No. 70 SEPTEMBER 1970

AVIATION SAFETY DIGEST

DEPARTMENT OF CIVIL AVIATION AUSTRALIA

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Contents

FRONT COVER: A Bell 47G-3B1 helicopter demonstrates its capabilities before a section of the crowd at the Bankstown Air Show held on the 20th of this month. The show celebrated the 75th Anniversary of the Municipality of Bankstown and was part of the "AVIAT 70" programme, commemorating the 50th Anniversary of commercial aviation in Australia. Bankstown's new control tower, which is to be opened shortly, can be seen in the background.

BACK COVER: In a picturesque setting at Pittwater, N.S.W., only a few miles by air from the heart of Sydney, a Colonial Skimmer negotiates choppy water as it taxies towards its moorings.

—S. J. Cherz photographs.

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

DECISION DISASTROUS . . .

After becoming uncertain of his position towards the end of a flight from Ayers Rock to Alice Springs, the pilot of a Cherokee Six decided to land on a road to ascertain his whereabouts from passing traffic. On final approach it became evident that the area of road selected was unsuitable, but the pilot persisted with the landing. After touching down, the aircraft struck trees on the side of the road, slewed to the right, and crashed. The aircraft was damaged beyond repair, but the six occupants escaped unhurt.

The pilot, who held a private licence, had hired the aircraft at Parafield Airport, South Australia, to fly to Darwin with his wife and four other passengers. The pilot had some 150 hours flying experience and had been endorsed on the aircraft type some twelve months before, but since that time had done little flying on this or any other type of aircraft. Three weeks before the proposed flight however, the pilot completed a satisfactory period of circuits and landings in the Cherokee Six at Parafield Airport.

As this was to be the pilot's first flight through central Australia, he spent a considerable amount of time beforehand preparing for it. After obtaining all WAC charts applicable to the routes to be flown, the pilot drew in the tracks and marked them all into 10 mile route segments. He also prepared flight plans for each day's flying as far as possible, leaving only the variable data to be completed and even went as far as preparing lists of the position reports he would make throughout the trip, with spaces provided for filling in times, altitudes and the stations to be called. The aircraft itself was fully equipped with all relevant VHF and HF radio frequencies, as well as with ADF and VOR radio navigation aids and an automatic pilot.

On the first day of the proposed trip to Darwin, the pilot and his passengers departed from Parafield, bound for Billa Kalina station, Coober Pedy and Ayers Rock. The pilot had originally intended to fly directly to Coober Pedy, where he intended to refuel the aircraft, but on learning that no fuel was available there, he re-planned to refuel at Billa Kalina Station, 94 miles south-east of Coober Pedy.

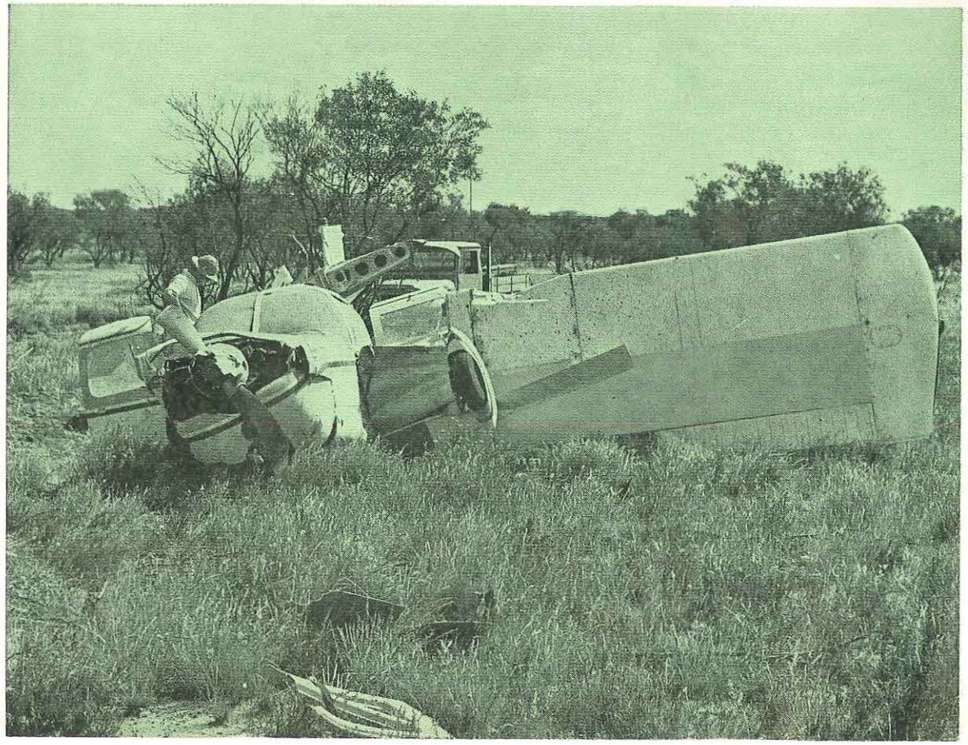
The flight proceded without incident and after refuelling at Billa Kalina Station, the aircraft flew on to Coober Pedy where the party had lunch, then continued to Ayers Rock in the afternoon where they remained overnight.

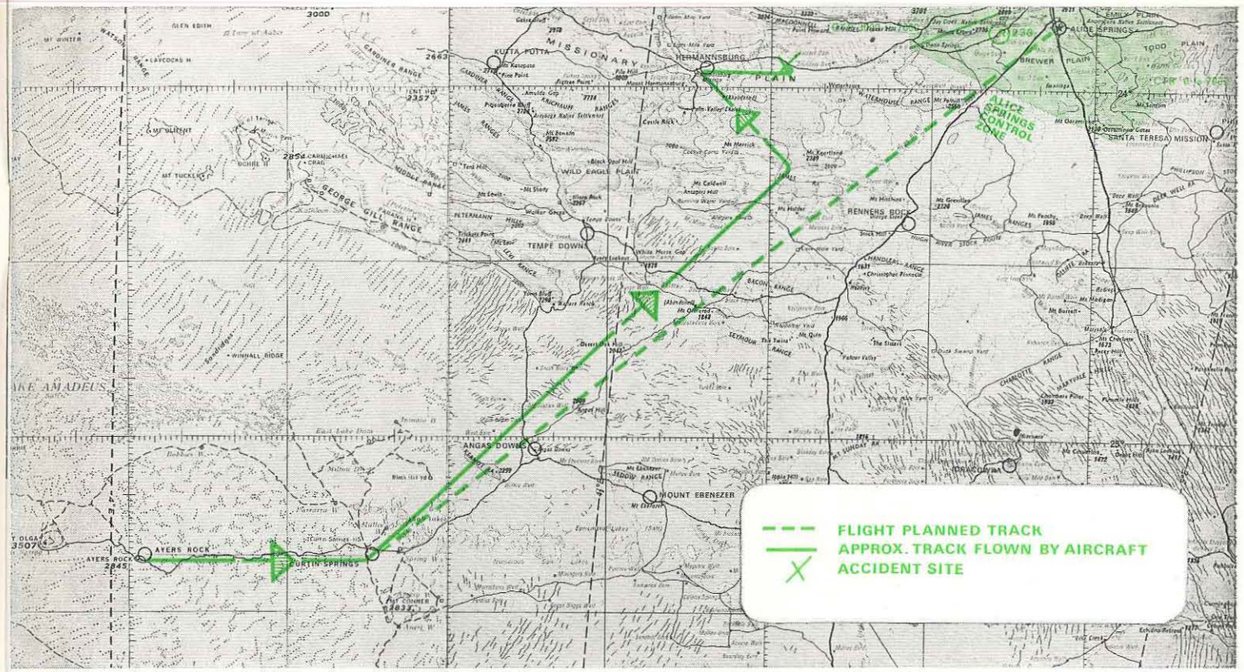
After arriving at Ayers Rock, the pilot again found it necessary to amend his original flight plan, which had provided for only the one refuelling stop between Parafield and Alice Springs. Because he had been obliged to refuel at Billa Kalina instead of Coober Pedy however, the pilot found he would need to refuel again before undertaking the 180 mile flight on to Alice Springs. As no fuel was available at Ayers Rock, the pilot planned to fly to Curtin Springs to refuel and then fly direct from Curtin Springs to Alice Springs. Because Curtin Springs is only 40 miles due east of Ayers Rock, the pilot decided he would fly this first leg NOSAR and follow the clearly defined road that links the two settlements. In preparation for the subsequent Curtin Springs - Alice Springs leg however, the pilot drew in the proposed track on the relevant WAC charts, marking it off as before in 10 mile segments, and filled in the track and distance to be flown on a flight plan form.

After spending the night at Ayers Rock, the party flew as planned to Curtin Springs on a NOSAR basis where 44 gallons of fuel were pumped into the aircraft's tanks, bringing its total endurance up to 240 minutes. The aircraft then departed for Alice Springs at 0942 hours local time.

After setting course, the pilot contacted Alice Springs by radio to request the current area forecast and submit flight notification, but found that radio propagation conditions were very poor and that he could not clearly read Alice Springs. He managed to advise his departure time and the details of the flight, which was to be made below 5,000 feet, and also told Alice Springs to expect a request for a clearance to enter the Alice Springs Control Zone. But because of the difficulty in reading transmissions from Alice Springs, he was not able to obtain the current area weather forecast. He therefore decided to navigate on a "no-wind" basis and estimated the time interval to Alice Springs as 69 minutes.

The aircraft as it came to rest alongside the Hermannsburg-Alice Springs road. Although both wings were torn bodily from the fuselage the cabin area remained relatively intact.





Map showing flight planned route from Ayers Rock via Curtin Springs to Alice Springs, approximate track actually flown by the aircraft, and position of accident site.

During the early part of the flight, the pilot spent a good deal of his time attempting to adjust the HF radio receiver for better reception and also in trying to locate the Alice Springs NDB on the aircraft's ADF. As a result, he did not concentrate on accurate map reading. The pilot was nevertheless satisfied that he was maintaining track, and at 1018 hours he reported he was over the Bacon Range, 65 miles south-west of Alice Springs. But once again, the pilot was unable to read Alice Springs' transmissions on HF and he began to be concerned lest he should be unable to establish adequate communication in time to obtain an airways clearance before reaching the Alice Springs Control Zone boundary.

Not long afterwards the pilot sighted a settlement some miles away to port, and he decided to divert and identify it. After reaching and circling the settlement at 1035 hours, the pilot (correctly as it turned out), identified it as Hermannsburg Mission, 60 miles west of Alice Springs and he reported his position accordingly. Alice Springs then passed the aircraft a clearance to "enter control zone on visual approach", but the pilot was still unable to read the transmission and advised he would call again when 30 miles out.

From Hermannsburg, the pilot decided that as there was a restricted area immediately to the west of the Alice Springs airport, his best course of action would be to maintain a heading "a little south of east" to intercept the Adelaide-Alice Springs road and then to approach the Control Zone along the road from the south-west. He set heading accordingly, but only about 10 minutes later he was surprised to see, immediately below him, a well defined gravel road carrying a good deal of traffic. He attempted unsuccessfully to identify the road from his map and became increasingly confused, and then began to suspect that the road might be the Adelaide-Alice Springs road and that the settlement he had identified as Hermannsburg Mission might be Renners Rock Station, which would place the aircraft much closer to the Alice Springs Control Zone than the pilot previously thought.

Still concerned that he might unintentionally stray into controlled airspace, the pilot held position, maintaining 3,000 feet while he discussed the situation with his passengers. Although one passenger suggested they return to the settlement they had just left and land, the pilot was doubtful of being able to locate it again. Telling his passengers that he could not risk flying into controlled airspace, the pilot then said he would land on the road to ascertain their position.

Descending to about 400 feet, the pilot made two precautionary circuits while he inspected what appeared to him to be a satisfactory section of road that was free of traffic, then approached to land into the west at 80 knots with two notches of flap selected. When about 10 feet above the ground, the pilot realised that the scrub on either side of the road was a good deal taller than he had first thought and he hesitated momentarily, but then, believing he was now committed to land, he continued with the landing.

The aircraft touched down normally but, after running a short distance, the starboard wing clipped a tree at the side of the road, swinging the aircraft to the right. The wing then collided heavily with other trees, tearing it bodily from its fuselage attachments, and slewing the aircraft further to the right into rough ground at the side of the road. The undercarriage collapsed and the aircraft ground looped to the right, bringing the port wing violently into contact with further trees which dislodged it also, and the wreckage skidded to a stop in a cloud of dust, nearly 700 feet from the point of touchdown. The pilot turned off the switches and the occupants clambered out. Although the aircraft was completely wrecked in the landing, the cabin itself remained substantially intact and the pilot and passengers, all of whom had been properly strapped in, escaped unharmed.

