30 degrees between the setting of the directional gyro and the compass reading. A further call from the controller confirmed this, informing the pilot that on being instructed to fly 180 degrees when turning for identification, he had actually tracked 150 degrees, and that when he resumed his own navigation to Kilmore he had actually tracked approximately 270 instead of his intended 306 degrees.

Because of the poor visibility, the pilot then requested radar guidance to Kilmore and after being given this and taking up the required heading, he endeavoured to locate the reason for the heading error. The problem was solved when he removed the headphones from the instrument panel coaming and the compass swung back to its correct heading. The remainder of his flight to Echuca was uneventful.

Tests subsequently conducted on the aircraft showed that errors of up to 50 degrees could be induced in the magnetic compass by placing the headphones in various positions on the coaming. This interference was of course, the underlying cause of the incident, but a contributory factor was undoubtedly the poor visibility. The pilot was familiar with the route and, had the weather conditions been better, it is probable that he would have discovered the error in time to avoid entering the Control Zone.

Two and a half years ago, in Aviation Safety Digest No. 68, an article entitled "Compass Interference" alerted readers to the possibility of magnetic articles affecting the reading of an aircraft's compass and referred to several incidents that had occurred as a result. Among the articles mentioned were automatic cameras, exposure meters, electric razors, dynamic-type microphones, and transistor radios, as well as items such as electric torches and cigarette cases which incorporate a magnetic "grip". Unfortunately, headphones were not included in the list, though they had been mentioned in earlier articles on the same subject.

The area above the instrument panel in a light aeroplane seems an obvious place to put articles during flight because it is so ready to hand. But as this and other incidents have shown, the consequences of utilising this space can have startling results. As our earlier article pointed out, it may be prudent to declare this area "out of bounds to all articles"!



UNDERCARRIAGE RETRACTS DURING TAXI-ING

AT the conclusion of a local flight on a property in Western Australia, the pilot of a Mooney M2OE landed his aircraft on the property's airstrip and taxied to the refuelling area. Shutting down the engine, the pilot left the aircraft to obtain assistance to make some adjustments inside the cockpit. While his assistant remained outside the aircraft, the pilot then re-entered the cockpit. When the task was completed, the pilot refuelled the aircraft and, leaving it parked alongside the strip, went to lunch.

The pilot said that when he returned some two hours later, he boarded the aircraft and carried out the normal pre-flight cockpit checks preparatory to departing on a further flight. Starting the engine, he began to taxi from the parking area towards the strip in use. After moving forward only about 150 feet however, all three undercarriage legs, without warning rapidly retracted. The underside of the fuselage and the propeller sustained considerable damage as they abruptly contacted the ground.

* * *

The aircraft was subsequently raised from the strip and, after emergency repairs had been made was ferried with the undercarriage locked down, to a workshop in Perth, for inspection and full repair. This detailed inspection revealed no defect which could have caused the undercarriage to retract accidentally. The rigging of the undercarriage was found to be within specified limits and the operating system was functioning correctly, as were the down-lock indicator light and switch assemblies.

On this aircraft type, the undercarriage is raised and lowered manually by operation of a lever in the cockpit. With the undercarriage down, the lever engages in a latch on the instrument subpanel and, when properly locked, it requires two distinct actions against spring pressure to release the lever and, by moving it backwards, commence undercarriage retraction. Because of its design, it is not possible, when the lever is correctly latched, for reverse loads applied through the system by any one or, for that matter, all the wheels, to release the lever and cause the undercarriage to retract of its own accord. It was therefore clear that, unless the pilot inadvertently unlatched the undercarriage himself before he began to taxi, the handle must have been unlatched beforehand and subsequent vibration then moved it backwards from the "down" position, causing the undercarriage to collapse.

It was not possible to determine positively how the lever had been dislodged from the "down" lock. The pilot admitted later that it could have been accidentally knocked from the latch while he was working on the aircraft, and there was also the possibility that the lever had been interfered with while he was away at lunch. Of perhaps greater significance however, than the precise details of how the lever came to be unlatched, was the fact that the pilot did not include in his pre-start cockpit drills a physical check of the position of the undercarriage handle. As he taxied forward from the parking area, the pilot was completely unaware of the unsafe position of the handle and he was, in fact, adjusting his radios as the aircraft contacted the ground. The red undercarriage warning light would not have been visible to him, as it had been adjusted to minimum brightness at some earlier time, and the throttle had been opened too far during engine starting and taxi-ing for the warning horn to sound.

The pilot involved in this accident had many thousands of hours aeronautical experience and was very experienced on this particular aircraft. He was, therefore, thoroughly familiar with the characteristics of the undercarriage system and its operation. It can only be assumed that, on this occasion, his familiarity with the aircraft type resulted in his adopting a casual approach to the pre-starting cockpit checks which led in turn, to his omission to confirm that the undercarriage was locked in the "down" position before starting the engine.

This accident illustrates once again the consequences of a haphazard approach to cockpit checks. It is only too easy for pilots flying the same aircraft frequently, to become complacent in their approach to these checks and limit them to a brief visual scan rather than give proper attention to each particular item. This is especially important in the case of a retractable undercarriage aircraft, where a check to ensure that the undercarriage selector or lever is positively locked "down", on first entering the cockpit, should be followed by a "green light" or indicator check after switching on the aircraft's battery power. It should hardly be necessary to remind pilots that a thorough and positive approach to vital action checks would prevent such needless and expensive accidents as the one described.

A matter of time

Pilot Contribution

The author of this article was involved in a mishap recently while flying from Mt. Gambier, South Australia, to Stawell in Western Victoria. He has generously contributed this frank account of his experience in the hope that others might benefit from his uncomfortable "lesson".

