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AVIATION SAFETY DIGEST

Department of Civil Aviation . . Australia

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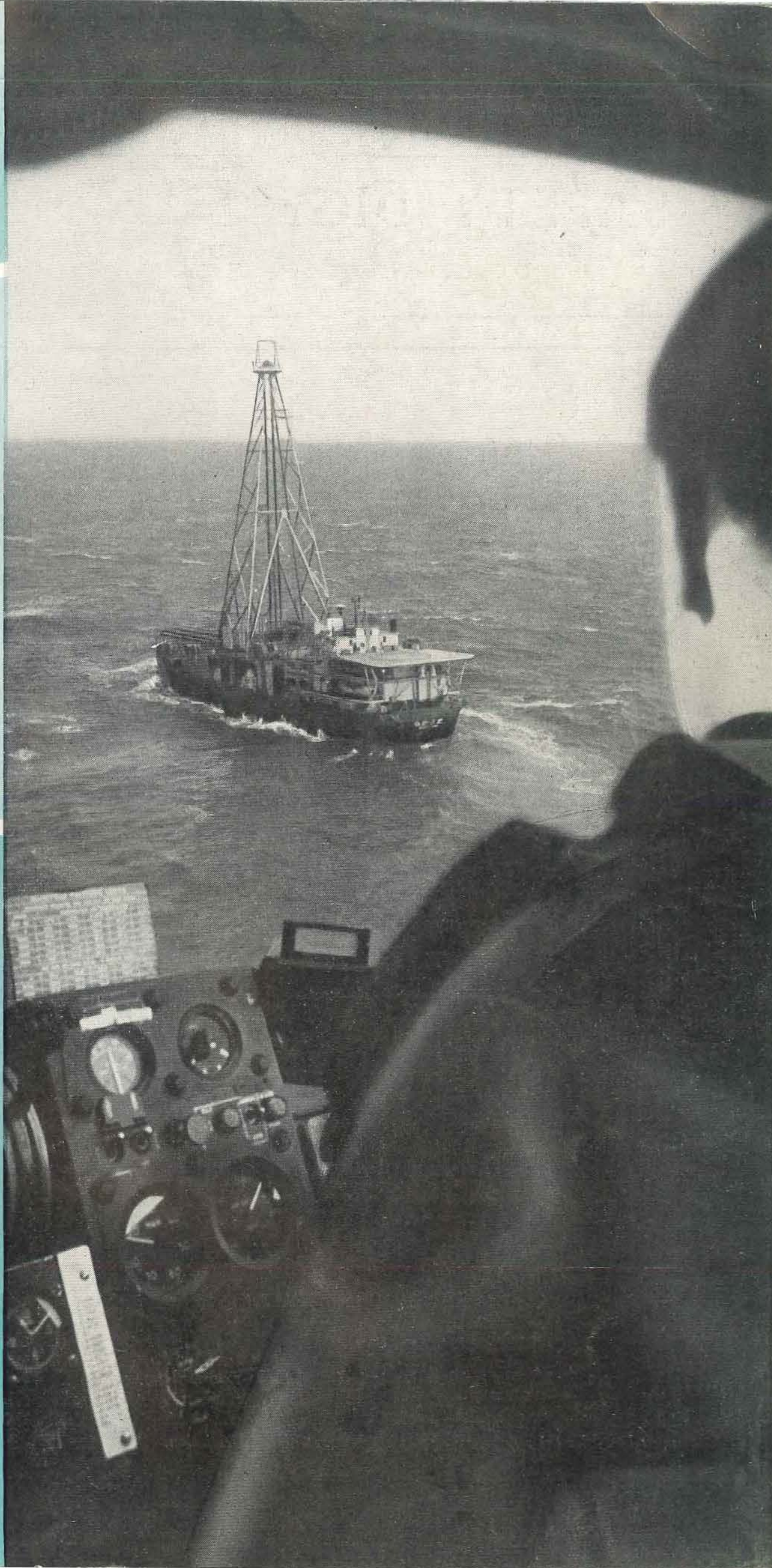

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Department of Civil Aviation . . . Australia

No. 47 SEPTEMBER, 1966

Contents

COVER: *A Bell helicopter under charter from Ansett-ANA, carrying personnel for the oil-drilling rig "Glomar III" in Bass Strait, approaches the vessel's landing platform in boisterous weather.*

Aviation Safety Digest is prepared in the Air Safety Investigation Branch and published quarterly. Enquiries and contributions for publication should be addressed to The Editor, Aviation Safety Digest, Department of Civil Aviation, Box 1839Q, P.O., Elizabeth Street, MELBOURNE, C.1.

NEEDLESS TRAGEDIES

It is our sad duty in this issue of Aviation Safety Digest to publish the reports of three fatal light aircraft accidents which together claimed the lives of nine young Australians.

The sheer tragedy of these unforeseen and catastrophic finales to what amounted to pleasure flights, is heightened by the fact that none of them need have happened—all three could have been avoided if the pilots concerned had not chosen to disregard the very regulations that have been framed to prevent such accidents. In two of the accidents also, innocent young passengers had entered the aircraft at the invitation of the pilot, doubtless with every confidence in his ability and judgment, and were taken to their death as a result of this misplaced trust—misplaced because the pilot either ignored, or failed to recognise the weight of responsibility placed in his hands, by virtue of his command of the aircraft.

It is perhaps significant that two of the pilots involved, though properly qualified for the category of flight in which they were engaged, had less than 200 hours aeronautical experience and the third had not a great deal more. It has truly been said that the greatest danger peaks occur in the first few hundred hours of a pilot's flying career—at this point he has learned to fly with confidence and tends to think he knows all the answers, but has not been flying long enough to see that there is always something more to learn. It is at this stage that a pilot is particularly susceptible to the "It can't happen to me" philosophy and is strongly tempted to excuse his own flying standard in words such as "Rules were made for the obedience of fools and the guidance of wise men",—never questioning that he could be in any but the latter category.

This type of thinking cannot be refuted too strongly. It has no place in aviation and one has only to watch the most experienced professional pilots to see that this is a fact accepted by those most qualified to judge. Logically, if pilots with such a wealth of experience cannot afford to depart from accepted standards, how much less can the pilot with only a hundred or so hours? This is the truth manifested time and again in fatal light aircraft accidents that speak for themselves.

Yet arguments of this sort apparently do not convince, for still the attitude persists in some that they know better than "the book". But even if logic fails to convince, there is perhaps a chance that stark, shocking reality may sometimes succeed. To any therefore who have tongue-in-cheek tendencies towards acknowledged standards of air safety, we commend a thorough study of the fatal accidents reported on pages 2, 5 and 7 of this issue.

DISASTROUS LOW LEVEL STEEP TURN

While making a steeply banked turn at low altitude around the homestead of a station property in South Australia, the pilot of a Cessna 175 lost control and the aircraft dived into the ground. Impact forces and the intense fire that followed destroyed the aircraft. The pilot and the four children on board were killed.

The five occupants were guests at the station homestead where, with others, they were being entertained over a holiday weekend. The pilot was from another station property and had arrived in his aircraft the previous day.

Shortly before 6 p.m., while a number of the guests were relaxing on the lawn at the rear of the homestead, the pilot offered to take the children for a flight. With his four prospective passengers, comprising the sons of the owner of a nearby station, and a girl and a boy who were staying for the weekend with their parents, the pilot left the homestead to walk to the aircraft parked on the airstrip 150 yards behind the house.

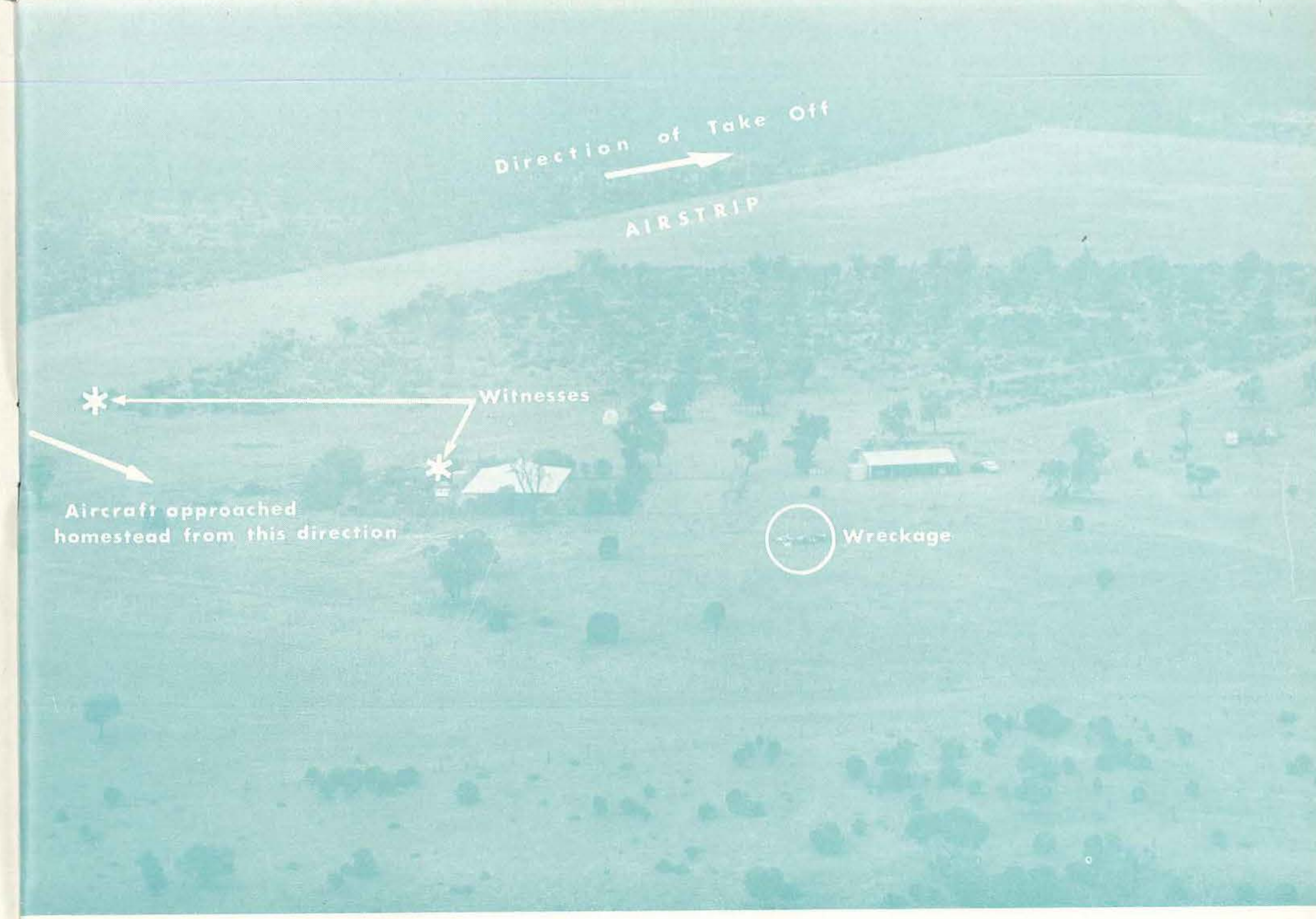
At the airstrip, the pilot seated his eldest passenger next to himself in the right hand front seat, and had the other three share the rear bench seat, though it was fitted with safety belts for only two passengers. He then started the engine, taxied to the southern end of the strip and after warming up, took off into the north.

After climbing away, the aircraft made a shallow turn to the left on to a southerly heading, and at a height of about 200 feet, passed to the west of the strip as it flew back in the general direction of the homestead. The father of two of the children, who had observed the take-off from the edge of the strip, watched the aircraft fly by and it was low enough for him to clearly see his son waving from the left-hand rear seat.

Over the southern end of the strip, the aircraft rolled into a left turn towards the homestead and, as it approached, the pilot progressively steepened the turn to bring the aircraft around the house. As the turn tightened and the angle of bank increased, the nose of the aircraft began to drop and it lost height. The aircraft nosed down more rapidly as the turn further steepened, and it finally dived out of view on the other side of the homestead in a near-vertical bank and a steep nose-down attitude. Almost immediately, there was a noise of violent impact and dense black smoke rose from beyond the house.

* * *

Investigation of the burnt-out wreckage confirmed that the aircraft had struck the ground while still in a steep nose-down attitude and while banked steeply to the left. The port wing tip had struck the ground first, followed almost at once by the nose of the aircraft, and the ground marks and wreckage distribution indicated that there had been no forward motion of the aircraft after the initial impact. The centre section had been subjected to severe impact forces, which were followed by fire of such intensity that many components of the engine and the fuel tank and cockpit areas, had fused into a mass of molten metal. Both mainplanes, with the fuel tank areas burnt out, were found in their normal position in relation to the fuselage. The flaps were found extended between 10 and 20 degrees. The fuselage behind the luggage compartment had folded to the left but was otherwise generally intact. The engine tachometer and the pilot's wrist watch were found in the burnt out cockpit area. The tachometer was jammed at 2500 r.p.m. and the watch had stopped at 1804 hours. No other readable instruments were found. The only aircraft components found away from the main wreckage were the lower section of the starboard door, found to the rear of the starboard wing tip and small fragments of perspex in and around the scorched area in front of the aircraft.



The steep angle of the final dive and the lack of forward movement of the wreckage after the initial impact, indicated that the aircraft was out of control, and probably in a stalled condition. The wreckage examination did not reveal any defect which might have contributed to this loss of control. No significant variation in the engine noise was noted during the latter stages of the flight and the jammed and burnt out tachometer found in the wreckage was indicating in the normal engine operating range. Although the propeller had been subjected to intense heat after the impact resulting in further distortion of the blades, there was still evidence of impact damage suggesting that considerable power was being delivered by the engine when the aircraft struck the ground.

