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AVIATION SAFETY DIGEST

DEPARTMENT OF CIVIL AVIATION AUSTRALIA

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Contents

COVER: A Piper Pawnee, caught by our camera while super spreading in Gippsland, Victoria.

Aviation Safety Digest is prepared in the Air Safety Investigation Branch and published at two monthly intervals. 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, 3001.

LOSS OF CONTROL ON TAKE-OFF

Immediately after lifting off at Goroka, New Guinea, a Beech Baron rapidly assumed an extreme nose-up attitude and climbed steeply to about 200 feet. The aircraft then fell away to the left and plunged to the ground in a near vertical dive. The aircraft was destroyed and the seven occupants were killed.

At the time of the accident, which occurred at about 0615 hours, the aircraft was taking off on a charter flight to Madang, 60 nautical miles away on the north coast of New Guinea. The aircraft had been chartered by the six passengers on board, who were returning to Madang after spending the weekend in the New Guinea Highlands at Goroka.

The pilot and passengers were at the airport and ready for departure before 0600 hours but were prevented from leaving by foggy conditions. The fog lifted quickly however and at 0610 the pilot directed the passengers to board the aircraft. The pilot took his place in the left hand front seat and started the engines. One passenger was seen to be seated beside the pilot, three passengers were sitting abreast in the second row of seats, and there were two passengers in the rearmost seats. The pilot let the engines warm, then carried out an engine run-up on the apron, before taxi-ing out. Because two other aircraft had taxied for take-off ahead of the Baron, this aircraft waited for several minutes at the holding point for Goroka's Runway 17L. During this time, the pilot appeared to carry out another run-up. The aircraft then entered the runway and commenced its take-off run.

The take-off appeared quite uneventful until the aircraft actually left the ground. At this point however, instead of climbing normally, the aircraft rotated into an extreme nose-up attitude, and with the engines apparently still delivering take-off power and the undercarriage extended, zoomed up at a very steep angle to a height of about 200 feet. Towards the top of the climb the engines seemed to be throttled back, and the aircraft appeared to stall and to fall over on to its back. The nose then dropped, and the aircraft dived to the ground at an angle of about 60 degrees and on a heading of 030 degrees magnetic, (i.e. in a direction almost opposite to that of take-off). An airport fire tender, manned by the New Guinean fire crew, arrived at the scene almost immediately, the crew having commenced emergency action as soon as they saw the aircraft assume its unusual attitude after lifting off. Although both the aircraft's fuel tanks were ruptured, no fire broke out and the fire crew found that all the occupants of the aircraft had been killed instantly.

The damage sustained by the aircraft confirmed that it had struck the ground in a steep diving attitude of about 60 degrees to the ground. The point of impact was 3670 feet from the commencement of the take-off run and 120 feet to the left of the runway centre line. The wind was calm at the time and the visibility was unlimited, and the weather conditions had obviously played no part in causing the accident.

At the moment of impact, the aircraft was still in the take-off configuration. The undercarriage was extended, the flaps were lowered 15 degrees, and the elevator trim was set 8½ units nose-up, the take-off setting normally used by some of the operator's pilots in this type of aircraft.

The damage to the propellers indicated that the engines were delivering little, if any, power at the time of impact. A detailed examination of the engines showed that they were nevertheless capable of normal operation at this time and there was no evidence that the fuel system had been mismanaged. This appeared to confirm the evidence of eye witnesses that a change in power occurred at or near the top of the climb, and it was considered very unlikely that the aircraft could have achieved the flight path and height observed if any reduction or loss of power had occurred earlier.

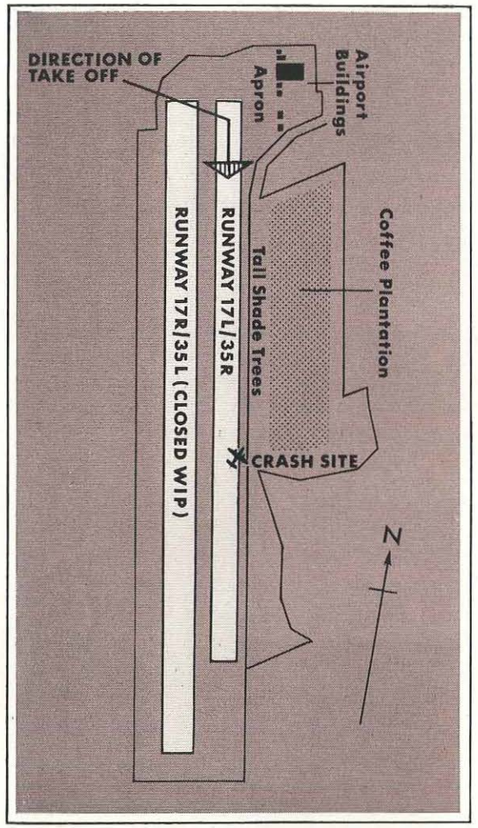


Diagram of Goroka Airport showing direction of take-off and position of wreckage.