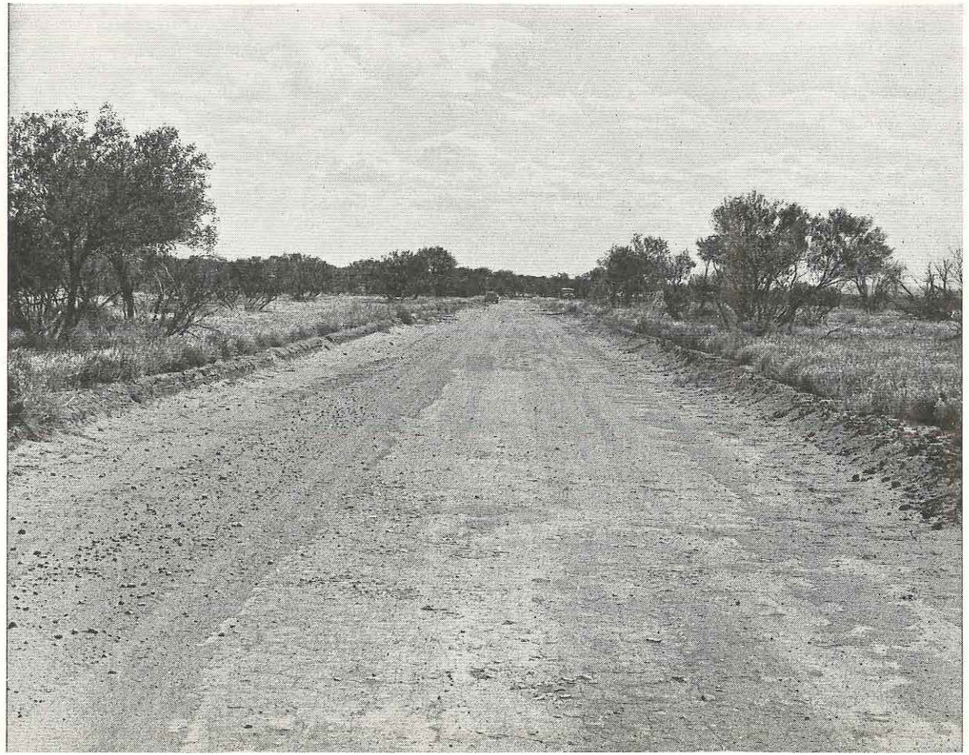
The site of the accident proved to be on the Hermannsburg-Alice Springs road, 10 miles east of Hermannsburg. The party was picked up by a passing motor convoy and driven back to Hermannsburg Mission. Later they were flown on to Alice Springs in an Aerial Medical Service Dove which happened to be on the ground at Hermannsburg when the motor convoy arrived.

* * *

The investigation confirmed beyond doubt that radio propagation conditions were extremely poor during the flight. Warnings that lower frequency radio transmissions could be affected by sunspot activity were current at the time and the pilot's difficulty in reading transmissions from Alice Springs is understandable in the circumstances.

As a result of this poor radio reception, the pilot was not able to obtain the current area weather forecast, which would have indicated to him that at the height he was flying, he could expect about five degrees of port drift. As it was, the pilot had assumed there was no significant wind and had planned the flight on a no-wind basis. In these circumstances, although the day was fine and clear, it was most important for the

The section of the road on which the aircraft landed, looking in the direction used. The wreckage, hidden by trees, lies immediately to the right of the parked vehicles in the distance.



pilot to give painstaking attention to navigation and map reading in the early stages of the flight to establish what drift existed, and to ensure that he followed the aircraft's progress accurately on his maps. It is evident however, that instead of doing this, the pilot devoted much of his concentration to adjusting the HF receiver and in attempting to obtain an ADF bearing from the Alice Springs NDB. As a result, his map reading became haphazard, and he gave himself no opportunity to detect any drift that was present.

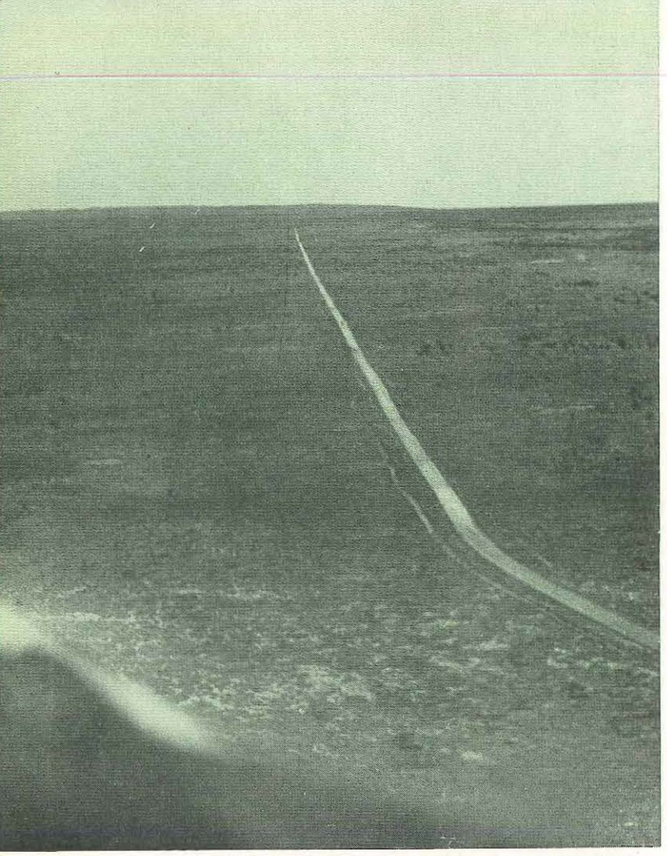
It was also evident that as the flight progressed, the pilot had less and less idea of the aircraft's true position in relationship to the landmarks along the aircraft's track as plotted on his WAC charts. Although the pilot's position report over Bacon Range at 1018 hours seems at first sight to indicate he was still on track at this stage, it is difficult to reconcile this position with his sighting of Hermannsburg some 10 miles to port, only a few minutes later. It thus seems more likely that when the pilot transmitted his Bacon Range position report, the aircraft was actually several miles to port of track and the pilot had only an approximate idea of his position. The fact that the pilot shortly afterwards chose to divert several miles to port to identify the settlement he had sighted, only adds further weight to this contention.

But despite the shortcomings in his navigation up to this point, the pilot correctly pin-pointed his position over Hermannsburg and reported his position accordingly at 1036 hours local time. As Hermannsburg is only 60 miles west of Alice Springs and connected to it by a clearly defined road, and the aircraft still had more than 180 minutes fuel remaining, the situation was by no means out of hand at this stage.

It is difficult to understand why the pilot did not make a greater effort to contact Alice Springs on VHF when HF reception was still so poor at Hermannsburg. In his statement, the pilot said that at Hermannsburg he was "changing frequency from VHF to HF in an effort to get better reception". Again however, his methods must have been haphazard for, when it became evident to Alice Springs that the pilot was not reading their transmissions on HF, and it appeared that an unauthorised penetration of the control zone was imminent, they called the aircraft repeatedly on VHF in an attempt to pass a clearance to enter the zone. It is also difficult to understand why, when he could not make contact from Hermannsburg at 3,000 feet on VHF, the pilot did not climb to a greater height, as there are no airspace restrictions in this area. Indeed, it is hard to see why the pilot chose to make the whole flight from Curtin Springs at this comparatively low altitude when a higher altitude could only make both navigation and radio reception easier. As already indicated, the visibility was excellent and there was no reason why the aircraft could not have flown at 9,000 feet if the pilot had wished to do so.

Nevertheless, when he was still unable to establish contact with Alice Springs from over Hermannsburg, the pilot's decision to remain south of the control zone until the aircraft intercepted the Adelaide-Alice Springs road was a reasonable one, especially in view of the fact that there is a restricted area immediately to the west of the Alice Springs airport. But once again, his navigational techniques seem open to question. Describing the events that led up to the accident, the pilot said that he "headed just south of east" and, in the light of his subsequent confusion only a few minutes later, this seems to suggest he was making no real attempt to navigate this leg of the flight accurately, but was simply intending to hold this new heading until the Adelaide-Alice Springs road "showed up" in front of the aircraft. Had the pilot carefully studied the surface details as shown on the chart in the vicinity of Hermannsburg, orienting them with the features of the landscape that he could see while still over the settlement, he would surely have been aware of the well-defined road connecting it with Alice Springs and appreciated the fact that his "just south of east" heading would be closely paralleling the first few miles of this road. Thus, when the aircraft passed over a section of this road a few minutes later, he should have been able to recognise it for what it was. As matters were, it seems that the pilot was not expecting to sight any road at all for some 20 minutes and, when the aircraft intercepted a road well before this time, the situation was so unexpected that the pilot immediately became thoroughly confused.

In his statement, the pilot said that he then "began to doubt his Hermannsburg position" which he had left only a few minutes before and "thought it might have been Renners Rock", which is on the Adelaide-Alice Springs road about 45 miles south-west of Alice Springs. But even if this had been so, there was absolutely **no** reason why he could not have returned along the road to that aerodrome to establish his position, either by landing or visually from the air. Indeed, one of the pilot's non-pilot passengers offered him this very sound advice, but for some inexplicable reason the pilot had convinced himself he would not be able to find the aerodrome again and that



The clearly defined gravel road, as it would have appeared to the pilot soon after leaving Hermannsburg.

his only course of action was to land on the road. Once again, it is difficult to understand why the pilot did not consider climbing to a higher altitude to try and establish his position or to help him return to his previous checkpoint. As already pointed out, there was no pressing reason whatever why the pilot had to land so hastily. The weather was good, the day was still young and the aircraft still had fuel for about three hours flying.

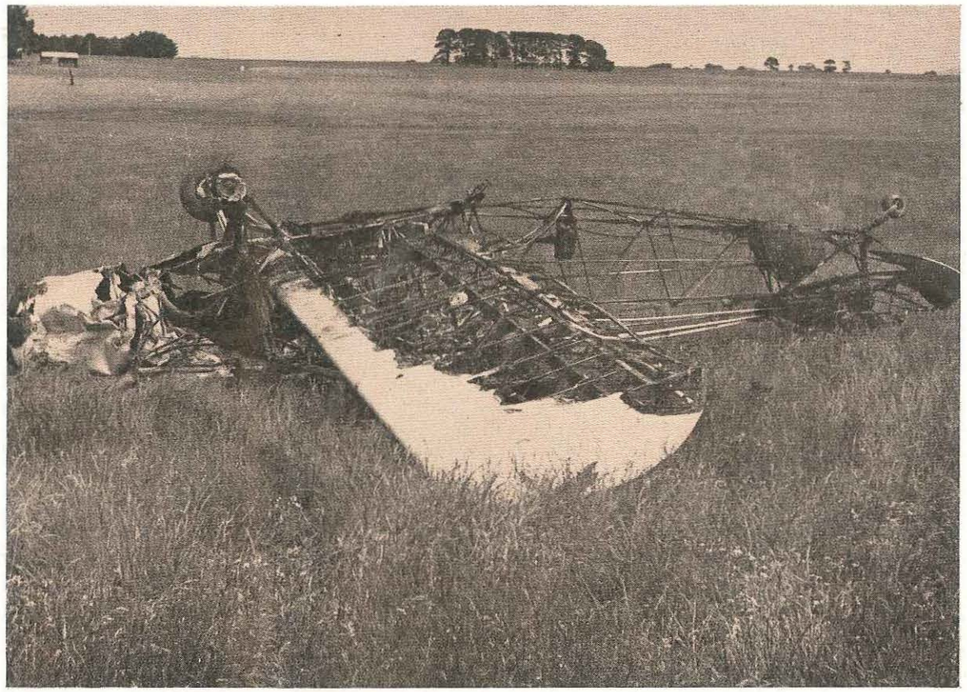
In any case, the section of road selected by the pilot was completely unsuitable for a landing, as events proved. The selection of a suitable landing area from the air is admittedly not an easy task for an inexperienced pilot, but in this instance, even when the pilot finally saw that the area was unsuitable, he still persisted with the landing.

In retrospect it seems that with the poor radio reception conditions he was encountering, his inability to obtain an ADF bearing on the Alice Springs NDB, the increasing uncertainty of his position as the flight progressed, his fear of inadvertently entering controlled airspace without a clearance, and finally the shock of finding a main road where he least expected it, the pilot gradually worked himself into a state in which he not only convinced himself that he was lost, but was unable to think logically. In this situation, his desire to find out where he was seems to have become so overwhelming that he lost all sense of proportion and judgement, and the landing on the road became his only solution to the problem.

The fact that this was the pilot's first experience of navigation in the outback undoubtedly played its part in setting the stage for this accident. The pilot had prepared for the flight carefully, but he did not follow this up by putting all his planning into practice. As it was so important to make an accurate "landfall" approaching Alice Springs, in order to obtain a clearance to enter controlled airspace, it would have been prudent for him to have planned his Curtin Springs — Alice Springs leg via clearly recognisable landmarks such as the aerodromes at Angus Downs and Renners Rock. From Renners Rock the pilot would then have had the road as a "navigation aid" to lead him directly to Alice Springs Airport. This would have added very little distance to the total length of the flight, and should have enabled the pilot to determine his position accurately before reaching the boundary of the control zone.

The lessons to be learned from this needless accident are not new, though an obvious one that emerges from this investigation is the need in remote areas to fly high enough to be able to navigate with as little difficulty as possible. The rest have already been well covered in the Digest supplement "Hints on Flight Planning and Navigation in Remote Areas", which was issued with Aviation Safety Digest No. 55 in March, 1968. Copies of this Supplement are still available for distribution and may be obtained by writing to the Editor.

Pilots who have gained their licences since this supplement was first issued are strongly recommended to obtain a copy and to study it carefully before undertaking any cross-country flight in sparsely settled, unfamiliar areas. Properly put into practice, these hints can help prevent other such inexperienced pilots from falling victim to the same doubts and fears as the pilot in this article. In this case he and his passengers were fortunate to escape without injury. As some of our more experienced readers are well aware, others in similar situations in the past have not been nearly so lucky.