The pilot was 23 years of age and had held a private licence for two years. During this period he had accumulated approximately 160 hours flying experience — nearly all of it, including his flying training, in this particular aircraft.

From the available evidence there is little doubt that the pilot commenced a turn at low level around the south-western end of the strip and the homestead to allow the children on board to clearly see their parents and others on the ground below. The aircraft's angle of bank steepened as the turn progressed and it seems likely that the pilot intended to continue the turn to orbit at very low level around the group on the lawn of the homestead. To try and achieve this, and at the same time keep the people on the ground in sight, the pilot may have tried to pull the aircraft into an extremely tight turn so the banked high wing would not obscure the view from the cabin window. It is possible that the pilot would have been giving some of his attention to the people on the ground, and perhaps pointing them out to the children on board, during this progressively steepening turn.

The stalling speed of the aircraft would have increased rapidly as the turn steepened. Manual data indicates that the flaps-up stalling speed of this type of aircraft is 56 knots in a turn with 20 degrees of bank, rising to 62 knots at 40 degrees, and 76 knots at 60 degrees. Beyond 60 degrees, the stalling speed would, of course, increase even more rapidly. In the configuration in which the aircraft was found, with the flaps lowered between 10 and 20 degrees, the stalling speed in a 60 degree banked turn would be in the vicinity of 70 knots, increasing to 90 knots as the angle of bank steepened to 70 degrees. A steep turn of this order requires the full skill and the undivided concentration of the pilot to maintain a level flight path. In this case, with the aircraft turning at very low level over a group of people, it is most unlikely that the pilot would have been giving his whole attention to flying the aircraft.

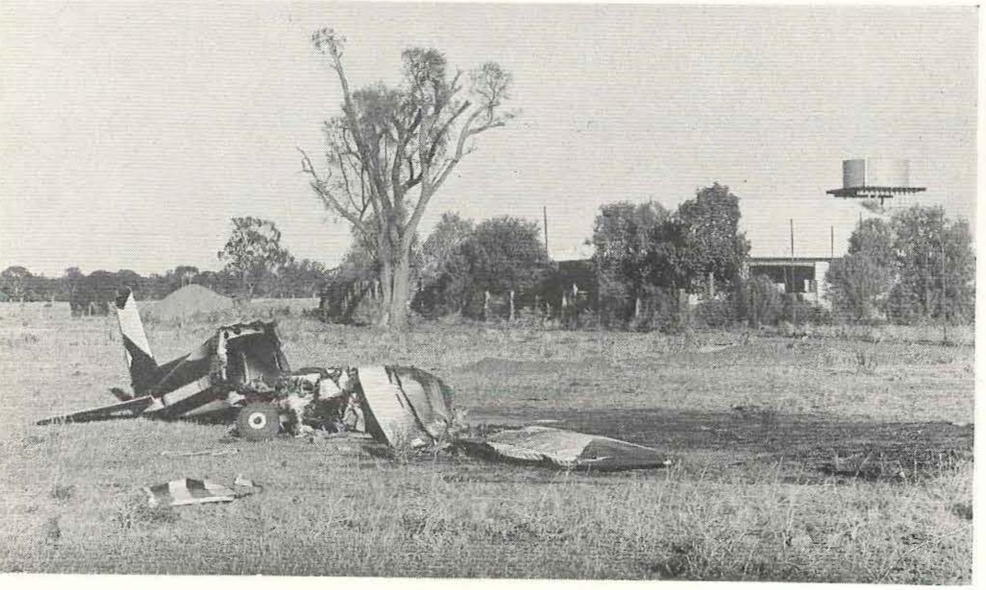
The loss of height involved in recovery from a stall, entered under such circumstances, is substantial, and when the sequence is initiated at only 200 feet, the outcome is a foregone conclusion.

There is an all-too-familiar ring in the analysis of the aircraft's flight behaviour up to the final dive and impact — it has all been said before in almost identical words. Indeed, just 12 months ago, the Digest published an account of a fatal accident that occurred in similar circumstances (see "Steep Turn, Low Altitude, Inattention", Aviation Safety Digest No. 43, September 1965). In this accident, only one of the four occupants lost his life, but only for the reason that the aircraft dived into water and not into solid ground.

As a sequel to that accident report, the Digest published a special article in the following issue, discussing the dangers of stalling and losing control during steep turns, and explaining the principles involved in the increase in stalling speed during turns (See "Watch Those Turns", Aviation Safety Digest No. 44, December 1965).

The engine tachometer as recovered from the wreckage. The needle is jammed in the 2,500 r.p.m. position.

The burnt out wreckage of the aircraft. The homestead around which the aircraft was turning is in the background.



There is one other consideration which, though it did not directly contribute to the cause of this accident, is nevertheless indicative of laxity in the pilot's flying discipline. The Flight Manual for the Cessna 175 states that the maximum number of occupants shall be four persons. Air Navigation Order 20.16.3.11 stipulates that two children may occupy one seat when their combined weight does not exceed 170 lbs., but in this case, the combined weight of the smallest two passengers was not less than 200 lbs. In carrying his four passengers, therefore, the pilot disregarded the requirements of the aircraft's Flight Manual and thereby contravened Air Navigation Regulation 112A(3).

A few months hence, will the Digest have the distasteful task of reporting yet another tragedy resulting from steep turns at low level? The Department will go on doing all it can to prevent such disasters, but the real answer to the question lies in YOUR hands.

FATAL DEMONSTRATION FLIGHT

At a country aero club in N.S.W., a visiting pilot was demonstrating a Cessna 172 he was hoping to sell to the club. Two young club members accepted an invitation for a flight, boarded the aircraft with the pilot and they taxied out for take-off. Five minutes later the aircraft was a heap of burning wreckage and all three occupants were dead.

The stage setting for this wholly unnecessary tragedy had begun the previous morning, a Saturday, when the pilot arrived with the aircraft to spend the weekend demonstrating it to club members. The weather deteriorated in the afternoon, and only about an hour's demonstration flying could be completed on the Saturday.

Next morning, the pilot arrived at the aerodrome at 1000 hours. After carrying out a daily inspection, the pilot invited the chief flying instructor to use the aircraft as he wished, but for the most part during the morning flew it himself, taking as passengers any club member who wished to go for a flight in the aircraft.

After lunch he made another flight, then handed the aircraft over to the chief flying instructor. The wind had strengthened and was now blowing from the west at about 15 knots with gusts in excess of 20 knots. As a result, the chief flying instructor found, during his approaches to land, that there was a severe wind gradient on the eastern side of the aerodrome, and formed the opinion that for students it was a "dual only" day.

When the chief flying instructor landed at the end of his second flight, the demonstrator pilot was waiting with another club pilot who wanted to try the aircraft. The chief flying instructor warned them to watch out for the wind gradient, and they taxied out, the club pilot at the controls in the left hand seat. The club pilot took off into the west, carried out a normal circuit, and turned on to final approach. Turbulence had been moderate but now as they approached, the aircraft flew into a severe downdraught. The downdraught lasted six or seven seconds and the pilot had to add considerable power to maintain a uniform rate of descent. A normal landing followed, and as they rolled to a stop on the strip, the demonstrator pilot invited the other to change seats and he would "show the boys these stall turns of mine". The club pilot declined and they taxied in.

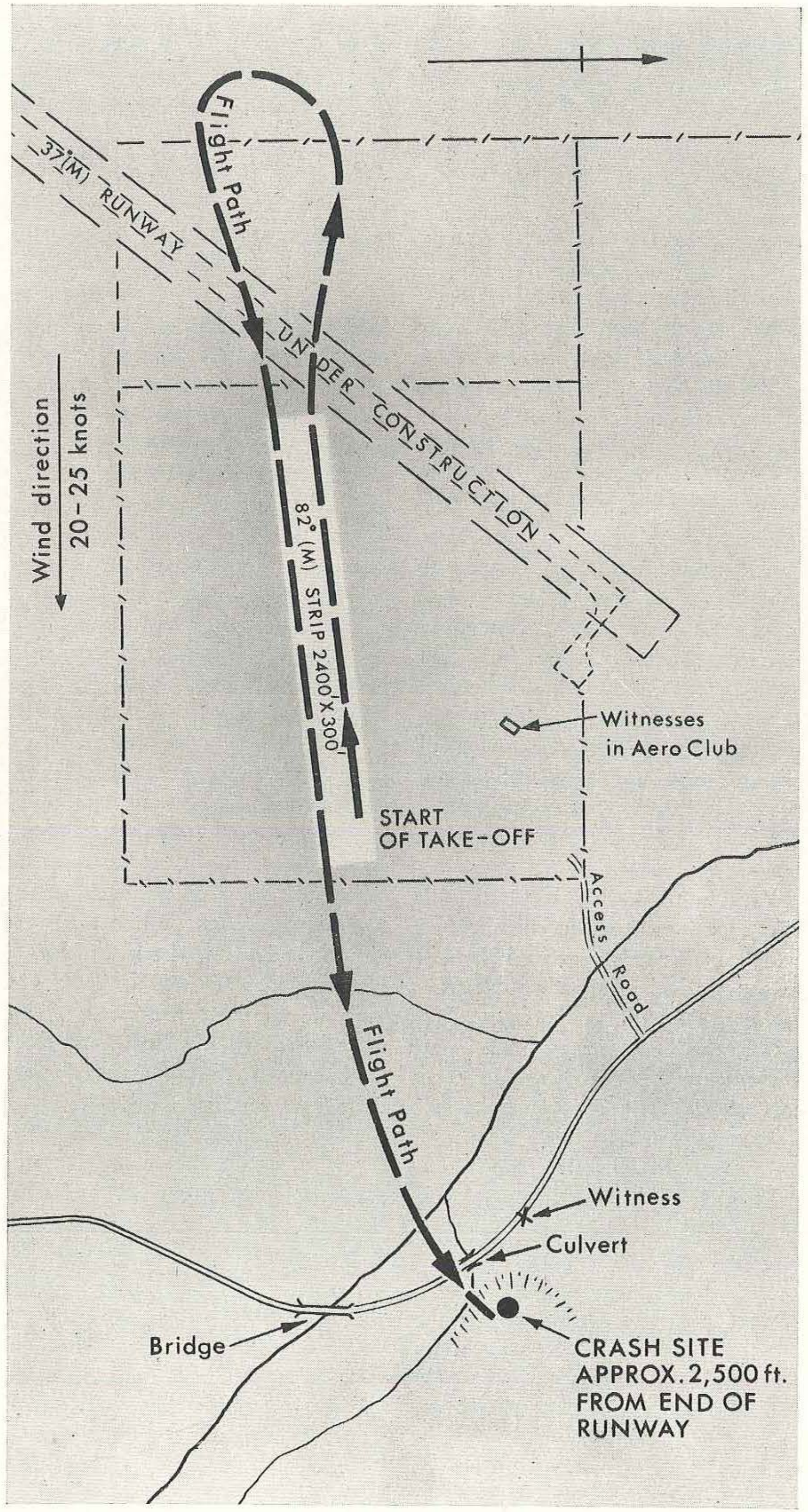
Back in the club house, the club pilot mentioned to other members he had been invited to go and do stall turns, but had refused because aerobatics made him airsick. Soon afterwards, the demonstrator pilot came into the building and issued a general invitation, "Who's for stall turns?" Two young student pilots agreed to go and the three left the club house.

Minutes later, pilots watching from the club house saw the aircraft take-off into the west. After it had climbed normally to about 500 feet, it performed a wing-over to the left and dived back towards the strip. The aircraft eased out of the dive as it crossed the aerodrome boundary and made a fast downwind run over the length of the strip at about 40 feet. Soon after passing the eastern boundary, it pulled up into a steep climb to some 300 or 400 feet and carried out what appeared to be a stall turn to the left. During the ensuing dive, the aircraft did not recover as the watching pilots expected, but with the nose still 60 degrees down, disappeared from sight behind an embankment and a few moments later black smoke rose up.

* * *

Subsequent examination of the burnt-out wreckage at the scene of the crash did not reveal any defect or malfunction which might have contributed to the accident. The aircraft had struck the ground while rotating to the left in a steep nose-down attitude, the initial impact being taken by the port wing. After the main impact,taken on the nose, the aircraft had bounced and slid for 30 feet and come to rest upside down.