The aircraft's flying control system was subjected to a scrupulous examination but this failed to uncover any evidence that could throw light on the cause of the accident.

While it was established beyond all reasonable doubt that the aircraft was structurally and mechanically sound up to the moment of impact, the investigation did reveal serious anomalies in the manner in which the aircraft was loaded.

In the first place, although the aircraft's flight manual states that the maximum number of occupants shall be six, seven persons were being carried in the aircraft at the time of the accident. In this model Baron aircraft, the six seats are arranged in three rows of two seats each. The front and centre rows consist of individually adjustable chairs with a seat belt attached to the frame of each chair, and the rearmost pair of seats is a non-adjustable bench seat with two seat belts attached to its frame. On this flight, the seventh occupant was seated between the two passengers seated in the centre row, actually sitting on the inside portion of each of these two seats, and was not provided with a seat belt.

Secondly, calculations made using the approved loading system for the aircraft, showed that although the all-up weight was less than the maximum permissible, the centre of gravity was 2.3 inches behind the aft limit and that even if the seventh occupant had not been carried in the aircraft, the centre of gravity would have still been behind the aft limit with all seats occupied. This was despite the fact that 60 pounds of luggage was being carried in the nose locker. As the all-up weight was less than the maximum permissible, the centre of gravity could of course, have been restored to safe limits by loading additional weight into the locker.

The pilot, though he had nearly 5,000 hours flying experience and held a senior commercial licence, was comparatively inexperienced in light aircraft, having gained most of his flying time on service and airline aircraft. His experience on Beech Baron aircraft was limited to only 13 hours. Against this, his conversion to the type appeared to have been adequately covered and it was learned that the pilot's attitude to flying was mature and careful. It was believed unlikely that he would deliberately carry out a manoeuvre which could jeopardize his aircraft and its passengers. There was evidence too that the pilot was not reluctant to discontinue a take-off when necessary. In the case of his take-off at Goroka, there was ample runway length available to abandon a take-off up to the point of the aircraft reaching its take-off safety speed of 86 knots. The possibility was considered that a door had opened, or that the pilot's seat had moved back on its rails, thus causing a control difficulty, but as both doors were found locked during the wreckage examination and all seats were locked in position also, this likelihood was discounted. The pilot was known to have been in good spirits immediately before boarding the aircraft at Goroka, and a post-mortem examination of his body disclosed no evidence that he was

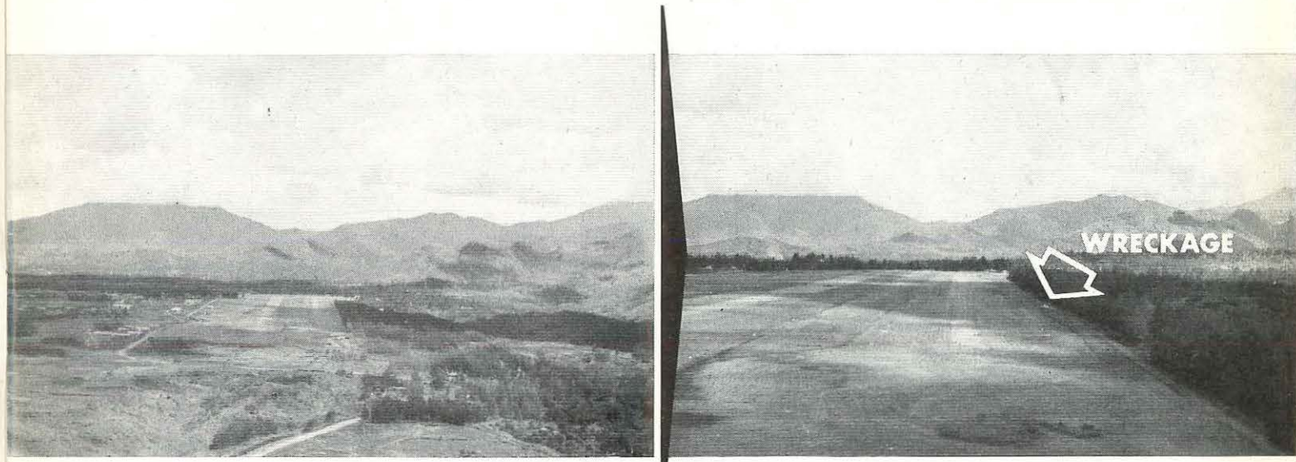
in other than good health at the time of his death. The likelihood of his having collapsed with the front seat passenger then attempting to control the aircraft was therefore discounted also. In any case, it was considered that if such a collapse had been imminent, the pilot would have had sufficient warning to abandon the take-off.