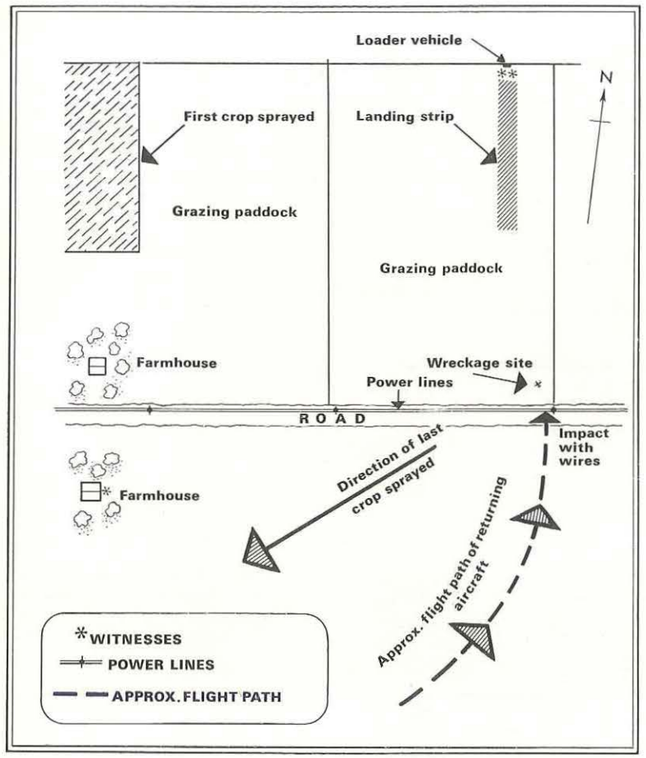


FATAL LOW-LEVEL LANDING APPROACH

While approaching to land at an agricultural airstrip at Hawkesdale in the Western District of Victoria, at the conclusion of a day's spraying, a Piper Pawnee flew into a power line, dived vertically to the ground and fell on to its back. Fire broke out and the pilot was trapped in the cockpit until the nearest witnesses were able to reach the burning aircraft and extricate him. The pilot was admitted to hospital with very severe burns and serious injuries, and the aircraft was completely destroyed. The pilot died from his injuries several weeks later.

Earlier on the day of the accident, the pilot had completed an aerial spraying operation in the Hamilton district. In the afternoon he ferried his aircraft to Hawkesdale, some 25 nautical miles to the south-east, where he was to complete his day's work by spraying two oat crops on adjacent properties.

The agricultural strip that the pilot was to use at Hawkesdale is located in the northern half of a grazing paddock, that is half a mile long in a north-south direction, and rises slightly towards the north. A local road running east-west adjoins the southern boundary of the paddock, and above the boundary fence on this side, a two-wire power line runs parallel with the road. An aircraft landing on the strip into the north thus passes over the power line on final approach. But as the power line is 1,350 feet short of the strip threshold and only 30 feet above the ground, the minimum available approach gradient is 1:35, well below the minimum gradient of 1:20 required for agricultural



Map of area in which accident occurred showing approximate flight path and relative positions of wreckage, power lines, airstrip and witnesses.

airstrips. Apart from this obstruction, the approaches to the strip are clear and, as the country is open, the wooden poles of the power line can be seen from almost any direction.

Approaching over the power line, the pilot landed normally at the conclusion of his ferry flight from Hamilton and, after obtaining details from local farmers of the area to be sprayed, took off at 1730 hours to treat the first crop, situated less than a mile due east of the landing strip. After completing this area he again made an approach to land into the north over the power line. The aircraft was reloaded in preparation for the second and last crop to be treated, and the pilot took off again.

This last paddock to be sprayed was approximately a mile away to the south-west of the landing strip's southern threshold and, after the aircraft had completed the spraying of this area at about 1845 hours, it was seen heading back towards the strip at low level. Continuing to maintain the same height, it flew directly into the power line in a level attitude. The undercarriage caught on the wires and the aircraft pitched forward violently as the stretching wire retarded it in flight. One wire snapped, the other slipped clear of the undercarriage, and the aircraft struck the ground in a vertical nose-down attitude, 105 feet beyond the point of collision with the wires, then fell over on to its back and slid a further 25 feet upside down. The forward section of the fuselage burst into flames and the fire spread rapidly.

The accident was seen by the operator's loader-driver and the farmer who owned the property, from half a mile away at the northern end of the landing strip, where they were waiting beside the loader vehicle. With several other men, they drove immediately to the crash site in the farmer's utility.

The very light wind that was blowing from the south-east was sufficient to keep the flames from the windward side of the aircraft and, while three men lifted the tail to free the pilot from the cockpit, the loader driver undid his harness and the farmer pulled him clear. As the photographs indicate, the aircraft was subsequently completely gutted by fire.

* * *

The weather at the time was most satisfactory for spraying operations, and although the sky was partly overcast, it was fine and there was very little wind. At the time of the accident the sun was close to the western horizon but as the aircraft was flying towards the strip from the south-west, it is unlikely that glare would have been a problem to the pilot.

The pilot held a first class agricultural rating and had more than 500 hours agricultural flying experience. His experience in Pawnee type aircraft amounted to only a few hours, but as he had logged a total of over 2,500 hours flying, he could not be regarded as inexperienced. On the day of the accident he had not begun flying until 1100 hours, and flew a total of only about two hours throughout the day.

The pilot obviously knew of the existence of the power line, having approached over it for his last two landings, and on this last approach it can only be assumed that he momentarily forgot it was there. It seems probable that, having completed his spraying operations for the day and as this was to be his last landing, he had relaxed his vigilance and his thoughts were on things other than the power line across his approach path.

The evidence of an eye witness who saw the crash from the verandah of a farmhouse half a mile south-west of the accident site indicated that the aircraft maintained a steady flight path up to the moment it struck the wires, and it was apparent that the pilot had made no attempt to climb to a safe height while returning to the landing strip for the last time. In the circumstances, the cause of the accident can only be ascribed to the fact that the pilot flew the aircraft at an unnecessarily low height.

* * *

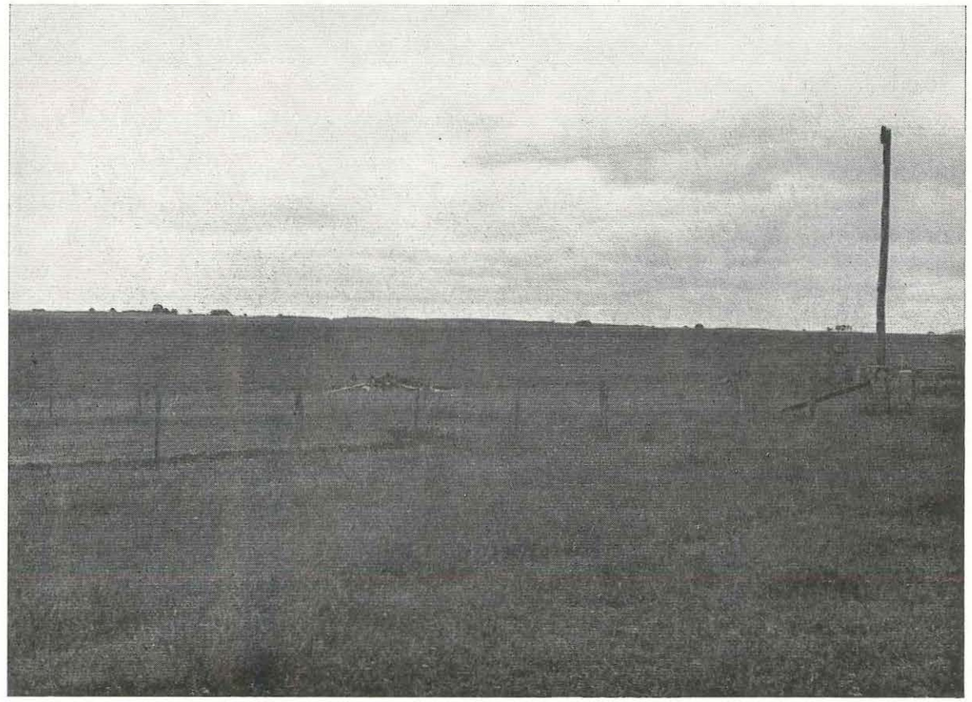
This needless tragedy is yet further exemplification of the fact that an agricultural pilot cannot afford to relax his vigilance at any time he is in the air.

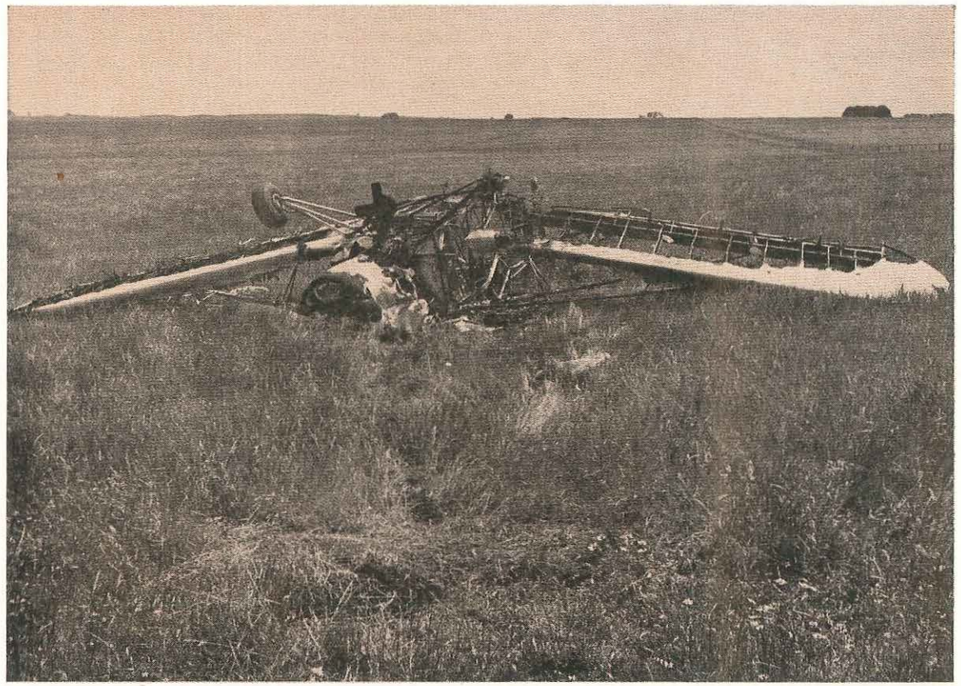
As indicated in the latest two issues of the Digest, there are some pilots and operators in the agricultural aviation industry who believe that insufficient control is being exercised over the erection of hazards such as power lines. While there is undoubtedly some truth in these contentions, and the Department and some electrical supply authorities are actually examining the problem at the present time to see what can be done to alleviate the situation, the fact remains that the magnitude of the task of marking or removing every man-made hazard would be so great as to be utterly impracticable. The only **realistic** solution to the problem for pilots and operators is to accept that agricultural flying, especially spraying, inevitably involves certain risks, and to employ every means at their disposal to reduce these risks to a minimum.

There are three principal ways in which such risks can be minimised:

- By flying the aircraft in such a manner that the chances of striking an unseen hazard are no greater than absolutely necessary.
- By maintaining a high standard of vigilance throughout the **whole** operation.
- By marking the positions of wires in some manner that is clearly recognisable to the pilot.

General view of accident site looking in the landing direction, with the two wire power line struck by the aircraft in the foreground. The wreckage can be seen a short distance beyond the fence. The strip from which the aircraft was working is in the middle distance, slightly to the left of the pole.



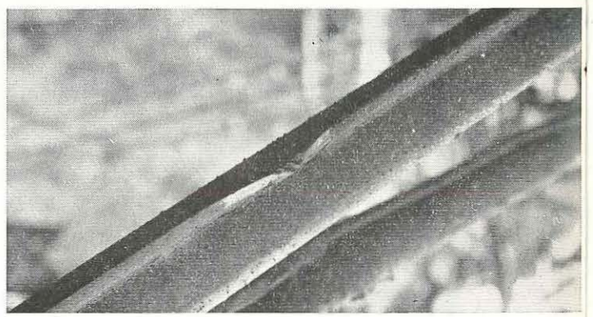


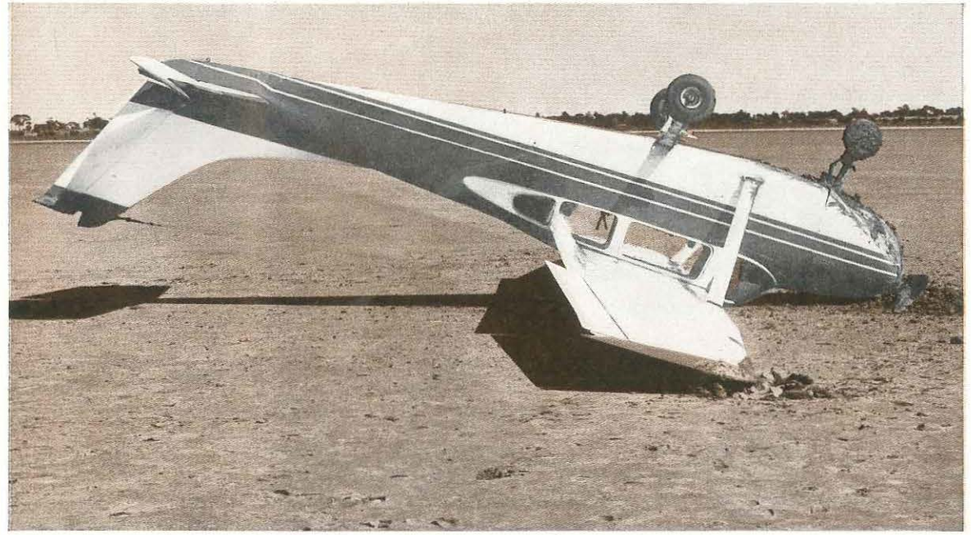
Above: The burnt-out wreckage, looking in the direction of flight. The landing strip can be seen on the rising ground directly behind the aircraft. The point of initial impact is in the foreground, indicated by the circle of grass cut by the propeller.

A satisfactory method of meeting the last-mentioned requirement is at present being investigated jointly by the Department, the Aeronautical Research Laboratories and some electrical supply authorities, and will be the subject of an article in the Digest as soon as the matter has been resolved.

The other two ways of reducing risks to an acceptable minimum are of course so obvious, and have been spelt out so many times before, that some pilots and operators may consider them hardly worthy of mention. But the fact is that they are such indispensable requirements for agricultural pilots and so important to safety, that they cannot be repeated too often. It is also worth noting that they are precautions which cost virtually nothing, other than a little more care, and which can be put into effect at any time. The further article on the subject of wires on page 26 of this issue may well provide some fresh food for thought on additional ways of implementing these precautions.

Below: Impact marks of the power line on the port undercarriage leg. Similar markings were also found on the starboard leg.





STICKY END . . . to a parachute drop!