In a statement later one of the club pilots who had witnessed the final manoeuvres of the aircraft, said that earlier in the day he and another passenger had accompanied the pilot on a flight over the town. Towards the end of the flight, as they were re-entering the circuit area at about 1500 feet, the pilot had pulled the aircraft up into a stall turn to the left then dived to cross the aerodrome at 150 feet. At the end of this run he had again pulled the aircraft up into a climb, allowed the speed to wash off, and then at 500 feet with a stall warning blowing, let the aircraft "drop off" to the left, closing the throttle as he did so. The pilot

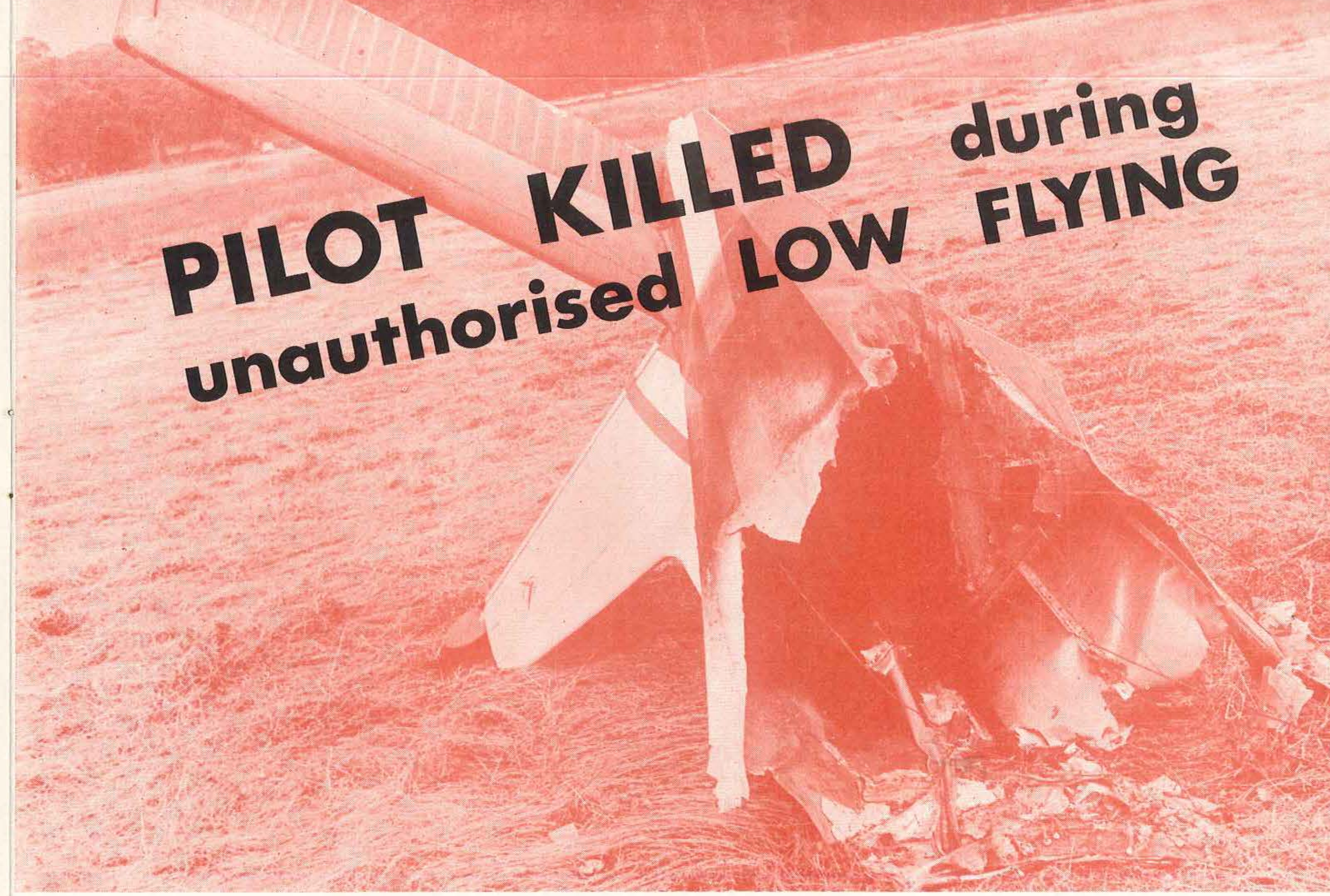


applied opposite aileron to level the wings as they dived almost vertically, then eased the aircraft out of the dive and landed straight ahead on the strip. The pilot had given the passengers no warning of his intention to perform these manoeuvres.

There is little doubt that when the accident occurred, the pilot was attempting to emulate this earlier performance. The reason why he didn't get away with it the second time is probably twofold; firstly, the pilot had begun the manoeuvres from climbing speed at only 500 feet, as against cruising speed at some 1500 feet on his earlier attempt, and secondly, the increased wind strength and the pronounced downdraught on the lee side of the aerodrome would have had the effect of increasing the amount of height required to recover level flight.

Good airmanship, caution and adherence to safety regulations are necessary ingredients of a safe operation and accidents of this type almost invariably point to omissions in these areas. This accident is no exception and other accidents covered in this issue of the Digest follow the same pattern. In this instance there is no better summary than the following quotation from the formal conclusions of the investigation:

> "The pilot carried out an acrobatic manoeuvre which was prohibited under the terms of the aircraft's Certificate of Airworthiness and in doing so he contravened Air Navigation Regulation 131(2)(b). The acrobatic manoeuvre was carried out at a lower height than 3,000 feet above the highest point of the terrain, countrary to the provisions of Air Navigation Regulation 131(3)(a).
> CAUSE: The probable cause of the accident was that the pilot attempted an acrobatic manoeuvre at an unsafe height."



PILOT KILLED during unauthorised LOW FLYING

It was a fine spring morning at an aerodrome in northern Victoria. Soon after 0900 hours a young pilot member of the local aero club, arrived to do some flying. The chief flying instructor was away for the day and only the office staff were in attendance at the club's office, but a part-time club instructor, who also ran a business in town, was on call for any instructional work that might be required. At the pilot's request, the club office telephoned the instructor to obtain his approval for the pilot to take one of the club's Victa Airtourers for a local flight. The pilot held a restricted private licence so the instructor authorised the flight verbally and requested the pilot to check the aircraft, and in particular the fuel before he departed. The pilot carried out a flight lasting an hour and 40 minutes, and returned and landed at 1120 hours.

After lunch, at about 1400 hours, the pilot presented himself once more at the aero club office and sought permission to make another flight. Again the office rang the instructor and obtained his authorization for the flight. The pilot signed the club's daily flying statement, indicating he accepted the aircraft for a local flight in the training area, and that it had 12 gallons of fuel on board. Very shortly afterwards, he climbed into the aircraft and started the engine, taxied out and took off.

Thirty miles to the south-east, in a valley at the foot of the northern slopes of the Great Dividing Range, a young farmer was mowing a paddock on his father's property. Suddenly, the whine of a light aero engine drowned the noise of his tractor and a Victa Airtourer flew very low in front of the tractor's path. The aircraft's sudden, unexpected arrival came as no real surprise — he knew who the pilot would be. The pilot was engaged to his sister and a number of times in the past few weeks had flown low over the property, waggling his wings. The young farmer got on well with his prospective brother-in-law and on one occasion had gone flying with him in the Victa.

The aircraft seemed to be flying nearly straight and level as it flashed across in front of him. He turned his head to follow it and was shocked to see it slice through a single-wire power line running parallel to the tractor's path. The power cable snapped and fell to the ground and at the same time the engine noise ceased abruptly. The nose of the aircraft rose, the port wing dropped and the aircraft rotated to the left and struck the ground with the starboard wing tip. The wing crumpled, the nose slammed into the ground and the wreckage skidded to a stop and caught fire. Jumping from his tractor, the farmer ran towards the burning aircraft. As he approached there was an explosion in the wreckage and the flames leapt up more fiercely. He ran to the homestead for assistance.

Minutes later, the manager of the adjoining property, who had also seen the aircraft crash, reached the scene. The wreckage was still well alight but the height of the blaze had passed. He pulled away the port wing, still on fire at the root, the tail assembly and the blazing cockpit canopy, then covering his hands and face with clothes, dashed into the burning wreckage and dragged the pilot free. It was too late.

* * *

The manager said later that at the time of the crash he was working in a cattleyard near his house about a quarter of a mile south of the crash site. He saw the aircraft, lower than normal, approaching from the west. It passed just to the south of his position and turned on to a northerly heading. The engine note decreased and the aircraft entered a shallow dive. As it descended, the wings "moved up and down fairly rapidly". The manager watched the aircraft until his view of it became obscured by trees. A moment later there was a loud "twang" from the single-wire power line that ran from his house northwards in the direction the aircraft had taken and the power line vibrated violently. The aircraft came into sight momentarily, apparently in a steeply banked diving turn to the left. It disappeared from view again and there was a noise like an explosion. He at once began to run to the scene of the crash.

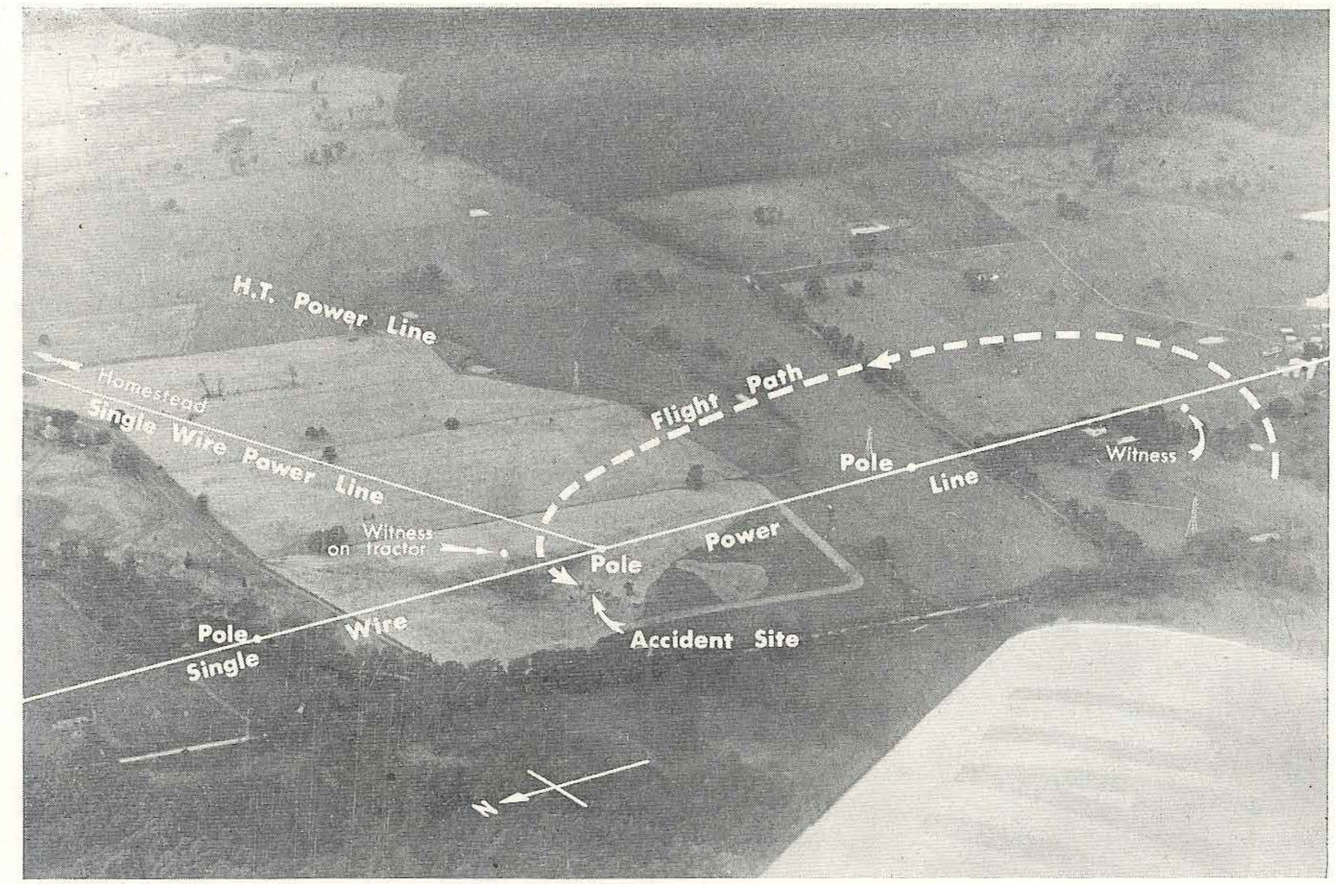
Examination of the wreckage, and impact marks on the ground, showed that the aircraft had struck the ground first with the starboard wing, while in a steep nose-down attitude. The first point of impact was 210 feet beyond the broken power line. The wreckage had then bounced and slid for 30 feet before coming to rest. The tail section and the outer port wing, which had been pulled away from the fire in the attempt to save the pilot, had sustained relatively little damage, but the remainder of the aircraft had burned to destruction. There was, however, no evidence to suggest that a loss of engine power or any defect in the airframe had contributed to the accident.

Although there were no impact marks on the virtually intact port wing and tailplane, or on the propeller, some 12 feet of the broken power line was smeared with paint matching the colour on the wing and tailplane. The destruction of the starboard wing by fire was too complete for any impact marks to be recognisable, but it is evident that it was this part of the aircraft that struck and broke the wire.

The power line that the aircraft struck is one of two single-wire branch lines crossing the property. The height of these branch lines is 36 feet. A main high-tension line, carried on steel pylons 120 feet high, also crosses the property 200 yards south of where the accident occurred, and the aircraft would have passed over this main line as it dived towards the tractor. (See flight path photograph.) Although the main power line would have been clearly visible to the pilot, the lower, single wire line would have merged with the background and been almost impossible to see from the aircraft.

The pilot was 20 years of age and held a restricted private licence. His total flying experience amounted to 130 hours, of which more than 50 had been flown in Victa aircraft. As the holder of a restricted licence, the pilot was authorised to fly "in command" only within five miles of his departure aerodrome or within the confines of the flying training area assigned to that aerodrome, except when engaged in an approved solo cross-country navigational exercise. The point where the aircraft crashed is some 16 miles beyond the boundary of the training area concerned, and as the pilot had not been authorised to make a solo cross-country training flight, his action in flying outside the area was a breach of Air Navigation Regulation 50(1). There was ample evidence that the pilot was familiar with the boundaries of the training area and with the limitation endorsed on his flight crew licence.