IT was one of the few times in my life that I was overtaken by the nauseating effects of panic. Although I overcame it quickly and tried to think calmly, I was plagued by the thought that I should never have let the chain of events that led to this situation reach the stage that it had.

I had completed my private pilot's course a few weeks earlier, and although I realized that I was now just **beginning** to learn to be a good aviator, I was very proud of my accomplishment and believed I had a reasonable understanding of what is required of a private pilot. Yet, suddenly, at 3,000 feet while on a short trip from Mt. Gambier to Stawell, I was panic-stricken and all the confidence I'd built up over the weeks of my training was destroyed. I had suddenly found I was running out of daylight with still a mountain range to cross to reach my destination, requiring more flying minutes than I had daylight left. How could I have got myself into this predicament? Why did I ignore many of the things I'd been taught only a few weeks earlier?

In retrospect it seems elementary, but it was not simple to me at the time. Naturally, I cannot be excused for the mistakes I made — I can only learn from them — but I can offer my appreciation of the situation in the hope that it may be a help to any other new pilot who might read this article.

* * *

I had flown over to Mt. Gambier to sit for a D.C.A. examination, and I had been requested to have the aircraft back at Stawell that afternoon if possible. Having completed the examination, I hurriedly made out a flight plan to ensure that I would get back to Stawell before last light. Converting my watch to GMT (as I thought), I nominated an ETD of 0615 GMT and calculated my ETA Stawell to be 0722. From the Visual Flight Guide I worked out that the end of daylight at Stawell was 0749 GMT, 27 minutes after my flight plan ETA. What I didn't realise was that, when working out the time conversion, I had unwittingly subtracted 10 hours from the time on my watch, instead of nine and a half. I had forgotten I was in South Australia and not Victoria, from where I had come that morning, and to which I was returning that afternoon. This, of course, meant that I had half an hour less daylight than I thought.

Radio communication with the Flight Service Unit at Mount Gambier was not good as I taxied out, but the last figure quoted by the Flight Service Officer when he passed me a time check was the word "two" and as it was 0622 GMT by my watch, I was quite satisfied. The result was that I left Mount Gambier not realising I didn't have a hope in the world of reaching Stawell before last light!

It was not until I had covered half the journey that I would let myself believe something had gone wrong. To a pilot with hours of experience this must seem ridiculous, but it's nevertheless true. When a chap has only been flying for a short while, there are so many things that haven't yet become automatic. The business of flying straight and level on a constant heading, visual navigation, mid-course corrections, all these relatively simple things require a lot of concentration for fledgling pilots. A new problem coming on top of these is thus 'quite unacceptable' unless it is so blatant that it glares at you and forces you to notice it. In other words, you don't **want** to believe there is a fresh problem because you've worked everything out beforehand and so "nothing can be wrong". Also, you're still not perfectly at ease and therefore don't **want** to meet any unexpected problems yet for fear that you may not be able to handle them. This is the best explanation I can give as to why I did not realise earlier that the light would be gone before I reached my destination.

When at last this point was driven home and I'd stifled the panic sufficiently to think again, I decided that I would change heading for Horsham. Although this was the same distance as Stawell, it was not over mountains, which might enable me to select a landing site along the way. So I descended to 500 feet and proceeded towards Horsham. All the paddocks seemed wet, and in the fading light I couldn't be sure of any of them. I thought there might be lights on the Horsham strip, so I didn't carry out any precautionary search at this stage, but hopefully maintained cruising speed and heading for Horsham.

By the time the town of Horsham came into sight, there was just enough light to permit a safe landing at the point where I was, but now that I'd come this far, I chose to press on to the aerodrome, and this was perhaps the biggest blunder of the whole incident. I didn't **know** there would be lights at the aerodrome, so I should have put the aircraft down right then and there while the visibility was still available. But at the time, "aerodrome" meant greater safety (even though it might mean a night-landing) than a landing in a paddock which might have been water-logged or pot-holed. It was contrary to what I'd been taught, but in the stress of the moment, that was my decision. I didn't know where the Horsham aerodrome was in relation to the town and as it was unlit I failed to locate it, so finally, in the last tinges of daylight I had to land the aeroplane on a dirt track just off the main highway, a mile or so out of town. I was very lucky to sustain no more damage to the aircraft than a smashed port navigation light, incurred when a tree branch glanced the port wing-tip, 50 feet above the ground before touching down. All I could feel after I brought the aeroplane to a stop was a deep sense of disappointment in myself, and an overall numbness. I didn't know then exactly where I had gone wrong, but in the hours afterwards I pieced it all together. Reviewing it all over again in the quietness of my room, I realised what my errors were and what I should have done to prevent the situation from progressing to the point it did. As it was the result could so easily have been fatal for my passenger and myself.

Although they shouldn't happen, mistakes can be made in time conversion and in this case I had allowed myself to be hurried during flight planning. This should be a time for careful calculation and consideration of every factor relevant to the flight. It doesn't pay to rush it, for just one small miscalculation can lead to other mistakes, as it did with me.

Finally, I realised that when the light was "running out", I should have put the aeroplane down on the nearest suitable landing place. I've learnt that it is always best to land safely in a paddock while you can **still see,** than to press on, on the strength of a hope, as I did.

So don't let ANYONE or ANYTHING pressure you into acting any differently to the way you normally would. **You** are the pilot-in-command, and you must do as **you** think fit — take all the time you need for flight preparation and don't be hurried along by others who are "eager to get going".

There is no room for guesswork in flying. It is not a game and everything we've been taught **must** be remembered and practised. Very often we're not given a second chance to benefit from mistakes like these! ——————→