AT Kalgoorlie in Western Australia, two sport parachutists planned to make a jump in a suitable nearby area. For this purpose the more experienced parachutist of the two inspected several dry lakes and clay pans to the north-east of the city to assess their suitability. One of these had previously beeen used as a parachute dropping zone, but as the bed of this dry lake was now being used for motor racing, he looked elsewhere. The parachutist then chose a clay pan two miles to the north-west and only half a mile from the access road. The surface of the clay pan seemed firm and its size adequate, and though he had no flying qualifications, the parachutist assessed it as suitable for a light aircraft to land on, as well as being satisfactory for use as a parachute dropping zone.

Two weeks later, the parachutists arranged the charter of a Cessna 182 for their parachuting exercise. It was arranged that the aircraft would depart from Kalgoorlie with the two parachutists on board, and fly to the clay pan, where they would make their descents. The aircraft was then to land on the clay pan, pick them up and fly them back to Kalgoorlie.

Before departing, the senior parachutist briefed the pilot on the parachuting procedure and on the way in which they would leave the aircraft. The first parachutist was to make a static line descent from 2,700 feet after which the aircraft was to be climbed to 5,000 feet, from which height the senior parachutist was to make a free fall descent to 2,300 feet before opening his parachute. This parachutist also briefed the pilot on the area of the clay pan which, from his earlier inspection, he believed suitable for the aircraft's landing. The pilot agreed to land on the clay pan as requested, if after an aerial inspection, he considered it satisfactory.

With the starboard door and front passenger seat removed, and the two parachutists occupying the rear bench seat, the aircraft took off from Kalgoorlie and flew to the clay pan to be used as the dropping zone. Both parachutists then jumped from the aircraft as planned. When they had reached the ground the pilot began a circling

descent from 5,000 feet while he waited for the parachutists to move off the clay pan as arranged.

When the area was clear, the pilot descended to a height of between 50 to 100 feet to make an inspection of the area on which he intended to land. He saw that it had clear approaches and that the surface was dry and apparently fit for him to land on. The pilot also noticed that the parachutists, who had moved to the side of the clay pan were holding their arms above their heads, and he assumed this to be a signal that the clay pan surface was firm enough for the aircraft. The pilot made a low circuit and lined up on the selected area to make a precautionary type approach.

In the meantime however, both the parachutists, on landing close to their target point on the clay pan, had found the surface, instead of being firm as they expected, consisted of heavy red mud beneath a smooth, apparently dry crust. The impact as they landed from their jump, drove their boots through the dough-like crust and their legs penetrated nearly a foot into the mud beneath. Both parachutists then realised that the surface was not suitable for the aircraft's landing. The surface was nevertheless firm enough to walk on carefully without breaking through the crust, and after gathering up their parachutes they moved to the edge of the clay pan. As the aircraft descended to make its inspection run, they waved to the pilot to try and convey to him that he should not attempt to land.

The wind, as the pilot continued his precautionary approach, was slightly from the left, so he touched down port wheel first. As the nose-wheel contacted the surface of the clay pan at a speed of about 25 knots, it immediately began to sink into the mud. The pilot attempted to hold it up, but the aircraft would not respond. Decelerating rapidly, the aircraft tipped forward on to its nose, the nose dug in, and the tail rose vertically, hung almost motionless for a few seconds, and the aircraft then fell slowly over on to its back. The pilot sustained only a minor injury and extricated himself from the aircraft before the two parachutists could reach the scene.

* * *

Inspection of the clay pan during the investigation confirmed that its appearance gave the impression of being suitable for landing. When walked on however, its "doughy" consistency was immediately evident, foot-falls making an impression about half an inch deep in the surface which would then "rebound", leaving footprints a quarter of an inch deep. It was learned that since the area had first been inspected by the parachutist two weeks before the accident, some 40 points of rain had fallen. Although there was no surface water lying on the clay pan at the time of the accident, this had undoubtedly contributed to the softness of the surface.

The pilot had not seen the muddy area where the parachutists had broken through the surface on landing, and as they had moved off the clay pan promptly, he had assumed that the surface was satisfactory. The parachutist's action in this regard was far from helpful. Although neither had any aeronautical qualifications, both had realized that the aircraft would not be able to land safely on the soft surface, and it is difficult to understand why they did not make a greater effort than they did to prevent the aircraft landing. On the soft surface of the clay pan, it should not have been too difficult for them to have conveyed some sort of message to the pilot. Even so, some share of the responsibility for the misunderstanding that arose must be laid on the pilot for not arranging some system of signalling with the parachutists beforehand.

Cause

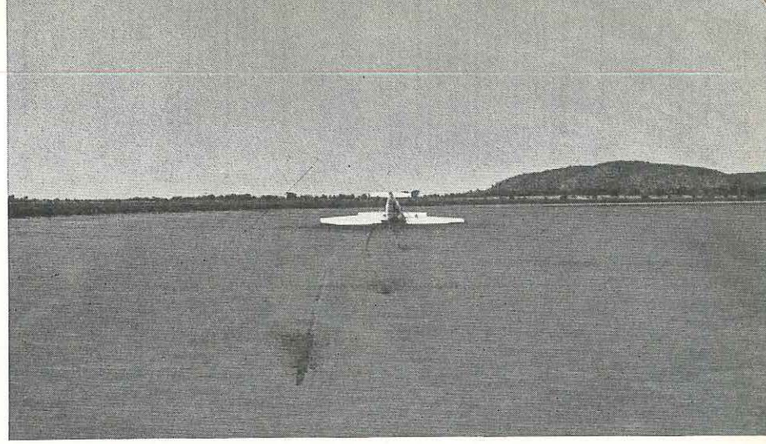
The cause of the accident was that the pilot attempted to land the aircraft on an unsuitable surface.

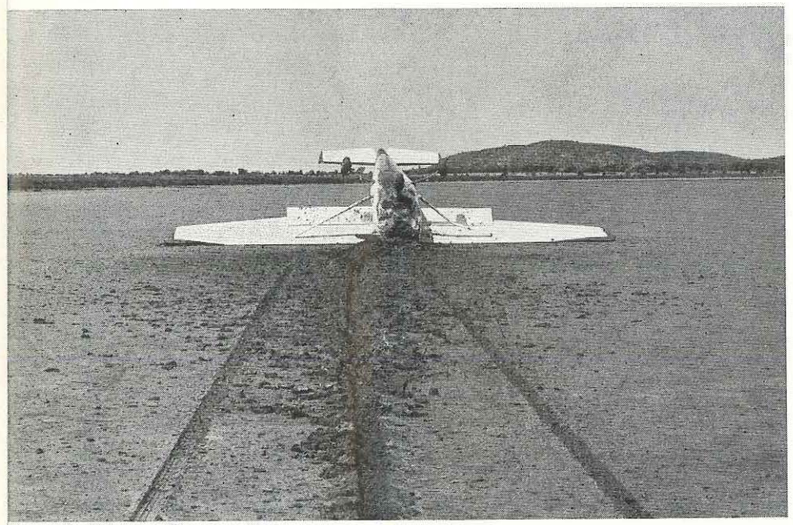
Comment

When inspected from the air red clay pans, such as the one featuring in this accident, often appear to have surfaces suitable for landing, but when examined from the ground are found to consist of "doughy", greasy mud. Similarly, salt-encrusted dry lakes frequently seem to have a suitable surface, but from the ground are found to have a thin crust which masks a veritable quagmire beneath.

Except in an emergency therefore landings on such areas should be avoided unless a ground inspection for dryness and firmness has confirmed their suitability. The accident described on these pages would have been avoided if arrangements had been made for this clay pan to be properly inspected before the aircraft landed. ———

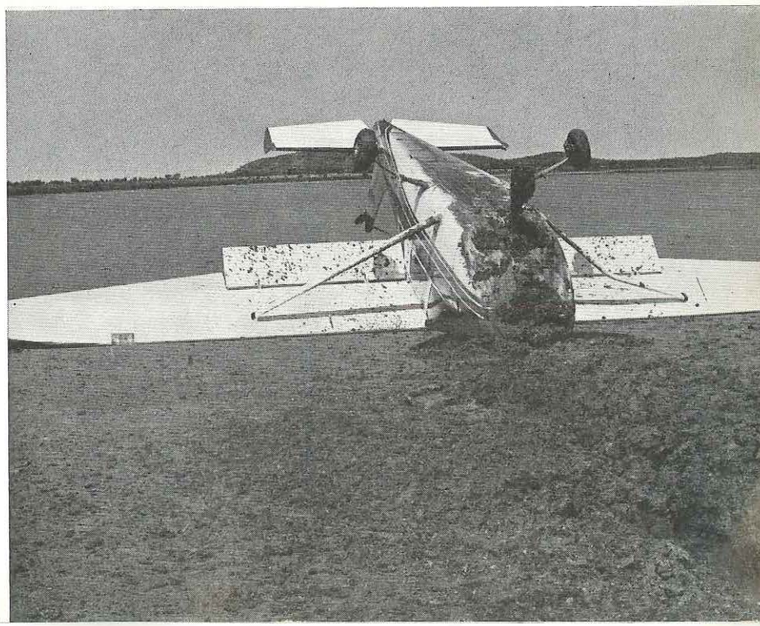
This series of pictures graphically illustrates the treacherous nature of the surface of the clay pan and the drastic effect it had on the aircraft's landing roll. Marks on the smooth crust clearly indicate the aircraft's touchdown point, port landing wheel first.

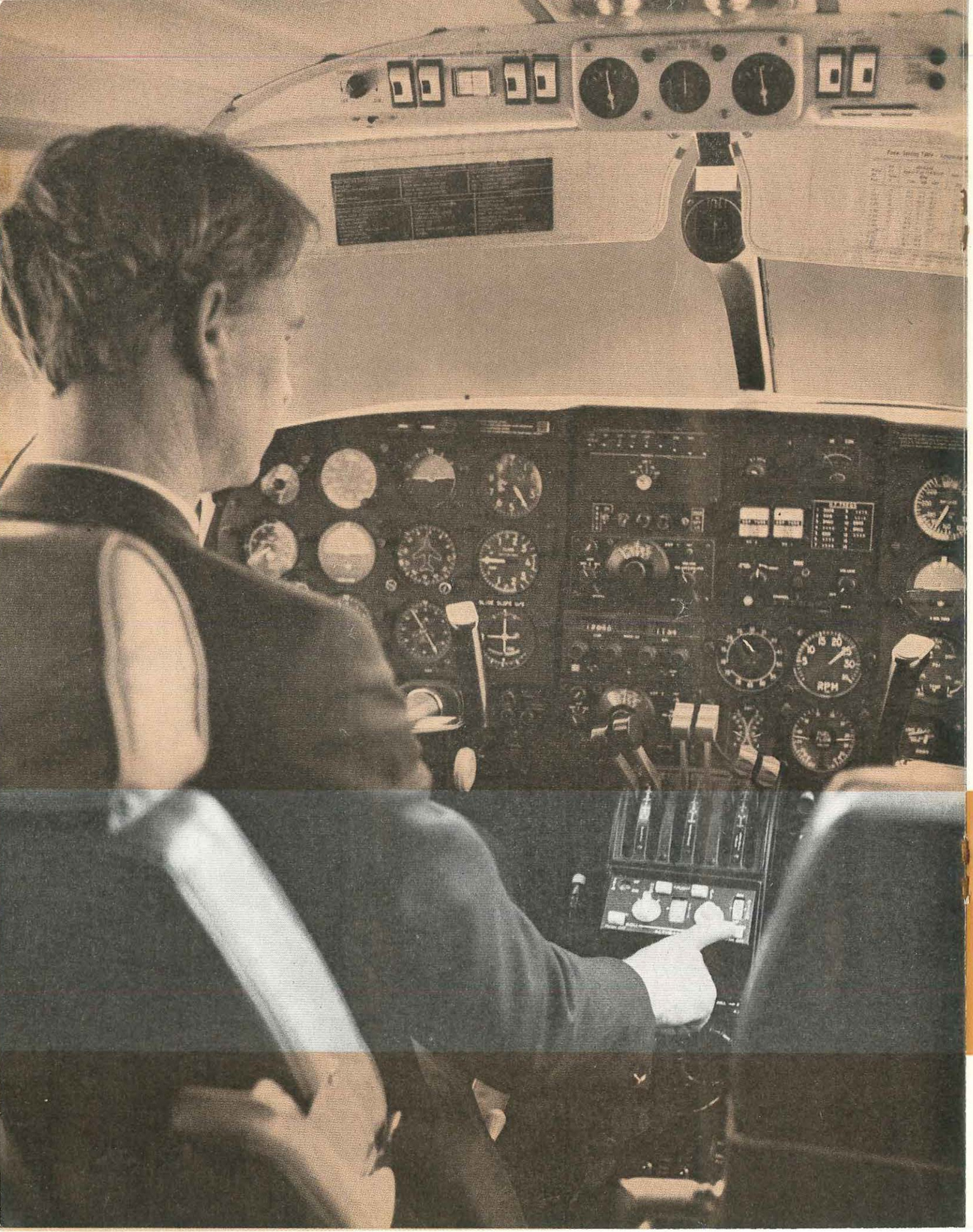




As the aircraft slowed, the nose wheel penetrated the thin, apparently dry crust, and rapidly sank into the thick mud beneath.

The aircraft as it came to rest, looking in the landing direction. Note the depth to which the nose leg penetrated into the mud before the aircraft finally fell over on to its back.





TRIMMED FOR DESCENT

ON the north coast of New South Wales, a Piper Navajo was making a single pilot IFR charter flight at night from Grafton to Coffs Harbour. Weather conditions were poor and the aircraft was flying at 4,000 feet in heavy cloud and rain with the automatic pilot engaged and encountering moderate turbulence.

After some period of normal operation the pilot noticed that the aircraft was pitching slowly forward and that the auto-pilot was not compensating for this change of attitude.