Giving evidence during the investigation, the owner of the property on



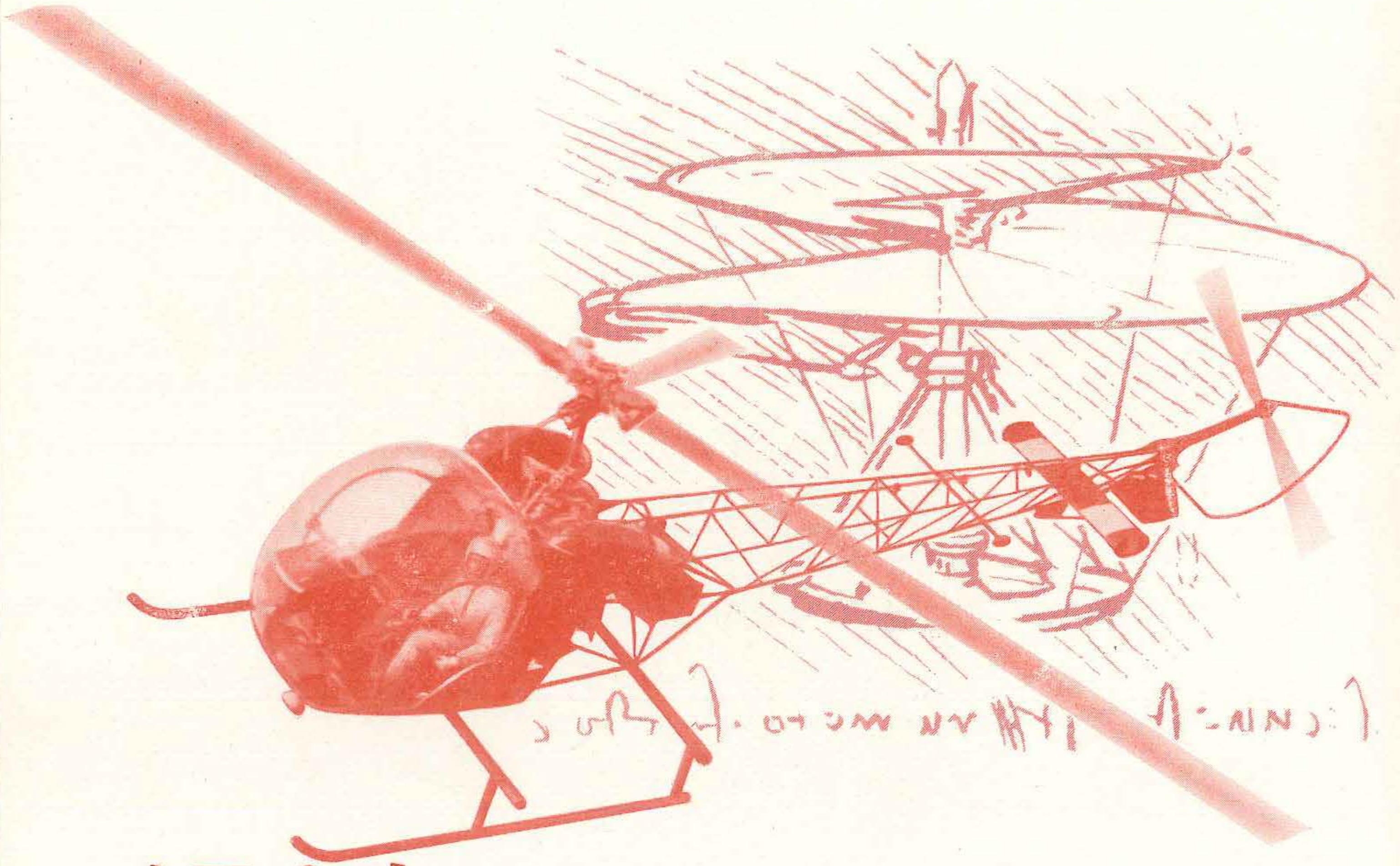
Aerial view of accident site showing approximate final flight path.

which the aircraft crashed, to whose daughter the pilot was engaged, said that the pilot had formerly worked on his property for several months and would have been familiar with the positions of the power lines. In the weeks preceding the accident, the pilot had flown low over the property on a number of occasions, and had made a practice of waggling the wings at any member of the family he happened to see working there.

The son of the owner, who was driving the tractor when the aircraft crashed, also gave evidence that the pilot had frequently flown low over the property, waggling the wings. He said the pilot had also flown low at one stage of a flight that he had made with him three weeks before. Normally, however, the pilot did not come lower than just above the height of the main power line pylons, which cross the property, and are about 120 feet high.

The evidence given by the manager of the adjoining property, describing the last minute of the fatal flight, is consistent with the pilot throttling back the engine and diving towards the tractor driven by the son, waggling his wings as he did so to attract attention. Whether the collision with the power line resulted from an error of judgment or was the result of the pilot forgetting and failing to see the wire in time to take avoiding action, could not be finally determined. The evidence of the investigation quite clearly indicates, however, that the pilot ignored the area limitations endorsed on his pilot licence and then flew the aircraft over the property of his prospective father-in-law at an unsafe height, in disregard of Air Navigation Regulation 133(2)(b).

The accident is another sad example of a pilot failing to appreciate that Regulations are framed to prevent such accidents and failing to recognise that his skill was not commensurate with his own estimate of his ability.



V.T.O.L. — then and now

Helicopters today in Australia, as in other parts of the world, are a familiar part of the aviation scene. Indeed, so commonplace have they become, and so essential to a great variety of specialized tasks, that it is sometimes difficult to realize how recently the helicopter has become a practical reality. Yet although it has come into prominence in this way only over the past few years, the helicopter is, in fact, the result of centuries of development.

On his death in 1519, the renowned philosopher-scientist of the Renaissance period, Leonardo da Vinci, left nearly 5,000 pages of manuscript, etc., revealing his extraordinary imagination and wide range of interests. Not the least of his talents was devoted to the theory of flight — the flight of man — hitherto a dream existing only in mythology and imagination. About 1500 he designed the world's first helicopter, or, as it was known then, the Helixpteron — "helix" meaning spiral and "pteron" meaning wing. That the Helixpteron became no more than a drawingboard notation lay more in the fault of the age rather than the designer.

From the time that da Vinci sowed the seed of vertical flight, history has been marked by developments and failures as man probed the potentialities and uncertainties of celestial freedom. Significant milestones in helicopter development, however, were few and far between until the early 20th Century brought Juan de la Cierva into the field. Hitherto, designers working on rotary aerofoils had been plagued by an inexplicable tendency for their crude models to roll uncontrollably to one side as soon as horizontal flight was attempted. The reason for this, as Cierva correctly deduced, was the fact that on a rotor in forward flight, the advancing blade moves at a velocity of the blade rotational speed plus the aircraft's speed, whilst the retreating blade has a velocity of the blade rotational speed minus the aircraft speed. This produced a lopsided lift effect over the rotor disc which resulted in a startling chain of slow rolls in early helicopter flights. But, beginning with the introduction of Cierva's corrective "flapping hinge" mechanism, rotor craft have been evolved and improved to the stage where there are now many thousands of advanced VTOL aircraft in operation.

The evolution of the helicopter from the time of da Vinci to the present day, spans some 450 years. But what of the men in whose hands the success or otherwise of all these operations has finally rested — the helicopter pilots themselves? Can we trace the development of the pilot in the same way as we can the complex machine he flies? Perhaps at least we can draw an analogy, embracing a much wider span of time, if we start with the mythical Icarus who is alleged to have flown for a time with feathered wings waxed to his back! For in one unfortunate respect there *is* a distinct parallel between this hero of Greek mythology and today's helicopter pilot. Like Icarus who, bent on glory, flew too close to the sun only to plunge earthward after several pounds of wax had melted from his wings, so too do many of our present-day helicopter pilots display similar indiscretions. As a nett result, helicopter operations in Australia have been marred by an unfortunate history of major and minor accidents, as illustrated by the following table. Certainly some of these occurred as the result of mechanical failure, but a high percentage can be attributed to the pilots involved.

Year ending	No. of Helicopters on Australian Civil Register	Major accidents resulting in substantial damage; or complete destruction of the aircraft	Proportion of major accidents to total Helicopters on Register
Jan. 1961	12	3	1:4
1962	14	2	1:7
1963	19	3	1:6.3
1964	30	4	1:7.5
1965	41	11	1:3.7

As can be seen, these accident figures do not take into account the numerous reported minor accidents and incidents that also cloud the industry. What is the reason for this high proportion of destruction on a type of aircraft with such recognised safe handling characteristics? We are all painfully aware of the disadvantage inherent in fixed wing operations in having to maintain a minimum airspeed to sustain flight, but with the helicopter, this difficulty has been reduced to a minimum. Surely then, a far better record might be expected.

We believe that the problem of the helicopter's high accident rate is primarily one of airmanship coupled with critical operating conditions. If the standard of the former can be raised to a sufficiently high degree, the effect of the latter will be minimised. From this viewpoint, therefore, let us examine three basic manoeuvres, at least one of which is nomally employed in some form during field operations by the helicopter pilot. We offer comments on each—not suggesting that they are comprehensive summaries but rather points which should be considered by the pilot during that particular operation.

CONFINED AREAS

"In attempting a take-off from a clearing situated amongst trees, the pilot lost translational lift due to incorrect assesment of operating conditions. The helicopter struck a tree and crashed to the ground."

(D.C.A. Accident Summary.)

Any consideration of confined area operations must include landings as well as take-offs. Although the actual take-off phase is the more critical in a confined space, any such take-off has, of course, to be preceded by a landing. Having made the landing, the pilot is then virtually committed to the take-off. Thus, the decision to land in a confined space is also a highly critical one, and, wrongly made, can indirectly be a factor contributing to a take-off accident. For this reason the two operations should be considered together.

What happens then when a pilot decides to make a landing in an unprepared clearing? Does he make a quick "eyeball" appreciation then commit himself to an approach? Is his subsequent take-off from the site just as perfunctory? Or does he set about the whole operation with the professional approach that both the expense of his machine and the lives of his passengers warrant? Unfortunately, in many cases the old maxim "Familiarity breeds contempt" prevails, and in the interests of false economy or downright laziness, the first method is employed.

Operating a helicopter in a confined area requires a high degree of handling skill, plus a comprehensive understanding of the aircraft's performance and capabilities. Sound judgment of obstacle gaps, wind velocity and direction, approach and take-off gradients, density height, etc., requires many hours of field experience. It is good practice for a pilot to develop, and adhere to, a suitable standard drill when flying confined area operations. To be worthwhile, such a drill should include the following checks:—

High Reconnaissance:	Check for wind (velocity, direction and gradient), availability of forced landing areas, obstacles, ground condition (surface, slope).
Low Reconnaissance:	(Incorporated in Approach): Confirm high reconnaissance findings, select touchdown point, gauge wind effects. IF DOUBTFUL — OVERSHOOT.
Ground Reconnaissance:	Confirm wind direction, plan take-off path, plan hover path, lay guide markers if necessary when manoeuvring close to obstacles.
Take-off:	Perform magneto check, pre-plan abort action to be taken in event of emergency.

Confined area operations have taken toll of more aircraft than any other manoeuvre in helicopter aerial work. If in doubt about the outcome, don't attempt the landing; undersell the helicopter rather than oversell yourself!

PINNACLE OR MOUNTAIN OPERATIONS

"During practice high altitude take-offs and landings from a mountain ridge in strong wind conditions, the pilot failed to correct for lateral roll on lift-off. The main rotor struck the ground causing the helicopter to overturn." (D.C.A. Accident Summary.)

What is there about a mountain landing that creates problems for helicopters? Firstly, there is usually an associated confined area problem such as that discussed in the preceding section. Secondly, there is the high density altitude usually encountered in mountain flying. Finally, and probably most critical, there is the turbulence almost inevitably associated with helipads located in mountainous or rough terrain.

As with confined area operations, the time spent during the aerial reconnaissance phase of the manoeuvre is a good investment. If there is any doubt about the helicopter's performance at the high altitude, it is a good policy to perform a power check — a slow flight at 40 to 45 knots over the pad at about 100 feet will give a good indication. If the engine power still in reserve during this manoeuvre is less than three inches of manifold pressure, there will most likely be insufficient power for landing and taking-off. This, of course, is a rough guide only and it will vary slightly from aircraft to aircraft.

In anything in excess of light wind conditions, there will probably be turbulence and wind gradient effects. It is a good rule, therefore, when approaching a pinnacle in such conditions, to make the approach slightly out of wind (see diagram). This keeps the helicopter out of the turbulence for as long as possible and also allows for better manoeuvrability in the event of an engine failure.

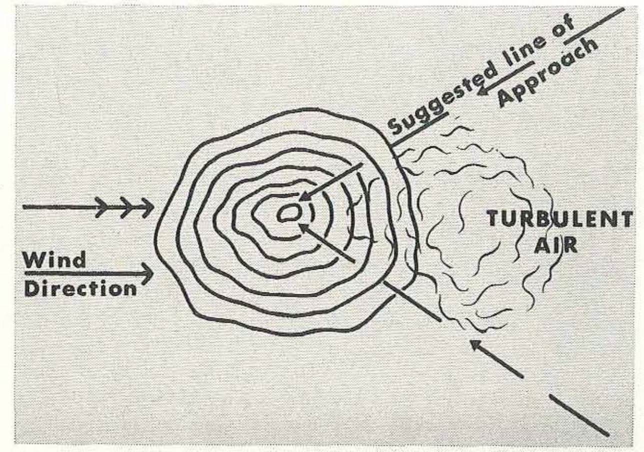


Diagram illustrating approach path recommended for a landing on a pinnacle. By approaching slightly out of wind the helicopter is kept away from much of the turbulence in the lee of the pinnacle.

On take-off, a loss of lift may be encountered as the helicopter moves from the pad over the edge of the pinnacle and leaves the ground cushion. In these circumstances, airspeed is more important than height, and a nose down attitude will have the dual advantage of quickly gaining airspeed and also lifting the tail boom clear of the edge.