Assuming that some fault had developed in the auto-pilot, the pilot disengaged it, using the disconnect switch on the control column. Immediately he did so, the aircraft pitched down violently and the pilot found it almost impossible to overcome the elevator control forces sufficiently to raise the nose and maintain altitude.

Still believing that the auto-pilot was at fault and that it had failed to disengage, the pilot tripped the pitch trim circuit breaker. This produced no further effect so the pilot went to trim the aircraft manually and only then found that the elevator trim was wound fully forward. As the pilot wound the trim back to neutral, the control forces returned to normal, and he was able to climb the aircraft back to cruising altitude. The aircraft had lost a total of 1,000 feet during the emergency.

* * *

The type of automatic pilot fitted to this aircraft provides control in three axes, and also incorporates an automatic pitch trim which operates whenever the pitch channel of the auto-pilot is engaged. Investigation of the incident revealed that a failure had occurred in the transistor circuitry of the electric pitch trim unit, which caused the trim motor to run away in a nose-down direction. It was also found that fluctuating loads on the elevators could interrupt this action and in the turbulent conditions in which the aircraft was flying at the time of the incident it is probable that the nose-down trim was progressively wound on in increments.

The increasing nose-down trim was at first masked by the turbulence and by the auto-pilot feeding in opposite elevator control. The fault would thus not have been evident to the pilot until the stage was reached where the auto-pilot was no longer able to fully cope with the increasing elevator load, as a result of slippage of the auto-pilot elevator clutch, a safeguard provided in the auto-pilot's design to limit the loads that can be applied to the controls. From this point on, as the aircraft's trim continued to be wound further forward, the situation manifested itself in the slowly increasing nose-down attitude of the aircraft first noticed by the pilot.

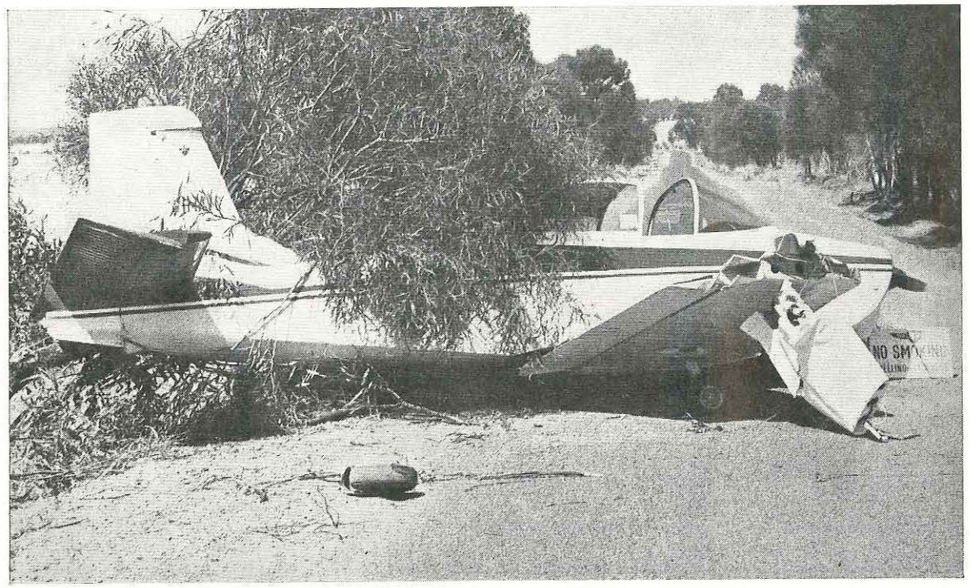
By the time the pilot had disengaged the auto-pilot as already described the elevator trim had reached the full forward position. Immediately the partial control compensation provided by the auto-pilot was removed, the full effect of the nose-down trim was transferred to the control column, causing the violent nose-down pitch and leaving the pilot with a control force that he could barely overcome.

Because the pilot understandably did not at first recognise that the nose-down pitch had been produced by the trim being wound into the full forward position, he continued to suspect the auto-pilot. The situation was thus not resolved until after the pilot had located and tripped the auto-pilot circuit breaker, found the trim in the full-nose-down position and wound it back. These actions inevitably took time, during which the alarming and potentially disastrous loss of height took place.

In the case of any malfunction of this type, the aircraft manufacturer and the manufacturer of the auto-pilot recommend that the circuit breaker should be pulled immediately the malfunction becomes apparent. This of course, has the effect of switching off the electric pitch trim system, thus providing the most positive method of preventing the automatic trim running away. To locate and trip the circuit breaker however, takes time and, until it can be performed, it is desirable that some interim measure be taken to stop the operation of the automatic trim. This can be achieved by turning off the automatic pitch switch, by disconnecting the auto-pilot itself, or by physically holding the trim wheel. In the type of aircraft involved in this incident, a light pressure applied to the trim wheel by the pilot's right knee is sufficient to prevent the operation of the automatic trim.

As a result of this incident, an airworthiness directive has been issued requiring aircraft fitted with this type of auto-pilot and automatic trim to be placarded to indicate that the pitch switch on the auto-pilot console controls both "pitch and auto trim" (see A.N.O. DCA/General 44). This switch is normally much more accessible than the circuit breaker and the placard should provide pilots with a constant reminder that a runaway in the automatic section of the electric trim circuit can be halted by this switch. This action should be followed by tripping the trim circuit breaker as recommended by the aircraft manufacturers.

Defects such as the one described may be easy enough to recognise quickly when flying visually in smooth air. But under instrument conditions and in turbulence it is a very different matter. For this reason, as this incident demonstrates, it may be prudent to monitor the auto-pilot more closely when operating in such weather.



THE WRONG KNOB — AGAIN?

During a final approach to land while conducting circuit training at Narrogin West, Western Australia, the pilot of a Victa Airtourer saw that the aircraft was undershooting and attempted to apply power. The engine failed to respond however, and the aircraft landed in a field short of the aerodrome. Although the pilot escaped uninjured, the aircraft was badly damaged as it ran through a fence and struck trees. The engine was undamaged in the crash, and when examined and tested later, was found to function normally.

The pilot, who held a restricted private licence, had flown the aircraft from Jandakot to Narrogin West the previous day. The flight was intended as one of the solo navigation exercises required for the removal of the area restriction on the pilot's licence. After remaining overnight at Narrogin West, the pilot planned to carry out some circuit practice at the aerodrome during the morning and to continue his navigational exercise back to Jandakot in the afternoon.

The aircraft had been refuelled before being hangared for the night at Narrogin West and in the morning, in preparation for his day's flying, the pilot carried out a thorough pre-flight inspection, including a fuel drain check. The fuel sample drained off was normal and contained no water or sediment.

The engine started without any difficulty and after the pilot had taxied out, it performed satisfactorily during the run-up made before taking-off. During the take-off itself, the engine appeared to be operating normally at full power, and the pilot climbed the aircraft to 1,000 feet as he began a left hand circuit of the aerodrome.

The circuit continued normally and after completing the base leg and turning on to final approach, the pilot saw that the aircraft was high and tending to overshoot, so he went to apply carburettor heat, closed the throttle fully, and lowered full flap. As the aircraft descended the engine seemed to be idling normally. At a height of about 150 feet, while gliding at 70 knots, the pilot saw that the aircraft was now undershooting slightly and he opened the throttle a little to adjust his descent path. There was no response from the engine.

The pilot closed and opened the throttle and checked that the fuel cock and pump were both turned on, but the engine remained dead. He then began a turn to the left in an attempt to reach a clear area but, realising that his remaining height and speed were insufficient to complete the manoeuvre safely, he decided to land straight ahead in the only area available to him.

The aircraft touched down on open ground in a paddock, but then bounced across an open drain and crashed through a fence separating the paddock from a road that crossed the aircraft's path at right angles. After colliding with trees on the verge of the road it finally came to rest with both wings dislodged and the port and nose undercarriage legs torn off.

The pilot, who was wearing a full harness comprising lap and shoulder straps was uninjured and immediately tried to open the cockpit canopy, but found it was jammed. Fearing the aircraft might catch fire, he quickly turned off the fuel, the ignition switches and the master switch and returned the controls on the instrument sub-panel to their closed positions. Bracing his foot against the crash pad above the instrument panel, the pilot was then able to gain enough leverage to force the canopy back sufficiently to climb out.

* * *

A detailed examination of the engine and carburettor was not possible at the accident site because of the difficulty of removing the cowlings from beneath the engine. After the aircraft had been returned by road to Jandakot however, a full inspection of the engine and fuel system was carried out.

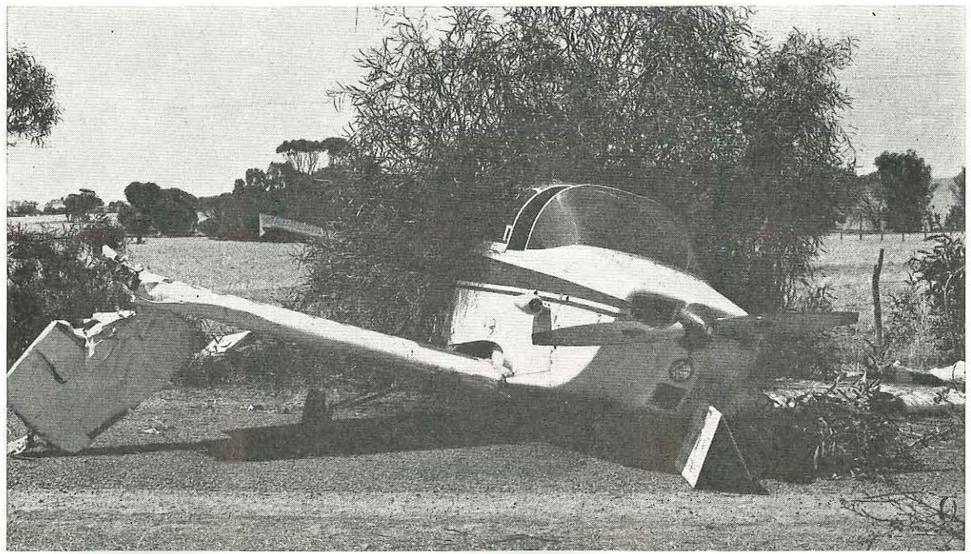
No fault could be found in either the ignition or fuel systems, nor in the engine controls. The engine started easily and idled normally. A run-up when the engine was warm produced no evidence of any malfunction and it responded well to rapid throttle openings from idling speed.

Although the pilot believed it was the carburettor heat control that he had pulled out at the time he closed the throttle on final approach to land, he said later that he could not be certain this control knob was extended when the aircraft came to rest. The pilot said his only thought at this time was to get out of the aircraft in case it caught fire, and he had quickly pushed in whatever knobs were extended at the same time as he turned off the fuel and switches.

Because of this, together with the fact that no fault could be found in the engine, it seemed that the engine failure could have been the result of mishandling and the possibilities were examined. In the Victa aircraft, as the photograph of the instrument panel on page 18 shows, the control knobs for carburettor heat, cabin heat and fuel mixture are similar in appearance and are located in close proximity to one another. The mixture control differs from the other two to the extent that it is red in colour instead of black and, being separated from them by the engine starter handle, is probably less likely to have been pulled in mistake for the carburettor heat knob. Had the pilot done so however, the flow of fuel to the engine would have immediately been cut off at the carburettor and the engine would have ceased to deliver power. But with the propeller windmilling, this fact would not have been evident to the pilot until he attempted to apply power by opening the throttle.

A more likely error in the Victa Airtourer would be to mistake the cabin heat control for carburettor heat. The knobs of these two controls are side by side and both being black and the same in size, are identical in appearance. Their only distinguishing

View of the wrecked aircraft with the paddock in which the pilot was forced to land visible in the background. Although both mainplanes were dislodged in the accident, the engine and propeller were undamaged.



feature are the placards gummed to the bottom of the instrument panel immediately above the respective knobs. An inexperienced pilot taking a hasty glance at the instrument panel could easily confuse the two black knobs and apply cabin heat instead of carburettor heat.

The aircraft was at a height of almost 1,000 feet when the throttle was closed, and had descended to about 150 feet when the pilot attempted to apply power during the final approach leg. The throttle was therefore closed throughout a height loss of nearly 900 feet. As well as this the weather at the time, with a shade temperature of 60 degrees F and a relative humidity of 61.5 per cent, was particularly conducive to carburettor icing. In these circumstances there would be a strong possibility of carburettor icing having developed during the descent if carburettor heat were not applied during this period. Thus, if the pilot had selected cabin heat in mistake for carburettor heat, it is possible that carburettor icing could have been responsible for the engine failure.

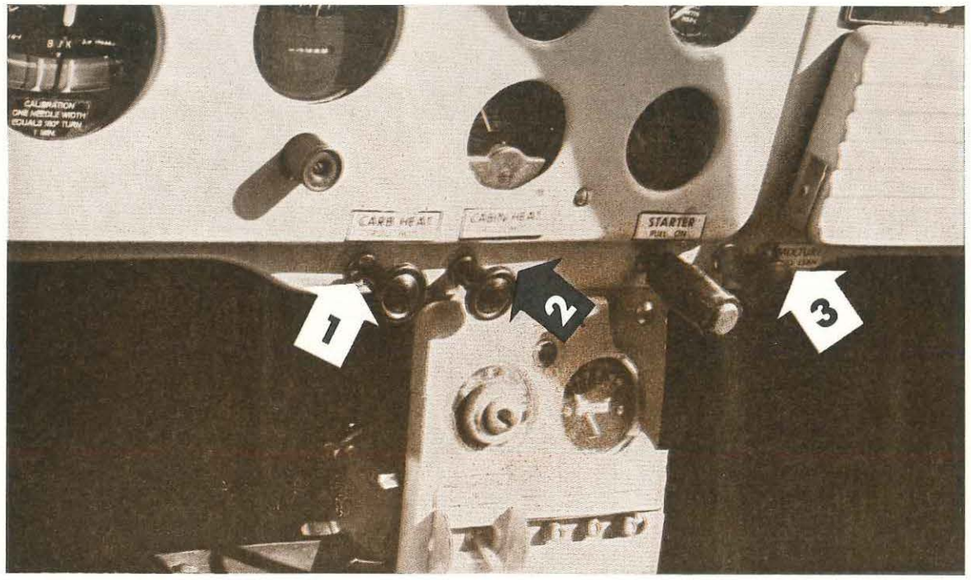
Because no fault could be found in the engine and the pilot was not able to recall the precise sequence of events that led to the accident, the cause could not be positively determined. The circumstances of the accident nevertheless strongly suggest that the pilot mishandled the engine controls while on final approach. This is by no means the first accident in Australia in recent years, in which an accident has resulted from apparent engine failure, but no fault could subsequently be found in the engine. In all such cases, though no actual cause of the accident could finally be established, the evidence of the investigation strongly indicated that the loss of power had resulted from mishandling of the engine controls. Other, similar, accidents have occurred to light aircraft overseas, some of which have definitely been ascribed to the pilot operating the mixture control in mistake for the carburettor heat control.

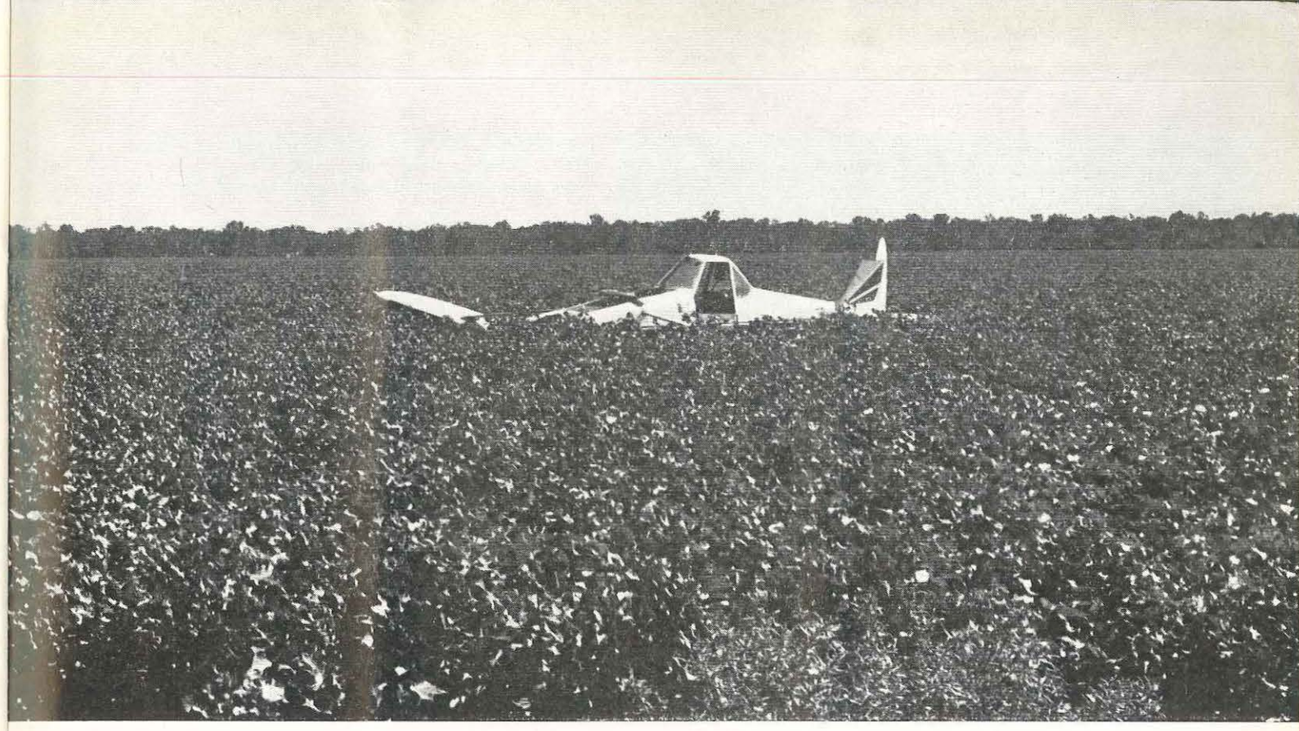
In the light of this past experience, this latest accident should serve to underline the care and clear thinking that pilots need to exercise when flying any type of aircraft in which the ancillary controls are grouped in a way that could lead to misidentification in the "heat of the moment".

Cause

The cause of the accident was that the aircraft sustained a complete loss of engine power at a height and in a position that precluded the possibility of a successful forced landing. A likely explanation of the engine power loss was that the pilot operated the cabin heat control in the mistaken belief that he was operating the carburettor heat control, and carburettor icing then occurred.

Close-up of the Airtourer's instrument panel, showing relative positions of (1) cabin heat control, (2) carburettor heat control and (3) mixture control.





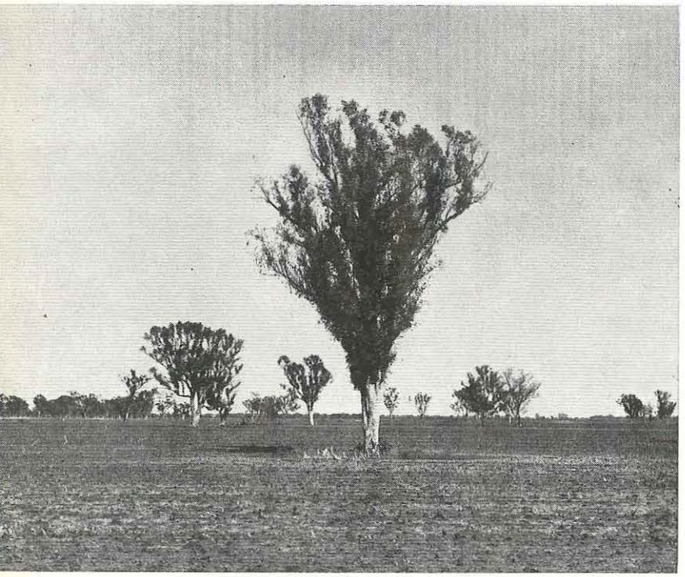
DUSK . . . the dangerous hour

SHORTLY before the end of daylight in a cotton growing area in New South Wales, the pilot of a PA-25 began what was intended to be a period of night spraying. The type of treatment being employed for the control of insects attacking the maturing cotton crops reaches its greatest effectiveness after sunset and the aircraft was properly equipped to conduct night spraying operations of this type.

The evening's work began soon after 1800 hours and the pilot completed spraying his first load 40 minutes later. The aircraft's tanks were re-loaded and at 1900 hours, thirteen minutes before last light, the pilot took off and flew back to the treatment area. Here he began swath runs east and west across a crop that had an "undulating" surface, the depth of the crop ranging between two feet and four feet six inches.

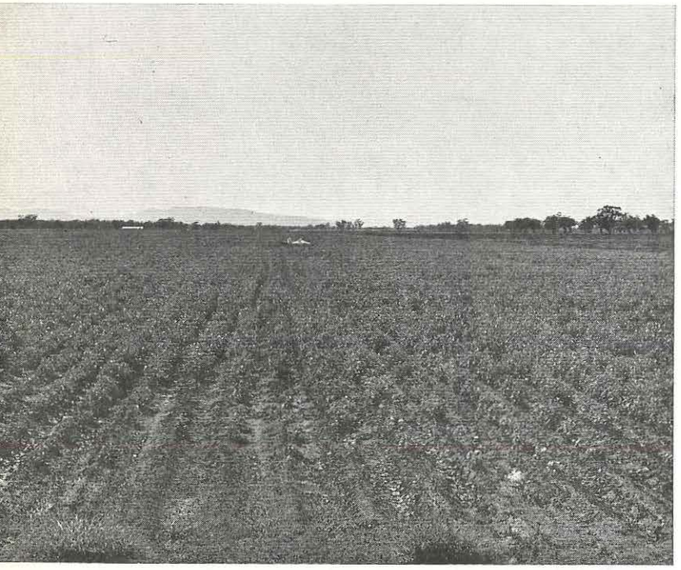
Approaching for his third run into the east with the aircraft's work lights turned on, the pilot had to fly over a tree 45 feet high and ony 120 feet from the boundary of the crop, before descending steeply to spraying height. During the descent, the aircraft sank more rapidly than the pilot expected and, as he attempted to level out, he realised the main wheels would enter the crop.

It is not uncommon for the wheels of spraying aircraft to enter the top of a crop without dire results, but at first it seemed to the pilot that the aircraft would not free itself from the crop, so he throttled back to reduce the force



Above: The tree over which the aircraft approached for its final spraying run, as seen from the edge of the crop. The proximity of the tree to the edge of the crop necessitated a steep descent.

Below: View from beginning of the run on which the wheels entered the crop. The aircraft can be seen in the distance where it came to rest.



of impact. But then the drag seemed to diminish and believing the aircraft might recover after all, the pilot applied full power and dumped the load. Despite this, the aircraft failed to accelerate and sank deeper into the crop. The pilot reduced power again, the starboard wing snagged in the crop, slewing the aircraft to the right, and it came to rest in the crop substantially damaged. The pilot was not hurt and after turning off the switches he left the aircraft. The time was just under three minutes before last light.

* * *

Examination of the aircraft disclosed no evidence of any fault which could have contributed to the accident. Both the aircraft's weight, and its centre of gravity position, were within prescribed limits at the time of the accident. The pilot was properly qualified for night spraying operations and was highly experienced in agricultural flying generally. At the time of the accident he was in good health and was not suffering from fatigue. As well as this, he was familiar with the area, having sprayed it several times before. The weather at the time of the accident was fine and warm, with a light and variable wind, with occasional gusts developing from the west to about eight knots.

Commenting on the wind conditions after the accident, the pilot said on his last run after he had passed over the tree in the adjoining paddock and began the descent towards the crop, the aircraft's rate of sink seemed excessive for its attitude and he believed the aircraft had encountered a gust with considerable tail wind component. It seems quite possible therefore in the conditions existing at the time, that the pilot's judgement could have been affected to some extent by an unexpected wind gust.

The factor which undoubtedly played the greater part in the events leading to the accident however, was the poor visibility that existed at the time it occurred. Although there was no restriction to the pilot's visibility by way of haze or the state of the aircraft's windscreen, the daylight had almost faded at the time of the accident and the pilot had switched on the aircraft's work light only a short time before.

It is a common experience with motorists that this is the worst time for seeing on the road and, with the aircraft flying close to the ground, the situation in which this pilot was placed is in many ways comparable. Many people believe that they experience greater visual difficulty while driving at dusk than they do driving at night with the headlights on. Moreover, the use of headlights at dusk is of little value other than to make one's own vehicle more readily visible to other drivers.

Studies that have been carried out support the belief that twilight visibility is poorer than might be expected on the basis of the natural light still

available at such times, but show that it is probably not as poor as a purely subjective appraisal might suggest. Some of the factors that the studies have shown to contribute to a loss of visibility at twilight are:

- A general loss of visual acuity occurs as a normal accompaniment to the reduction in illumination.
- The adaption of the eye lags behind the rapid decreases in illumination that occur after sunset.
- The relative brightness of the sky inhibits the eye's ability to adapt to the dark, and provides a source of glare.
- The changes in light distribution as the sun sets can reduce the visibility of low contrast objects.
- The reduction in observable tree detail that occurs at twilight as the result of the disappearance of strong shadows may cause a person to over-estimate the loss of visibility.

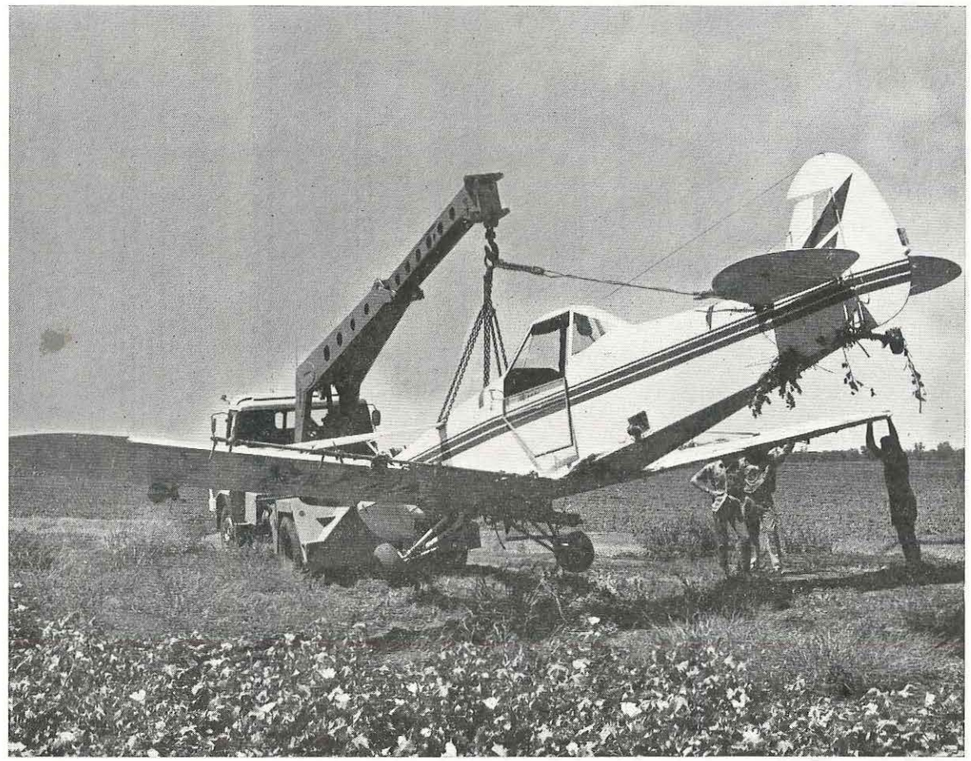
Taking into account the pilot's experience, together with the circumstances in which the accident occurred, it seems probable that the loss of detail referred to in the last mentioned factor was primarily responsible for the pilot's misjudgement in this accident. This factor, together with the pilot's actual reduced visual acuity in the deepening twilight, appears to have resulted in his establishing the aircraft in an excessively high rate of descent which, possibly because of an adverse downwind gust, he was unable to correct before the aircraft struck the crop.