CRITICAL LOAD CONDITIONS

"During a running take-off from a clearing, the aircraft was lifted off the ground below effective translational lift. Further application of collective pitch resulted in rotor r.p.m. decay and the aircraft struck trees." (D.C.A. Accident Summary.)

As the seasoned rotary wing pilot will know, the situation may be encountered where a helicopter is correctly loaded within all-up-weight limitations yet has insufficient power to hover. The reason for this, of course, is a combination of high gross weight, high density altitude and calm wind conditions. By referring to the performance chart for the aircraft, the take-off or landing distance to clear a 50 foot obstacle may be obtained. Nevertheless, there may be occasions where such a chart is not available, or even produced, for that particular helicopter operation. In this case, a landing or a take-off should only be attempted in an emergency situation.

To perform a successful running landing, the condition of the landing strip surface must first be accurately determined. If the area is unfamiliar, make a low flight reconnaissance over the touchdown area. A slippery grassed surface is perhaps the ideal, while dry rocky ground should be treated with the utmost caution. Ensure that, prior to touchdown, the helicopter maintains translational lift. During the actual touchdown run, direction may be maintained by cyclic control, and heading by anti-torque control — provided, of course, that rotor r.p.m. is maintained until the ground run has ceased. Soften the touchdown by a small application of collective pitch and ensure that the skids are level and aligned along the direction of flight.

The take-off run should employ the maximum distance available into the prevailing wind, if any. Lift the helicopter off the ground as soon as practical after translational speed has been obtained — this reduces drag and increases manoeuvrability. Pay close attention to manifold pressure; overboosting and overpitching is a prevalent malpractice during this phase.

Where density height and all-up-weight are critical, keep control changes in flight to a minimum and where possible make all turns at half rate with the airspeed restricted to a slow cruise. This reduces the possibility of retreating blade stall, a condition that could develop quite easily with the rotor blades working at the large angles of attack inevitable in critical circumstances. If there is any doubt whatever as to the ability of the helicopter to perform within prescribed limits during and after take-off, the wisest action any pilot can take is to reduce the payload. It pays dividends in the long run.

* * *

It may be argued that this discussion barely scratches the surface of the subject and some competent rotary wing pilots may feel justified in criticizing it as "teaching one's grandmother to suck eggs". If this is so, perhaps we can be pardoned if we point out that the flying experience of the 23 pilots who were involved in the major accidents listed on page 11 averaged 4046 hours per pilot!

The helicopter industry is a rapidly changing one and pilots should aim to keep pace with the new capabilities and limitations that the modern helicopter presents. Development, in most cases, breeds complexity, and this in turn requires constant familiarity with the aircraft for efficient and safe operation.

It is a temptation to become blase about helicopter flying; it is easy to become dangerously overconfident. Unfortunately, in these aircraft, is not quite so easy to get out of an emergency situation resulting from an error of judgment. A higher standard of pilot technique, coupled with a greater sense of responsibility, will go a long way towards improving the present rather dismal helicopter accident record.

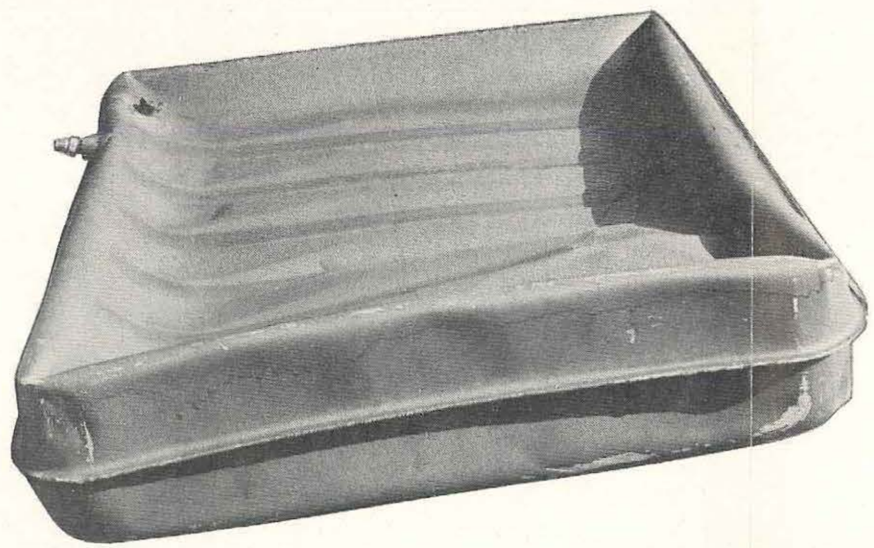
Aviation Safety PICTORIAL

GONE WITH THE WIND *(Left)* Beware now that boisterous equinoctial weather is with us again! This is what wind did to a privately owned Tiger Moth, despite the fact that it was tied down! Last year two agricultural aircraft, both Cessna 180's, also suffered. One, parked on a strip while storms were moving through the area, was swung from its position by a sudden wind squall and the port wing was dashed against a tree. The other 180, was parked with wheels chocked and brakes hard on, on a strip in hilly country while the pilot was helping his loader-driver make repairs to their vehicle. The wind, which was blowing across the strip, increased to over 20 knots while they were working causing the aircraft to jump the chocks. Blown by the wind, it then skidded down into a deep gully to one side of the strip, tearing off the tail plane and one undercarriage leg.

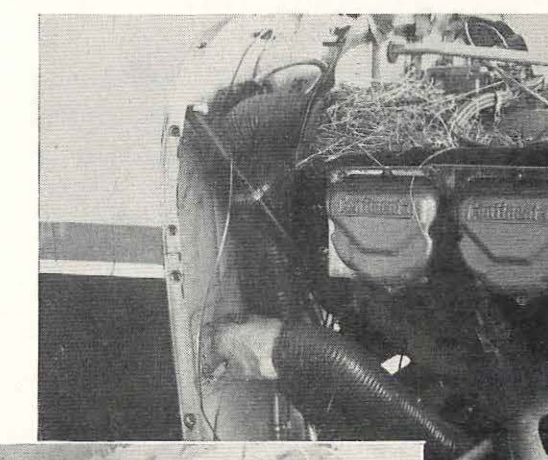
DON'T BE IN SUCH A HURRY *(Right)* The pilot of this Mooney retracted the undercarriage immediately it became airborne on take off from Perth airport. The aircraft sank as the wheels came up; the propeller hit the runway, and the pilot carried out a wheels up emergency landing straight ahead. Damage was confined to the bent propeller and minor abrasions to the underside of the fuselage. The pilot evidently retracted the undercarriage before establishing a positive rate of climb. The Mooney owner's handbook states "on take-off, do not touch the (undercarriage) handle . . . until you have a safe airspeed and are sufficiently high above the runway to avoid sinking back on the ground." The pilot admitted he had been making a practice of raising the undercarriage immediately the aircraft became airborne.

COLLAPSED FUEL TANK *(Right)* This was what a L.A.M.E. found when he inspected a Cessna 337 at Port Moresby after the pilot had reported that the fuel gauge was inaccurate. Wasps were the culprit. They had built a mud nest in the air vent line, and as fuel was drawn from the tank, atmospheric pressure compressed the walls of the tank, substantially reducing its capacity.

A similar incident a few months ago led to a complete loss of power on one engine of a Piper Twin Commanche. This time distortion of one rubber fuel cell caused the contents gauge to indicate ¾ full when it was actually empty. The pilot was able to re-start the engine after switching tanks. After landing a visual check of the offending tank vent did not reveal any sign of an obstruction, but a piece of wire poked up the vent dislodged a wasp's nest deep inside the wing.

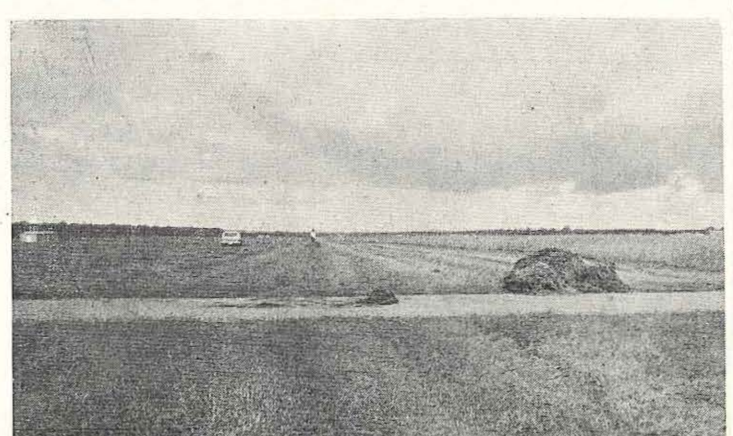


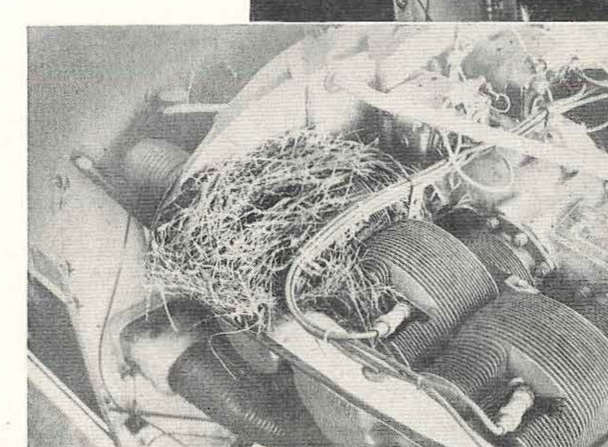
BIRDS AMONGST THE BARRELS *(Below and Right)* And making themselves at home too! This is but one of several instances of birds trying to nest inside the cowlings of aircraft left in the open, in some cases for only a few hours! On one occasion, the nest had been built in the air intake hose leading to the exhaust muffler shroud, and it caught fire when the engine was shut down after a cross-country flight. The fire was quickly doused with a C02 extinguisher. The pilot had made a complete pre-flight inspection before taking off and had not seen any obstruction in the air intake. The nest had evidently been built well down the air intake hose and out of sight.



UNUSUAL OBSTRUCTION *(Below and Right)* The mown grass shown in these airport pictures was responsible for delaying a Britannia for two hours. The aircraft was taxi-ing to the terminal when mown grass at the edge of the taxiway was caught in the slip-stream and ingested into the engine where it obstructed the engine air intakes. The presence of the grass in the engine was not detected until the aircraft was preparing to take-off.

It is probably not generally realised that mown grass can pose an ingestion hazard to all turbine powered aircraft and to turbo-props in particular. This is especially so when large aircraft are using narrow taxiways and grass at the sides is freshly mown. Mown grass can also pose a problem with helicopters if it is whipped up by the rotor wash and drawn into air intakes.



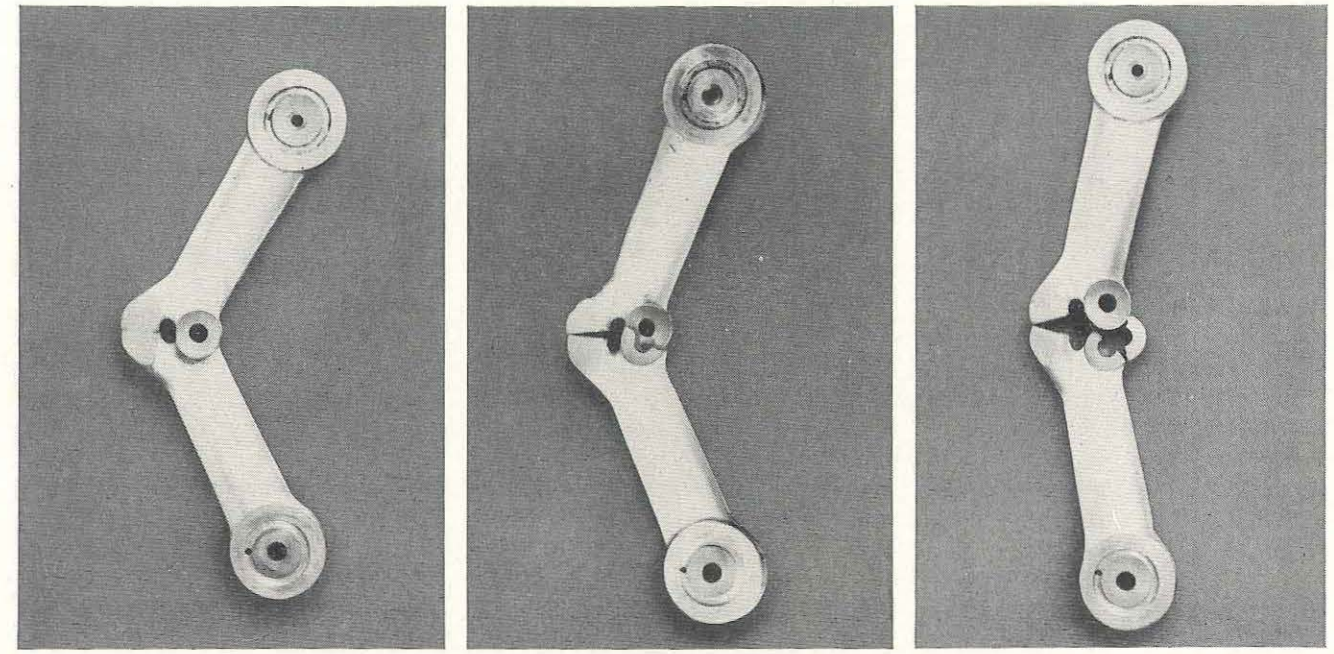


OLEO LEG . . . Maintenance on light aircraft

Analysis of a number of accidents to aircraft that have involved the failure of oleo shock absorber undercarriages, indicates that incorrect maintenance is frequently a contributory cause. The most common fault has been lack of oil in the strut, leading maintenance staff to over-inflate the strut to restore it to its correct inflated length as measured on the exposed portion of the piston tube. The purpose of this article is to explain, in general terms, the basic principles of the oleo shock absorber strut and to emphasise the necessity for maintaining the oil level and air pressure within the proper limits. The article is not intended to descibe any particular strut, since there are several types in common use today and the same general principles apply to them all. Rather, it is concerned with correct day to day maintenance by pilots and maintenance engineers, many of whom may have gained the bulk of their experience on aircraft with undercarriages employing rubber shock cord, coil spring, or spring steel, shock absorber equipment.