The accident provides a most interesting and important illustration of the degree of care that is obviously necessary when obliged to make fine judgements in failing light. It should serve as an object lesson, not only to agricultural pilots who are sometimes required to make the transition from day to night spraying, but to any pilot who is inclined to "press his luck" by operating right up to last light at an unlit aerodrome or landing area.

Cause

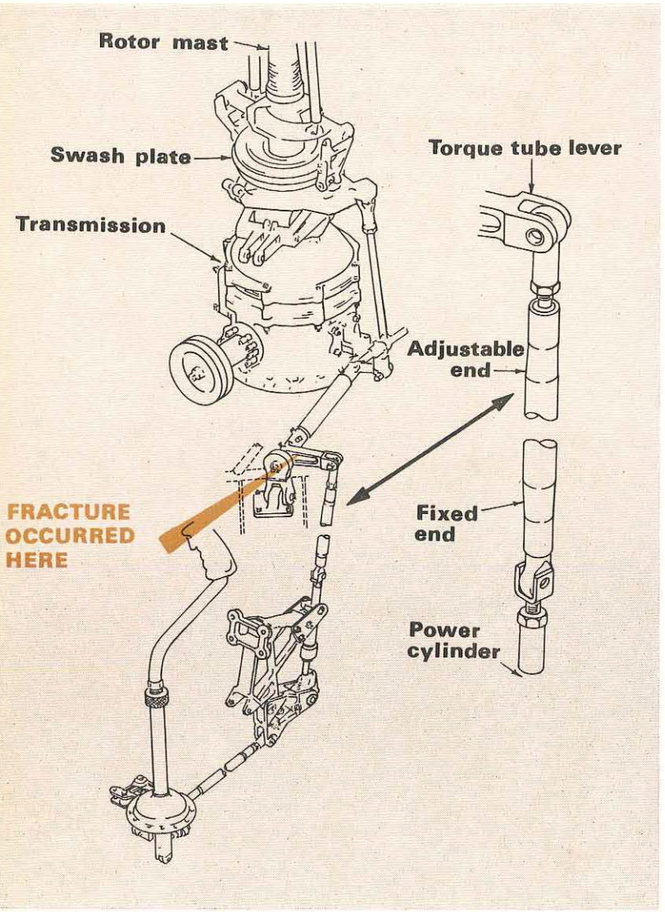
The cause of the accident was that, in lighting conditions requiring great care, the pilot misjudged his descent to spraying height.

Damage to the undercarriage and the lower section of the fuselage is evident as the aircraft is lifted clear of the crop.



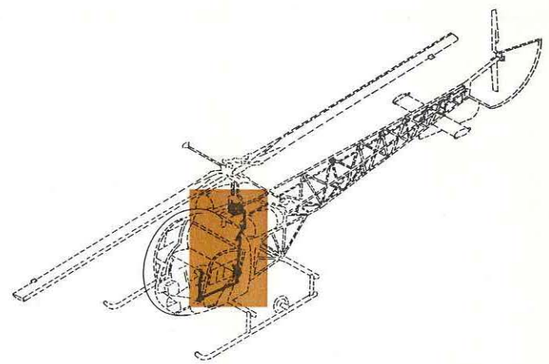
The importance of correct installation

IN New Guinea recently, a Bell 47G helicopter was involved in a accident when a failure occurred in the cyclic control system. During the subsequent investigation, it was found that a torque tube lever in the lateral cyclic control linkage had fractured.



Further examination then revealed that the push-pull control rod connecting the lever to the cyclic control power cylinder had been installed some time previously in the reverse sense. It was evident that stresses imposed on the torque tube lever by this incorrect installation had, over a period of time, been responsible for its failure.

As shown in the diagram on this page, the adjustable end of the push-pull rod is intended to attach to the torque tube lever and is able to accommodate itself to the radial movements of the lever. But if the rod is installed in an inverted position, the space between the ears of the torque tube lever fork is not wide enough to accommodate the fixed end of the tube and fouling occurs as the lever travels upwards. This has the effect of transferring the point of maximum bending from the design point at the axis of the torque tube, towards the centre of the lever.

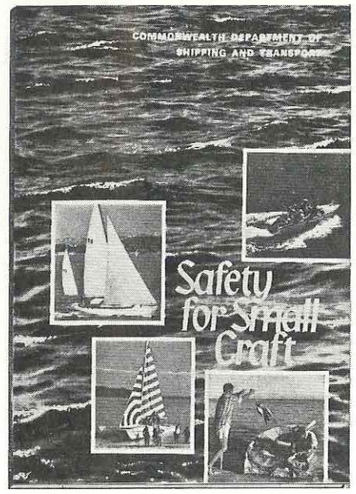


The incorrect installation had apparently gone undetected for some 140 flying hours before the failure occurred. There is no doubt however that the inspections and checks performed after the installation of the rod should have disclosed the discrepancy, especially as full right lateral cyclic control would almost certainly have not been obtainable in this instance. It is also somewhat surprising that pilots flying the helicopter in the intervening period did not notice the obstruction in the cyclic control movement.

In this case the helicopter concerned was a service aircraft and the circumstances of the accident are not, strictly speaking, a matter for the Department of Civil Aviation. But it is mentioned in the Digest to emphasise yet again the paramount importance of properly conducting duplicate inspections after any adjustment, repair, or replacement of parts in the primary control system of any aircraft. Instructions detailing the procedure for these duplicate inspections will be found in Airworthiness Directive DCA/GEN/26.

In many cases with light aircraft, especially in remote areas, inspections of this type may become necessary when only one Licensed Aircraft Maintenance Engineer is available. In such cases, the pilot is usually called upon to take the place of the second L.A.M.E. in the duplicate inspection. It should go without saying that a pilot required to participate in a duplicate inspection should make himself thoroughly familiar with the system he is going to inspect. Duplicate inspections were introduced for the express purpose of preventing accidents such as the one mentioned in this article. Properly performed, they will do exactly that.

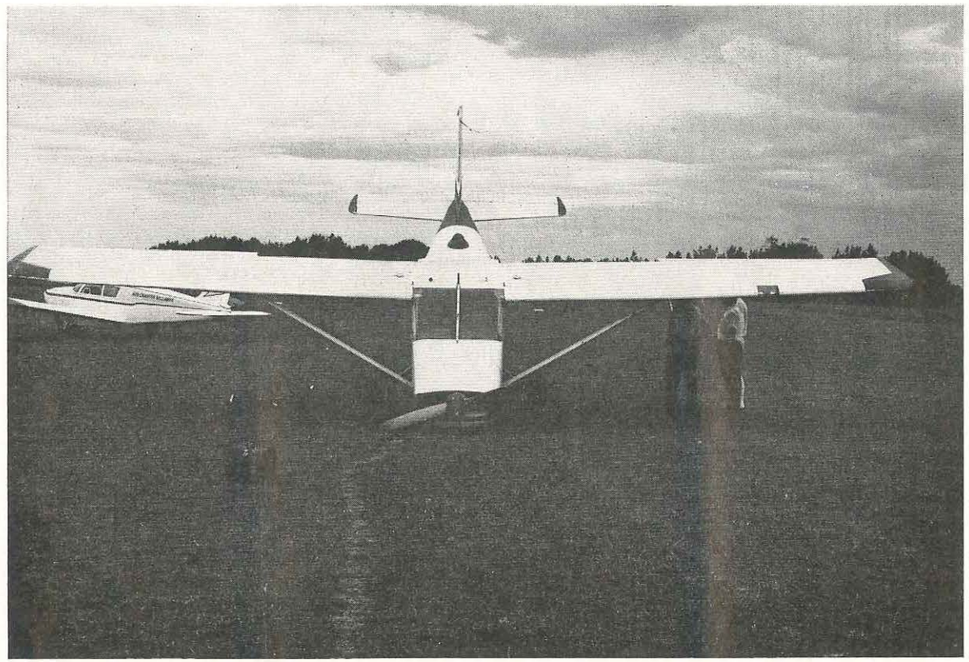
SAFETY and SAR . . . at sea



A handbook entitled "Safety for Small Craft" has recently been published by the Commonwealth Department of Shipping and Transport. It contains a wealth of information for all boating enthusiasts — a cross-section of the community which undoubtedly includes many members of the aviation fraternity.

There are also some sections in the book containing information on which pilots engaged in a search action at sea would be briefed, and some, such as the section dealing with emergency signals, which it would be desirable for a pilot to know even though not engaged in a search. The essential parts of these should already be familiar to pilots as they are contained in the Emergency Procedures Booklet (MAP 5), issued with the AIP.

"Safety for Small Craft" costs only $1.00 and is available from offices of the Department of Shipping and Transport, Government Publications Offices, mercantile marine offices and most bookshops. It is recommended reading for all in the aviation industry whose professions or pleasure pastimes are in any way associated with the operation of small sea craft.



COSTLY WOOL GATHERING!

LATE in the afternoon, at a grazing property in the Western District of Victoria, the owner of the property decided to make a short local flight in his Cessna 175 to bring the engine thoroughly up to operating temperature before he drained and replaced the engine oil.

The paddock which the grazier used as a landing area adjoined a timbered area occupied by the homestead and other buildings on the property, including the shearing sheds. Shearing was in progress at the time, and there were a number of sheep in the vicinity of the shearing sheds. A wire fence with two gates separated the well-timbered shearing shed paddock from the landing field.

Returning from his brief flight ten minutes later, the pilot overflew the landing field, completed a circuit and entered a final approach leg which passed over the homestead and shearing sheds. The landing area was clear and the pilot lowered full flap as he passed over the trees on short final approach. Just before touching down, the pilot, out of the corner of his eye, saw something move from the right across the landing path of the aircraft. Just as it touched down, there was a thud from the front of the aircraft and the pilot realized the nose leg had been damaged. The pilot held the aircraft level with the elevators for as long as possible, then the nose dropped and the aircraft slid on its nose cowling and main wheels for about 100 yards before coming to rest.

On stepping out of the aircraft, the pilot found that it had struck and killed a sheep that had run in front of the aircraft from the right hand side. The impact had dislodged the nose leg completely from its mountings.

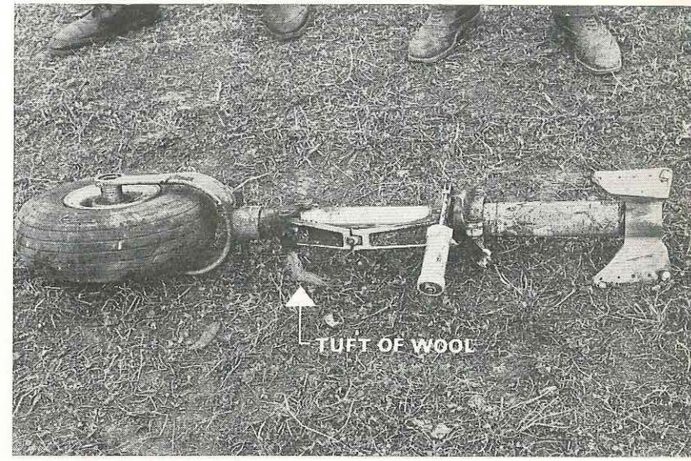
It was not possible to determine just how the sheep was able to enter the landing field. It seems likely that when the aircraft was on its final approach, the sheep was somewhere in the vicinity of the fence and was thus not readily apparent to the pilot. Then, as the aircraft approached the area where the sheep was, it would probably have been hidden from the pilot's view by the aircraft's nose. If, as seems likely, the sheep had run ahead of the aircraft, as it descended and overtook the animal, it is understandable that the pilot did not see it, particularly if the sheep was diverging towards the aircraft's flight path from the right hand side.

In these circumstances, the pilot cannot be criticized for not maintaining an adequate look-out during his landing approach, particularly as there was nothing to make him suspect there was a sheep in the field. On the other hand, the fact that the sheep was there and able to run into the position where it caused the accident indicates that whatever precautions had been taken to keep sheep out were inadequate.

There have been a number of mishaps in recent months, in which aircraft have collided with animals while landing or taking off from landing areas in country districts. This further accident provides a timely, if costly illustration, of the extreme care that must be taken when operating aircraft in country areas with livestock in the vicinity.

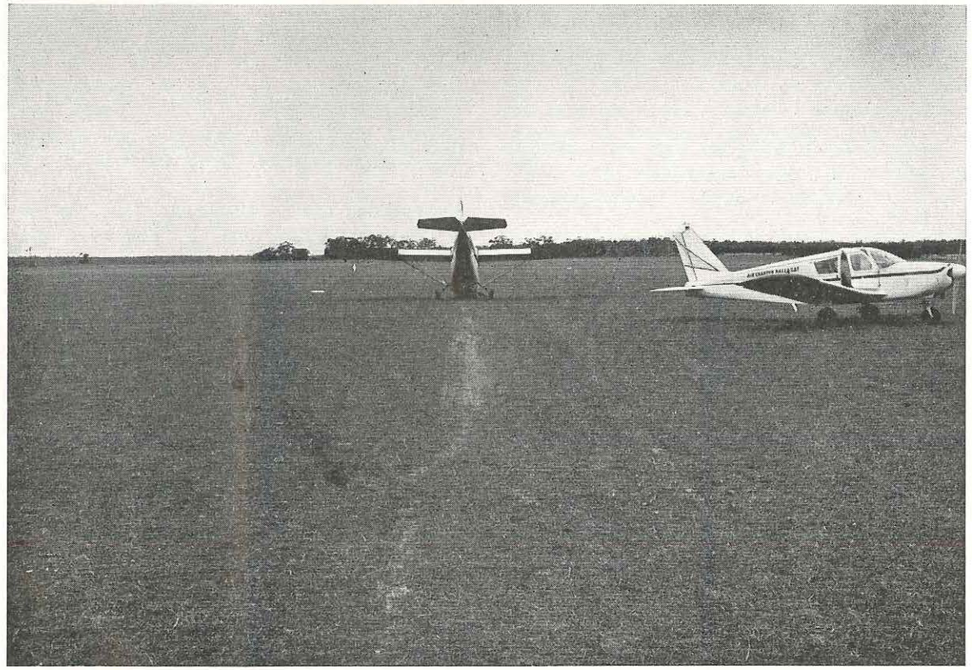
Cause

The cause of the accident was that the measures taken to ensure that the field was free of sheep were inadequate.