The shock absorber struts used on the majority of the popular light aircraft today consist basically of two steel tubes, the large one being generally referred to as the cylinder, and the smaller one as the piston. The piston is usually retained in the cylinder by either a large circlip or a gland nut on the lower end of the cylinder, although on at least one type there is no mechanical stop within the strut itself. The circlip or nut, where fitted, forms a stop for the piston, but is not usually intended to carry any of the loads imposed when the strut is in operation. In service, the extension of the strut is generally limited by torque links, attached to the strut to also prevent the piston rotating within the cylinder. Finally, an oil tight seal is provided on the lower end of the cylinder, between the cylinder and piston tubes. The assembled strut is installed, with the upper end of the cylinder fastened to the aircraft structure and the wheel assembly located at the lower end of the piston tube.

Filling instructions for oleo struts are usually set out in the maker's manual or may be found on a plate attached to the strut. Hydraulic fluid is poured in through the air valve plug hole at the top of the cylinder with the strut *fully compressed* and upright, until the strut is completely filled. With the strut still vertical, the piston



Torque links as fitted to some types of light aircraft oleo legs. The sequence shows how the links can be fractured in over-extension, as is likely to occur if the return stroke of the oleo leg piston is not adequately dampened. The torque links are fully extended in the photograph at left. Fracture of one of the links is inevitable as they are forced beyond this fully extended position.

is then pulled right down to the cylinder stop and pushed back to the fully compressed position. This process should be repeated several times to ensure that air has been completely purged from the strut, after which the oil level should be checked again with the strut compressed, and oil added, if necessary. When filling some types of struts after assembly, it is essential that the torque links be disconnected to ensure that the piston can be moved all the way down to the stop in the cylinder. If the torque links are left connected while these struts are being filled, the piston will not go down sufficiently far to allow the oil to displace all of the air, and there will be an air space below the piston. This space must be filled with oil and the procedure outlined will ensure that it is done. Once the strut has been correctly filled, however, it is not necessary to disconnect the torque links during routine maintenance inspections, unless, of course, the strut packings leak and allow the strut to lose a large quantity of oil.

When the strut has been correctly filled, the air valve plug is replaced and the torque links where fitted are re-connected. Then, with the aircraft standing on its wheels empty, the strut is inflated until the piston extends to the length specified by the makers. Checks should be made for air leaks around the valve and for oil leaks around the lower end of the cylinder.

The strut contains an oil metering system which not only controls the rate of compression when the strut is loaded heavily, as in a hard landing, but restricts the rate at which the strut extends again. This ensures that the energy absorbed by the strut in a very short period of time is released at a much slower rate. If this feature were not present, the strut would release the energy at the same rate that it absorbs it, causing the aircraft to bounce. It would also cause the piston to move rapidly and under very high pressure, to the extent permitted either by the piston mechanical stop or the torque links. This would ultimately lead to fracture of the torque links and/or the failure of the gland nut or circlip in the lower end of the cylinder. The inevitable end to this sequence is that the piston and wheel drop out of the cylinder and separate completely from the aircraft, and the pilot is left with only the cylinder in place of a wheel on which to make the best landing he can.

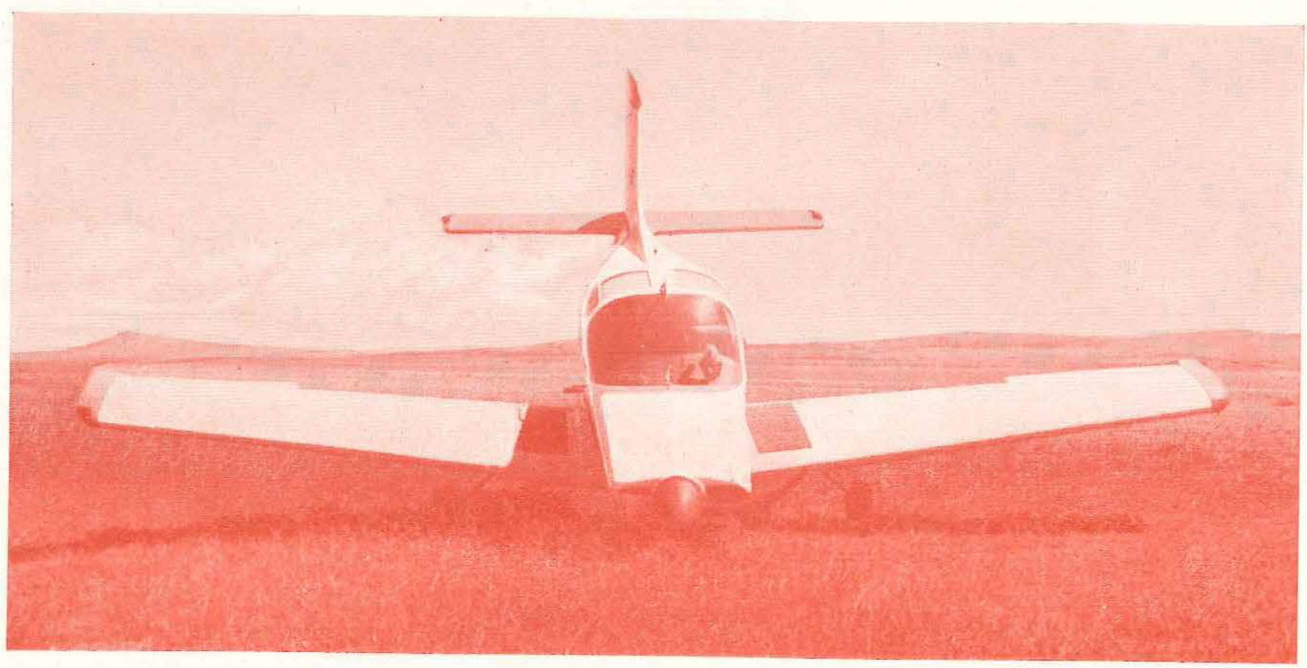
With a properly filled and inflated strut, the stroke of the piston is such that it will accept landing shocks before it reaches the full extent of its inward travel, or "bottoming" as it is more colloquially known, and there will be sufficient oil for the metering mechanism to control the strut during the return to its normal position. If the oil level is permitted to fall below the specified level, the recovery stroke will not be properly controlled and the conditions leading to the failures already described will be initiated. It naturally follows that the lower the oil level, the sooner the failure will occur.

Once the strut has been properly filled, it is usually sufficient to deflate it periodically and check that with the strut fully compressed, the oil level is as recommended by the makers. This check can be conveniently carried out during 100 hourly inspections, but should be made more frequently if there is reason to suspect oil is leaking from the strut. Any leakage will most probably take place on the piston tube and since leaks develop fairly rapidly once they reach this stage, it is advisable to have the strut inspected and, if necessary, overhauled whenever leakage is evident.

Having discussed the function of the oil in the strut, the work done by the air compressed in the strut may now be considered. Its purpose is much the same as a spring; providing a cushion for the aircraft to ride on during ground operation, as well as sharing in absorbing the landing shock. It also serves to return the strut to its fully extended position against the friction of the seal and packings when the aircraft becomes airborne. If the strut is under-inflated, it will compress to a greater extent on landing, and in extreme cases the limit of travel will be reached. A strut in this condition leads to mishaps in the form of damage to the airframe, bent propeller tips, ground looping, etc. Over-inflation restricts the movement of the strut in that it is forced continually against the maximum extension of the torque links or the mechanical stop within the strut itself, and the end result of this battering is much the same as if the oil level were too low.

Neglecting oleo strut maintenance has been responsible for at least three very expensive accidents, two of which could easily have inflicted serious injuries to the occupants of the aircraft. It would be hard to say how many cases of minor damage, such as bent propeller tips, have resulted directly and indirectly from this same cause.

Oleo undercarriage struts work hard. Give them the attention they deserve and avoid adding to the Department's accident statistics!



Pilot Contribution

COMPLACENCY can be COSTLY

To a private pilot with several years' Service experience behind him, a flight from Bankstown to Canberra looked "a piece of cake". But an embarrassing surprise brought home the fact that piloting ability alone is not always enough! It is to his credit that he has written this frank account to spare others a like predicament.

I had planned to fly a club aircraft from Bankstown to Canberra and return, VMC below 5,000. As I have held a private licence for eight years and flown some 2,000 hours, most of it in Army light aircraft in Australia and South-East Asia, it might have been expected that any tendency to negligence on my part would long since have been eliminated. But as subsequent events showed, this was far from the case!

Always having had plenty of radio equipment in service aircraft and always, on previous occasions, having had the *right frequencies* in civil aircraft I had flown, I made out my flight plan, entering "RUT VHF and RUT HF* in the appropriate spaces, without knowing whether these frequencies were fitted to my aircraft or not. Mistake No. 1! When I had finished, I handed my plan to the briefing officer. Next to the words "RUT VHF" he wrote "118.7 and 121.7", explaining that these frequencies were now mandatory for aircraft operating into Canberra. I nodded my head wisely and assured him that I had them. Mistake No. 2! The briefing officer handed me copies of all the relevant Notams, which I placed in my "nav" bag with a knowing nod, but without so much as a glance. Mistake No. 3! I was to read these Notams, very much the wiser, on my way back to Bankstown later in the day. My complacency continued to assert itself during my pre-flight checks, and I finally departed Bankstown still not having verified the frequencies in the aircraft's V.H.F. equipment.

By the time I was abeam Goulburn, however, all this was forgotten. The aircraft was on track, on time, and everything was seemingly on the ball. I was thoroughly pleased with myself and looked forward to a cup of coffee in Canberra. It was not until I was approaching the Canberra Control Zone boundary and Sydney instructed me to call Canberra on 118.7 that my embarrassment began. At this stage, rather than admit to Sydney that I had found that I did not have 118.7, I acknowledged, then began a frantic search for an alternative frequency; I looked in my R.A.A.F. en route chart (three months out of date) and to my delight saw 3023.5 listed. I began calling Canberra on this frequency.

By this time I had reached the zone boundary and needed a miracle to save face, so dismissing my private thoughts about Canberra Tower's tardiness on 3023.5, I switched over and called them on 121.7, their ground control frequency. Mistake No. 4! I managed to contact Canberra on 121.7 and asked if they were listening on 3023.5. To my horror, I was promptly informed that this frequency had been removed from service more than two months previously! In a small, unconvincing voice I asked if I might enter the zone on the ground control frequency. Their very definite "Negative" was only what I expected and deserved. I turned on to a reciprocal heading and set course back to Bankstown. During the flight home I took out the disregarded Notam sheets and there, sure enough, was the statement that 3023.5

* Standard Abbreviation for "Route Frequencies".

had now been removed from Canberra. My embarrassment was complete.

The trip, as it turned out, was not entirely wasted. Even though I didn't actually get to Canberra, at least my experience benefitted, and it forcibly drove home a few points which I think are worth passing on:—

★ Before making any future trips I must make sure I have the correct frequencies, and note those that I have, as well as those that I will need, on my flight plan.

★ Notams and other amendments to issued aeronautical information, are only made available for the benefit of myself and other pilots, so why not use them?

★ Briefing Rooms provided at Airports are efficiently run and the staff always more than helpful, but all this effort and expense is wasted if I don't listen to what the briefing officer has to say.

Familiarity breeds contempt. I thought I knew all my communications procedures for cross-country flying pretty well, but my judgment was based on past, not present, airspace utilization. With the increase in the volume in traffic, and the growing complexity of the air traffic control system, near enough obviously isn't even close, let alone good enough!

COMMENT:

Some readers may be inclined to think that Canberra Tower's treatment of the pilot in this case, was a little unreasonable. After all, if he was in communication with the tower, why **not** let him enter the zone? Our contributor has summed up the situation very aptly, but a little further explanation may help to clarify the thoughts of readers who are not familiar with the Canberra Control Zone.

The Aerodrome Approach Control Unit at Canberra is responsible for providing separation and aerodrome operational information for a complex range of aircraft activity including military training in both helicopters and fixed wing aircraft, civil training in general aviation aircraft, regular public transport aircraft, and general aviation aircraft on local and cross-country flights. With the work-load generated by this diverse volume of air traffic, facilities are simply not available to permit an approach control service to be provided on the surface movement control frequency. Unless an emergency situation exists therefore, or the flight is of an urgent medical nature, a clearance to enter the Control Zone cannot be issued to an aircraft that is not equipped to communicate on the frequencies specified in Air Navigation Orders, Aeronautical Information Publications and Notams.

Report That Heavy Landing!

The engineers removing the cowls of a Cessna 182 undergoing engine maintenance in an authorised workshop, found that the firewall and adjacent skin on the underside of the fuselage were extensively damaged.

A check was made of the operator's aircraft records for the preceding three months but this check, and other enquiries, could not establish how or when the damage had occurred. It was almost certain, nevertheless, that the damage was the result of a heavy landing.

Had the damage not been detected it could have progressed to the point of causing a serious accident

—ALL BECAUSE ONE UNTHINKING PILOT FAILED TO REPORT A HEAVY LANDING.

Unusual Landing Accident

(Summary based on Accident Report issued by Ministry of Aviation, United Kingdom)

An Avro 748 was making an approach to land at Leeds/Bradford Airport at the end of a scheduled night flight from London. At the time, a frontal system was moving through the area and the surface wind at the airport was reported as 150 degrees, 20 knots, gusting to 30 knots.

From 10 miles south-east of the airport, the aircraft was directed by radar to a position for a visual approach to runway 15. Turbulence was experienced and the approach was made with a flap setting of 22½ degrees. As the aircraft approached the runway, the crew's view was impaired by heavy rain and sleet causing glare in the beams of the landing lamps. Glare from the runway lights reflecting in the wet runway also became dazzling. In gusty, turbulent conditions, the aircraft crossed the threshold at about 100 knots, three knots above the optimum threshold speed, and as it was about to touch-down the wind veered 30 degrees.

The initial touchdown was moderately heavy. When the aircraft seemed to be firmly on the runway, the captain permitted the first officer to select ground fine pitch, accomplished by withdrawing the flight fine pitch stops of the propellers. As the first officer did so, the aircraft became airborne again, then pitched heavily on to the nose undercarriage and bounced two or three times. Both nosewheel tyres burst, the port nosewheel disintegrated, and a piece of the wheel casting struck the port propeller and was flung through the side of the fuselage into the forward section of the passenger cabin, where it came to rest on the starboard luggage rack. Directional control of the aircraft was maintained and it was brought to rest approximately 500 feet from the upwind end of the runway. No one was injured.

At the time of the accident, work was in progress to extend the runway. The threshold had been displaced and the length of runway available for landing was 3,350 feet. The calculated landing distance required by the aircraft in the existing conditions was 2,775 feet. For technical reasons the lowest intensity setting of the runway lights available was 10 per cent of their full brilliancy. Portable angle of approach indicators were in use. Inspection of the runway showed three separate impact marks which were attributed to the nosewheels of the aircraft. The first marks commenced 1,430 feet along the runway from the displaced threshold; the second at 1,645 feet and the third at 1,730 feet.

Examination of the aircraft revealed that an abnormal percentage of the landing load had been taken by the nose undercarriage. The port nosewheel had disintegrated and the starboard was broken. In the nose leg attachment area, the fuselage skin was wrinkled and frame and stringers distorted. The nature of the damage was consistent with a severe upward and to starboard loading from the nose undercarriage.

Examination of the nosewheels showed that they had been severely overstressed during the landing; there was no evidence of any pre-accident defect. Laboratory checks showed the wheel material to be metallurgically and mechanically satisfactory. The characteristics of the fracture of the port nosewheel indicated that it had failed under a single application of stress and there was evidence that this stress occurred while the tyre was still inflated. Inspection of the nosewheel tyres showed that they had been severely abraded laterally and penetrated by the wheel flanges after being deflated.

The propellers of the Avro 748, as on all Dart engined aircraft, are fitted with fine pitch stops for both ground fine pitch and flight fine pitch. The ground pitch stop is a fixed stop which corresponds to a propeller blade angle of zero degrees; it is provided for use on the ground when starting the engines, and to ensure maximum windmilling drag for retarding the aircraft during the ground run after landing, or during an abandoned take-off. The flight pitch stop is intended to be engaged at all times in flight and prevents the blade angle from falling below 18.5 degrees, thus preventing excessive windmilling drag. When the flight fine pitch stops are withdrawn, the propeller blades are free to move to the ground fine pitch stops. Withdrawal of the stops is controlled by a single lever on the throttle pedestal. Although it is possible to withdraw the flight fine pitch stops in flight, provided the throttles are closed, this practice is not permitted and the pitch stop withdrawal lever should only be operated when the aircraft is on the ground. The landing drill stipulated in the flight manual requires the propeller flight fine pitch stops to be withdrawn as soon as possible after the nosewheel has touched the ground.

The first touchdown, which was heavier than normal, probably resulted from the pilot's impaired visual reference and the gusting wind conditions. The ensuing damage to the aircraft, however, was not attributed to the initial contact with the runway, but to the events that followed, causing the aircraft to land again heavily in a nose-down attitude. When the nosewheels contacted the runway initially, the captain thought the aircraft would stay on the ground and this prompted him to allow the first officer to withdraw the flight fine pitch stops. The reason for the aircraft becoming airborne again was not fully established, but it is likely to have been a combination of a wind gust and reaction to oleo leg compression. When the aircraft left the ground again the airspeed was too low for elevator control to be effective, and, as ground fine pitch was achieved, the ensuing windmilling drag caused the aircraft to pitch heavily on to its nosewheels.

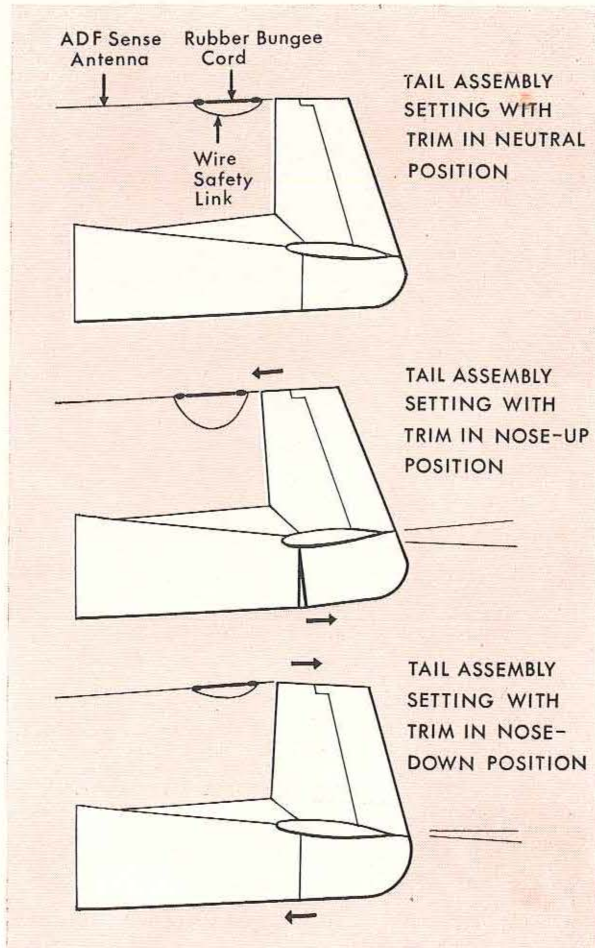
ANTENNA OBSTRUCTS TAIL TRIM MOVEMENT

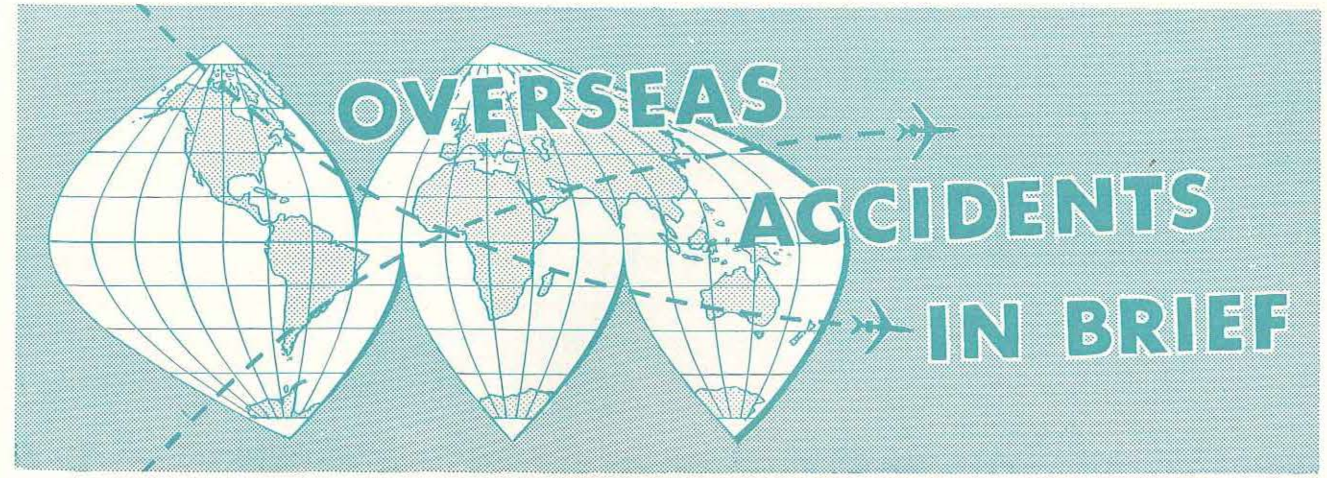
A Mooney taxied out for take-off at Moorabbin Airport, but while at the holding point, the pilot advised he was returning because the elevator trim was unserviceable. The pilot had found that no nose-down trim movement could be obtained.

On this aircraft, the A.D.F. sense antenna is attached to the top of the fin. Investigation established that just before the aircraft taxied from the tarmac, the A.D.F. sense antenna, had been shortened for tuning purposes by radio maintenance staff. The radio engineers did not know that on the Mooney, the elevator trim operates by moving the whole empennage including the fin, and that any slack in the aerial wire connected to the top of the fin is taken up by a bungee cord in series with the aerial wire. A wire safety link, installed in parallel with the bungee strainer, provides for failure of the bungee (see diagram).

When the adjustment to the aerial was made, the trim position was such that there was some slack in the safety wire. The adjustment to the length of the aerial took up this slack and prevented the fin from pivoting back as the trim was wound further towards the nose-down position.

The fault was corrected by replacing the wire safety link with another of adequate length.





Control Lost in I.M.C.

A private pilot who had no instrument qualifications departed with two passengers in a Beech Baron on a private flight from Houston, Texas, to El Paso on the Mexican border, a distance of some 580 nautical miles. Before taking off and afterwards in flight, the pilot was advised of "below VMC" weather extending eastwards from a cold front that lay across the proposed track about midway. The pilot also received a sigmet which reported extremely adverse thunderstorm activity, with tops 25,000 to 35,000 feet, in the vicinity, and ahead of the front.

Approaching Austin, approximately 120 nautical miles from Houston, forty minutes later, the aircraft encountered cloud and the pilot was advised to contact Austin Approach. In response to queries, the pilot informed the controller that he was flying on the autopilot at 3,800 feet in instrument conditions and would declare an emergency to "get down" rather than continue. He said the aircraft was equipped with ILS and he was familiar with its use. The pilot was then instructed to turn right from 320 degrees on to a heading of 020 degrees. The approach controller reported radar contact established and then instucted the pilot to turn right again on to 120 degrees. During this turn the pilot was also told to descend to, and maintain 2,200 feet. The pilot acknowledged, saying he was descending "very rapidly". The controller then advised him the aircraft appeared to be in a tight turn and told him to turn left on to 120 degrees. There was no response and shortly afterwards all contact with the aircraft was lost. The Austin weather at the time was "Ceiling 200 feet, broken, 1,000 feet overcast, visibility two miles, light rain showers and fog".

The wreckage of the aircraft was found on level ground a mile from the Austin VOR. The aircraft had dived into the ground with great force with both engines developing power. There was no evidence of any failure or malfunction having occurred before impact. An eye witness described hearing the sound of a low-flying aircraft, and seeing it emerge from the low cloud and fog, strike the ground and burst into flames.

C.A.B., United States.

COMMENT:

The old, too-often repeated story of the non-instrument pilot continuing into I.M.C. weather, with loss of control the inevitable result.

HELICOPTER OVERTURNS

The pilot of a Hughes helicopter, making a landing on a beach, decided to touch down where the sand was wet, instead of on a dry area, to avoid blowing loose sand. The landing approach was made into the north. At the time a 10-15 knot wind was blowing from the north-west.

As the aircraft touched down, the landing skid on the starboard side sank deeper into the wet sand than the other skid, and the pilot decided to take off again to find a firmer area. As he tried to do so, the embedded skid caused the helicopter to heel over towards the starboard side. The crosswind, blowing from the port side, accentuated the effect, the main rotor blades struck the ground, and the helicopter rolled on to its starboard side.

C.A.B., United States.

OVERSEAS ACCIDENTS IN BRIEF

VICTA COLLIDES WITH POWER LINES

Flying solo over Rotorua, N.Z., the pilot of a Victa 100 was making an experimental broadcast on V.H.F., his commentary being recorded on tape by a local broadcasting station. Just after he had described his flight at low level across the playing fields of a Rotorua high school, his commentary ended abruptly and, at the same instant, the electric power supply to the city was cut off. At that moment, eye witness had seen the aircraft collide with a high tension power transmission line bordering the playing fields of the school, and crash in scrub nearby. The pilot was killed and the aircraft destroyed.

The pilot was a radio announcer with the broadcasting station to which he had been transmitting his commentary. He held a student pilot licence and had been flying for less than two months, his total aeronautical experience amounting to only 27 hours, 11 hours of which was solo time. About 10 days before the accident, the pilot had mentioned to club instructors that he was hoping to make an experimental broadcast from the air, and that if reception by the broadcasting station was satisfactory, he would then like to make another flight, duing which he would describe his experiences for the benefit of listeners to the station's "breakfast session". To these general proposals the aero club had no particular objection.