Above: The complete nose wheel leg, torn from its mountings when the aircraft struck a sheep, as it was found in the paddock. A tuft of wool is still adhering to one of the torque link bolts.

Below: The damaged aircraft, as it came to rest on the strip looking in the landing direction. Ground marks left by the underside of the engine cowling as the aircraft slid to a halt, can be seen in the foreground.



Pilot Contribution

POWER LINES . . . how to avoid them

The author of this article is a highly experienced Australian agricultural pilot, and the advice he offers is based on personal observations accumulated over years of agricultural flying experience. The hints he gives on detecting power lines from the air should provide food for thought for all agricultural pilots whose work requires them to avoid these hard-to-see hazards in flight.

POWER lines constitute one of the greatest potential hazards to aerial spraying operations. The uncertainty of their whereabouts, particularly branch lines, greatly increases a pilot's mental stress and work load. Could this be relieved, it would largely reduce the pressure under which the pilot is working and enable him to approach his task in a more relaxed manner. As a result, the chances of striking wires, either those not observed, or those that the pilot knows are there but forgets because of stress, would be largely reduced.

Wires are hard to see, especially so in the case of branch lines, so when surveying an area for wires from the air, the first consideration is to look for indications of wire runs rather than the wires themselves. Once the indication of a wire run has been noted, finding the wires themselves is a relatively simple task. Retaining the position of the wires in mind also becomes easier as the pilot is more certain of the layout of the power lines and so should have less fear of hitting an unseen wire.

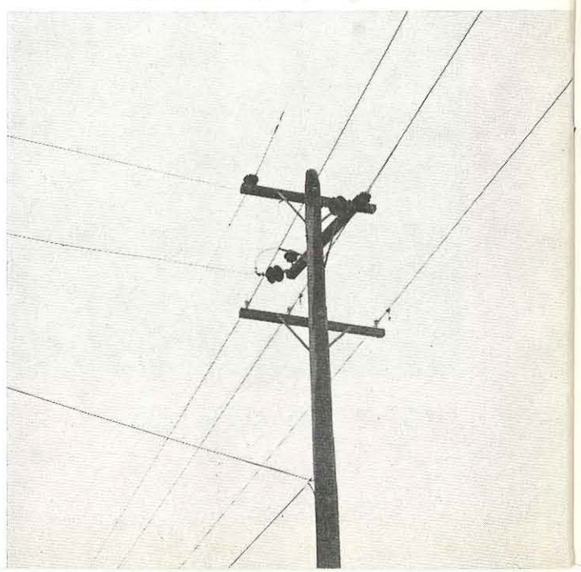
Because wires cannot be run anywhere without support, the best indication of their presence is the poles on which they are carried. Pole runs thus indicate wire runs and these pilots can survey while approaching the area to be sprayed. It is not enough to be content with noting the position of pole runs only in the immediate vicinity of the job, because wires can pass through the treatment area from as much as half a mile from the closest supporting pole, so areas surrounding the actual treatment area are also important. As well as this, there are many factors that can cause an aircraft to lose height into surrounding areas and a pilot should be familiar with the disposition of wire runs in these areas.

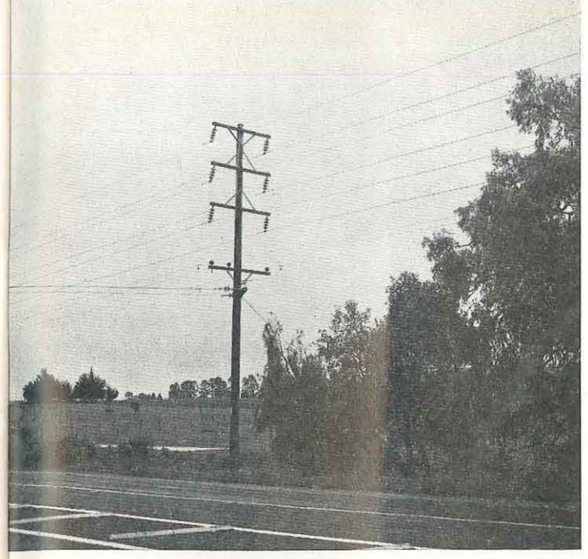
Having established the pole runs, the next point for the pilot to note is the position and relationship of insulators and cross-trees on the poles themselves. With the exception of single wire runs, wires are normally attached to insulators mounted on cross-trees on the poles. The wires then run away at an angle very close to 90 degrees to the cross-tree, so cross-trees on poles all facing the same way indicate wires running that way.

Branch wire runs are easy to spot by checking each pole for the presence of cross-trees facing in other directions on the pole. The presence of these other cross-trees denotes a cross or branch line. Looking in a direction that forms an angle of 90 degrees to the cross-tree should reveal the next supporting pole on the branch line, even if it is partially hidden by trees. This rule holds good for all wires from major grid power lines, down to domestic supplies lines in which more than one wire is used.

Bends in some types of multiple wire runs are easily seen because the insulators are hung at an angle to the cross-tree rather than straight down. The direction in which the insulators hang shows

Cross-trees on pole indicate the direction of wire runs. Note that the insulators on the branch line in this case are inclined downwards, denoting a sag in the wires running in this direction. Two bracing wires are attached to the lower part of the pole.





Insulators hung at an angle to cross-trees indicate a slight bend in the main wire run. The "hang" of the insulators denotes the direction of the bend. Note the tight branch lines, with insulators horizontal, and the stay wire almost obscured by trees.

the direction of the bend. With all bends, whether on a multiple or a single wire line, it is important to watch closely for a strainer wire on the pole on the "outside" of the bend.

A wealth of information can be gleaned from the way that some insulators sit in relation to the pole. At bends for instance, insulators are often slung from below the top of the pole and if they are almost horizontally out from the pole, the wire is tight with little droop. Insulators hanging down at an angle of 30 degrees to the horizontal denote that there will be pronounced sag in the wire. These insulators and their attaching bars can thus be treated like a railway signal; straight out — tight wire, hanging down — slack wire. Most poles are of about the same size but the height of the bar mounted on the pole which carries the insulator varies considerably and can be used to estimate the clearance to be expected under the wire NEAR THE POLE.

Single Wire Power Lines

Single wire power lines are probably the most insidious hazard of all as they can be extremely difficult to detect from the air, and can be encountered in the most unexpected places in rural areas.

The insulators mounted on top of the poles of a single wire power line can be a useful guide in determining the run of the wire. Sometimes the insulators are of clear material which show up well in the sunlight, but in any case the size of the insulators used forms a bulge on the top of the pole which can usually be seen from

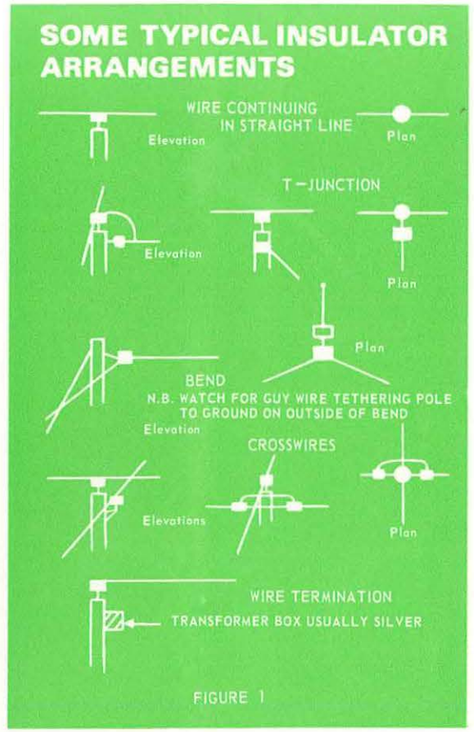
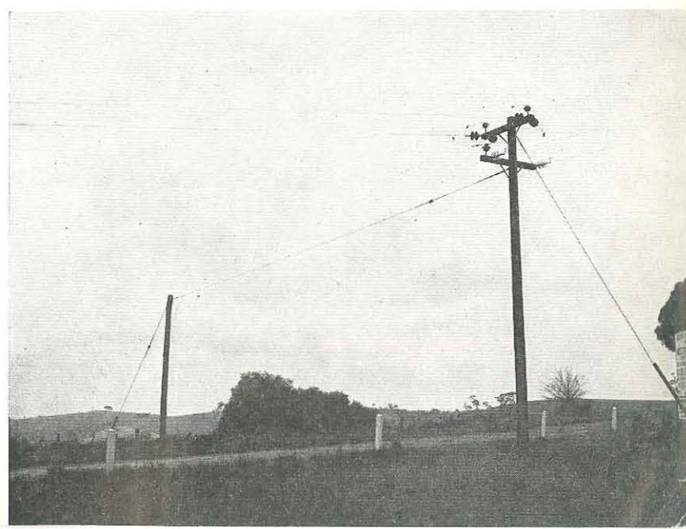


FIGURE 1

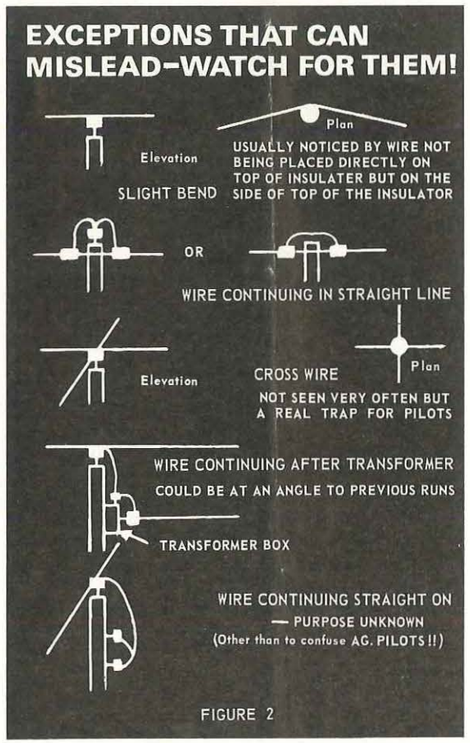
some distance away. Some typical single wire insulator arrangements are shown in Figure 1. Fig 2 shows some of the exceptions to the rule that can be encountered from time to time and which need to be looked at carefully.

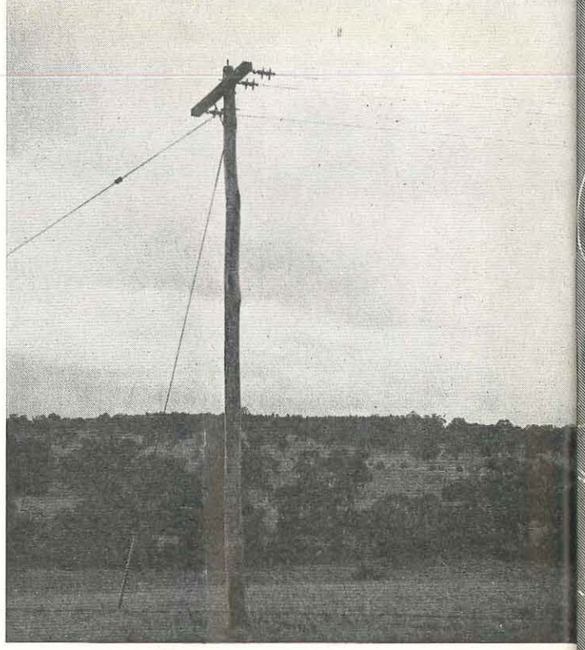
A dangerous combination. As well as the normal stay wire on the "outside" of the bend in the main wire run, a horizontal bracing wire, opposite the tight branch lines, leads to a pole and a further stay wire on the far side of the road.



Using the identification of insulators in this way while approaching the treatment area, helps the pilot to anticipate the wire runs and to look in the correct direction for other poles. However, because the next nearest pole could easily be hidden by trees, it is wise to watch for a wire run for at least two pole distances from any indicated junction or bend.

It is important to remember that the appearance of insulators should be used only as a **guide** to the wire run, and that the only safe way to determine the actual run is to fly over the poles themselves. Ground inspections do not always give good indications of wire runs as the wire may be hard to see and the poles hidden from view. There is thus no substitute for a thorough aerial inspection as well. Quite often, the poles of a single wire power line are placed amongst trees or in other places where they are hard to see. The pole closest to a farm house is nearly always amongst trees and it is a wise precaution to assume that any farm building has the power connected unless a thorough visual inspection proves otherwise.





A power line termination, with horizontally mounted insulators and characteristic bracing wire arrangement. The insulators standing out at right angles show that there is little droop in the wires.

It is also very important to remember that it takes very little time to erect a single wire run. A field that was inspected and found clear of wires a few days previously may have had a wire erected across it by the time a pilot returns to treat the area, and this fact may not be known to local people with whom he is working. For this reason pilots should always inspect an area again immediately before they begin treatment.

* * *

All that has been said in this article is intended only as an aid to observing **indications** of wire runs. A pilot should always confirm the actual wire run by observing the wires themselves. After all, it is the wires the aircraft hits not the indication! But properly and sensibly used, the system of looking first for the indications of wire runs and then for the wires themselves should relieve the pilot of a great deal of tension and work load and enable him to proceed with the actual treatment in a safe, more relaxed, and expeditious manner.

Pilots should also bear in mind that it is possible to see and study wires, poles, cross-trees and insulators without being in an aircraft. It is possible to look and learn when driving through any area hung with power lines. They are many "clues" to power line arrangements. The one you observe while driving today could save your life while flying tomorrow!