Two days before the proposed experimental flight, the pilot spoke to the Aerodrome Superintendent at Rotorua, requesting permission to fly low over the city during this flight. He was told that it would be necessary for him to obtain the consent of the Department of Civil Aviation, the City Council, the police and the Chief Flying Instructor of the aero club. When the pilot raised the matter with his Chief Flying Instructor the following day however, he was told in no uncertain terms that nobody would be permitted to fly below the regulation minimum safe height. If the pilot wished to fly over the city, he would have to do so abiding by all official regulations. The pilot made no further mention of low flying, and on the day of the accident, informed the duty controller at Rotorua that he would be making a local flight of about an hour's duration over the city and its environs. No reference was made to flying low during this conversation. Approval for the pilot to make a flight of one hour was given by a club instructor in the usual way and the aircraft took-off. Twenty-five minutes later the aircraft crashed.

The day was cloudy and the power lines would have been difficult to see from the low-flying aircraft, as they would have been against a background of hills. In any case, the pilot's preoccupation with handling the microphone and concentrating on his broadcast would to some extent have precluded his maintaining an effective lookout.

Eyewitness accounts of the final stages of the flight confirmed the pilot's description recorded on the tape and the cause of the crash was only too clear. Responsibility for complying with the regulations rested entirely on the pilot. He had sought permission to fly low and had been refused it, then took it upon himself to act as he did. *The lesson to be learned from this accident is too obvious to require elaboration.*

Department of Civil Aviation,
New Zealand.

MISJUDGEMENT
During Low Flying

While making a local flight with the pilot alone on board, a PA-22 struck a clump of trees at the edge of a clearing, and crashed. The pilot was seriously injured and the aircraft substantially damaged.

The purpose of the flight was to drop maps to a group of Boy Scouts in timbered country, 350 feet above sea level. The clearing into which the drop was being made is roughly circular and 600 feet in diameter. The day was fine and clear and there was no wind.

The aircraft made four runs across the clearing, the first at about 1,000 feet above the ground. The succeeding three runs were flown at progressively lower levels. On the final one, the aircraft appeared to dip slightly over the clearing, then struck a clump of trees 50 feet high on the south-west side. The impact swung the aircraft to the right and it struck a large tree 225 feet further on, fell to the ground and came to rest upside down.

The pilot said he thought the aircraft had encountered a downdraught but it seemed unlikely that a downdraught of a sufficiently serious nature could have existed at the time. More probably, the diversion of the pilot's attention between flying his aircraft and dropping the maps, had contributed to the pilot's misjudgment.

Department of Transport, Canada.

Fish Spotters Collide in Flight

While the pilots of two Champion 7EC aircraft were each engaged in spotting fish for their respective company's fishing vessels, the aircraft collided in the air over Chesapeake Bay, Virginia, on the east coast of the United States. Neither aircraft was badly damaged and each was able to return and land at its base.

Examination of both aircraft showed that the starboard undercarriage fairing, with the tyre and tube, on the higher aircraft had been damaged by striking the propeller and the upper port side of the lower aircraft's engine cowling. The fuselage underside of the higher aircraft had also been damaged as it brushed across the upper surface of the lower aircraft's starboard wing. The starboard fuel tank filler neck had been torn from the lower aircraft.

The pilot of the higher aircraft said that before the accident, while he was flying at an indicated altitude of 2,000 feet assisting his company's vessels to set fishing nets, he noticed two other fish-spotting aircraft working in the area, one about 500 feet below him, and the other about 1000 below. While he was circling to the left in a 30-degree bank watching the boats close the fish nets, he felt a bump and then saw the other Champion as it passed beneath his aircraft. After the collision he levelled out and saw that the altimeter read 1,900 feet. After checking that the other aircraft was still flying, he advised his company of the collision and returned to his aerodrome to land.

The pilot of the lower Champion said that before the accident he was circling to the left in a 15-degree bank at an indicated altitude of 1,650 feet while spotting fish for his company. As his aircraft was turning through a westerly heading he heard a bump and thought he had been hit by another aircraft. After the impact his altimeter indicated just under 1,700 feet. After advising his fishing vessels, he too, returned and landed without further incident. Neither pilot had seen the other's aircraft immediately before the collision.

During the investigation it was found that the pilots, both of whom were very experienced, had worked this area together on numerous occasions, though for different companies. By common consent all fish spotter pilots working in this area use an altimeter setting of 30.00 inches to maintain separation. The altimeters of both aircraft were found set at 30.00 inches but the exact altitude of the accident could not be determined. Both pilots had failed to maintain surveillance sufficient to ensure adequate separation while they were manoeuvring in the same limited area.

C.A.B., United States.

Wings Fail During Test Flight

A highly-experienced commercial pilot departed on a local flight in an Aeronca, to test the operation of a newly-installed carburettor. A few minutes later the aircraft was seen at about 5,000 feet over the vicinity of the airport carrying out what appeared to be stalls. One witness, who was watching the aircraft, said that after being momentarily distracted he looked for it again, and saw that both wings had separated from the fuselage and that it was diving to the ground. The fuselage crashed 400 feet from the airport boundary and the wings fell to the ground independently, landing some 200 feet away. Witnesses said that they heard the engine running at high power until the moment of impact, but none had actually seen the aircraft shed its wings.

Investigation established that the wings had broken off at the spar root attachment points. The main attaching bolts remained in the fuselage attachment fittings, but the corresponding holes in the wing spars had been elongated and the bolts had pulled out through the metal and wood spar fittings. Examination of the failed parts, including the flying wires, showed that the failures were the result of in-flight positive overloads. There was no evidence of previous failure or fatigue. *The accident was attributed to in-flight overloads induced by the pilot, which had exceeded the design strength of the aircraft structure.*

C.A.B., United States.

Take time to THINK . . .

• Engine Failure ?
• Fuel Exhaustion ?
• Pilot Incapacitation ?
What then ?

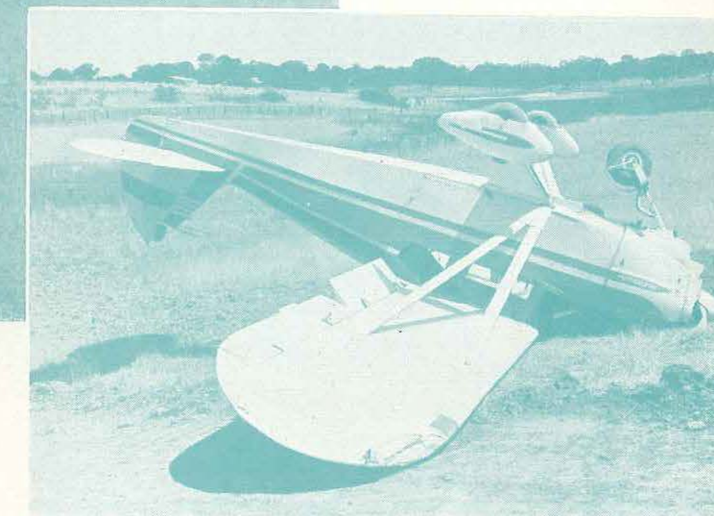
. . . Simply that the pilot missed his destination on the final 37-nautical-mile leg of an 85-mile cross-country flight and didn't take time to try and establish his position. Instead, he decided to land in the first likely looking paddock, to find out where he was. Unfortunately, for the pilot, it wasn't likely enough!

The flight from Bankstown to Bathurst, N.S.W., was part of a solo cross-country navigational exercise to qualify the pilot for the issue of an unrestricted private licence. The weather was fine but smoke haze reduced visibility to about five miles. The first part of the flight was uneventful and the aircraft arrived over Katoomba on ETA at 0058. The pilot set course for Bathurst, ETA 0123, and seven minutes later pin-pointed his position over the road that runs south to Jenolan Caves. His next intended pin-point was the Tarana-Oberon railway line but when he was unable to sight it, he maintained his heading, thinking there was little chance of his straying far off track, in the short distance remaining to Bathurst.

His ETA Bathurst passed but still there was no sign of it and after another 20 minutes flying, the pilot decided his best course of action was to land to find out his whereabouts. After descending from his cruising level of 4,500 feet and some searching, he located a field with an apparently clear landing run into the wind. The pilot first made two low runs to check for obstructions, then a precautionary approach to land, touching down just inside the fence. Most of the landing run, however, proved to be downhill, and although he immediately applied full braking the aircraft ran for 800 feet and into mounds of earth and soft soil in the lower corner of the paddock. The nose wheel dug in, and the aircraft somersaulted slowly over on to its back. The pilot was not hurt and after finding he had landed 23 miles south-west of Bathurst, he reported the accident to Bankstown ATC by the telephone.

Asked during the investigation why he had flown on for 20 minutes after his ETA Bathurst, the pilot explained that most of this time was taken up trying to establish his position and looking for an area to land. The pilot pointed out that smoke haze was limiting visibility at the time. He did not think he would have been very far south of the track and thought most of his eventual track error resulted from his attempt to find somewhere to land. He admitted he had not made any real attempt to pin-point his position after passing Katoomba.

Although the pilot said that much of the flight time after his ETA Bathurst was taken up trying to establish his position, it is evident that this effort was confined to trying to relate what he could see, to his map. It



clearly did not involve any systematic changes of heading to either return to his last-known position or to intercept an obvious landmark such as main western railway line. The pilot had not sighted the spur railway to Oberon as he expected, seven minutes after crossing the Jenolan Caves road, and this should have alerted him to the fact that he was off track. Then, when he failed to sight any section of the main western railway, and Bathurst finally did not materialise by ETA, this should have confirmed he was south of track and suggested a turn to intercept the railway — a feature he could hardly miss. Alternatively, if he was in real doubt, the pilot could have turned on to a reciprocal heading and flown back to his last-known position. He had more than ample fuel on board, even to return to Bankstown if necessary, and the day, if hazy, was fine with no significant cloud.

It seems, however, that the pilot, having flown on expecting he could not miss Bathurst, became alarmed when he at last saw that his position was uncertain. This apparently gave way to a sense of panic and influenced him to land at the first opportunity. Had he flown the Katoomba-Bathurst leg of the flight with the same care that he gave to the Bankstown-Katoomba leg, this sudden realisation of being lost would not have caught the pilot unawares and he undoubtedly would not have acted so rashly.

There is a lesson in this accident, not only for the would-be navigator, but also for more experienced pilots who find themselves caught out by bad weather or poor visibility. Instead of diverting a little sooner to an area where better conditions were known to exist, some have gone on to the point where they have felt their only alternative was to land at the first possible opportunity. In these circumstances, even comparative "old hands" have acted as this pilot did and their undue haste has frequently had similar results—results that could easily have been avoided with a little forethought and common sense, which is one of the primary ingredients of airmanship. It is good airmanship always to have a plan of action for when the expected fails to materialize—to know what you will do if, for example, that check point does not turn up on ETA, or if deteriorating weather should prevent you reaching the aerodrome where you intend to refuel.

What then *should* you plan to do when this sort of thing happens? It is not possible to lay down rules to cover every situation—the best alternative can only be determined after all the particular circumstances have been considered. The important thing is to *be prepared*. Then, when things do go wrong there will not be that sense of alarm, induced by being caught off-guard, which can lead to a hasty, ill-considered decision.

Thought Transference?

Transcript from a recording tape in the Control Tower of a capital city Airport:

RME: Romeo Mike Echo is coming up final for Zero Two.

Tower: Romeo Mike Echo — the wind is picking up now — it is oscillating violently through about three zero degrees — zero three zero to zero six zero. One five and up to two five knots.

Tower: I will give you a further check on short short final. Clear to land.

RME: Romeo Mike Echo — would zero six be more suitable do you think?

Tower: It could be — the wind is changing so rapidly. If you would prefer overshoot and have a look at zero six.

RME: Roger. Overshooting. Would you light zero six?

Tower: Roger.

Tower: Mike Mike Foxtrot — Cross zero six and hold on the taxiway, clear of both runways.

Tower: Mike Mike Foxtrot — Moderate to severe turbulence reported in the circuit area. We will see what the 727 has got to say after he arrives.

RME: Romeo Mike Echo. We'll confirm that — it is severe.

Tower: Roger. He says it's severe Mike Mike Foxtrot.

RME: Romeo Mike Echo. Wind check?

Tower: Romeo Mike Echo — Zero six zero, one five, gusting to two five. Wind still swinging very rapidly but only through about three zero degrees at the most.

RME: Romeo Mike Echo. When we turn on to final, I wonder if you could give us an intermittent wind check?

Tower: Romeo Mike *Foxtrot* — will do. Continue approach and I will give you frequent checks on final.

RME: Romeo Mike *Foxtrot*. Many thanks.

Tower: Romeo Mike *Foxtrot* — the wind is oscillating now between zero five zero and zero niner zero, one zero to two five. Clear to land.

RME: Romeo Mike *Foxtrot*.

Tower: Wind check: Zero five zero to one one zero, one five to two five.

COMMENT:

Notice that two transmissions after addressing MMF, the tower controller erroneously transposed the last letter of RME's callsign and addressed it as Romeo Mike **Foxtrot.** RME's response is a particularly interesting example of thought transference; instead of correcting the error the aircraft perpetuated it and acknowledged as Romeo Mike Foxtrot! From then on until the aircraft shut down on the apron all exchanges between ground and aircraft used the wrong identification.

No doubt the stress of the existing weather conditions, and the fact that the other aircraft's callsign contained a rythmic similarity to RME's, helped to induce this error. But this does not mitigate the fact that a serious error unwittingly occurred and that pilots and controllers alike must constantly be on their guard for potentially dangerous errors of this sort. No difficulties arose on this occasion but that is not to say that serious confusion and perhaps traffic confliction could not occur in similar circumstances.

We don't want to "point the bone" too much but it may be significant that an earlier section of this same tape shows that, on one transmission, only the last two letters of a callsign were used. At the risk of labouring the point, we can only repeat again that this practice gains nothing and can obviously contribute to the type of error quoted in the transcript.