Another possibility considered was that there might have been some interference with the controls by the front seat passenger. The aircraft was fitted with dual controls but as the front seat passenger was physically much smaller than the pilot, and his seat was found in the fully rearward position, it seemed extremely unlikely that the pilot would not have been able to overcome any accidental or intentional interference before the aircraft adopted its very steep nose-up attitude. Similarly, in the event of the front seat passenger collapsing, it was considered most unlikely that the pilot would have been distracted to the point of losing control of the aircraft in the manner observed.

In view of the evidence that the aircraft's centre of gravity was outside the aft limit, a series of flight tests were carried out in another Baron aircraft to obtain information on what influence the centre of gravity position would have on longitudinal stability and elevator effectiveness during, and immediately after take-off. The tests were made with the aircraft in the same configuration as that of the crashed aircraft at the time of the accident, using take off power at a density altitude of 6,000 feet, the conditions existing at Goroka at the time of the accident. Six flight tests were made with the centre of gravity arranged in various positions. In all cases it was found possible to maintain a normal attitude in the pitching plane with the use of elevator. The tests showed that the control column push force necessary to maintain a safe flying speed increased uniformly as the centre of gravity moved further aft, and the maximum force required on the control column was never in excess of 29 lbs.

A further test was then carried out with the aircraft in the same configuration and the centre of gravity slightly forward of that of the crashed aircraft. This time a short field take-off technique was simulated to determine the effect on the controlability of the aircraft. It had been calculated from data obtained during the previous tests, that the control column push force required to counteract the nose-up tendency, could be expected to be of the order of 18 lbs. At 70 knots however, when the control column movement necessary to effect the lift-off in a short field take off was applied, the aircraft immediately be-

Goroka Airport as seen on the approach to Runway 35R (Reciprocal to aircraft's take-off path). The position of the wreckage is indicated.



gan a powerful nose-up rotation. The experienced test pilot who was flying the aircraft recognised this unexpected condition at once and promptly applied nose-down elevator, but even so, a push-force in excess of 40 lbs. was required to regain a normal longitudinal attitude.

As already pointed out, the greater part of the pilot's flying experience had been gained on heavy aircraft which require the use of a positive rotation technique at lift off. Although this technique is not necessary for a normal take-off in a light twin-engined aircraft such as the Baron, it closely resembles the control wheel movement characteristic of breaking ground in short field take-off in this type of aircraft. If the pilot had employed this technique during the take off on which the accident occurred and a similar pitch-up took place which was not immediately opposed, control of the aircraft would almost inevitably have been lost and a flight path similar to that observed would have resulted.

It was not possible to determine the exact point at which the aircraft lifted off during the take off that led to the accident, but in the course of the investigation at Goroka it was noticed that other Baron aircraft taking off on Runway 17L were consistently reaching a height of only 30 to 40 feet on passing the site of the accident. The very steep climb adopted by the aircraft on the fatal take-off would undoubtedly account for much of the height of 200 feet which it was seen to gain, but even so, it seems probable that the aircraft lifted off earlier than normal. If this were the case the aircraft would certainly not have attained the take-off safety speed of 86 knots employed by the operator.

The impact crater made by the port engine. The damage to the propeller clearly indicates that the engine was developing little, if any power at the moment of impact.

The Wreckage by the side of the runway looking back in the direction of take-off.

Cause

The probable cause of the accident was that the pilot did not take timely recovery action when the aircraft adopted an unusually steep nose-high attitude immediately after becoming airborne. It is probable that the steep nose-high attitude resulted from premature rotation of the aircraft in a situation of the aircraft being loaded outside safe limits.

Comment

Surely so tragic an accident as this, should not be necessary to confirm, in the minds of pilots and operators, the value of strict adherence to loading systems and flight manual requirements. The accident does serve however, to stress the fact that some light aircraft can be loaded outside their centre of gravity limits, even though the load distribution might *appear* to be right and normal for the aircraft.

Don't judge by appearances—check the facts!

A QUESTION OF COMMAND

DC-8 CRASHES DURING APPROACH

(Based on Accident Report Issued by the National Transportation Safety Board, United States)

IN the course of a night training flight, and while making a simulated two-engined approach to land at New Orleans International Airport, Louisiana, U.S.A., a DC-8 crashed into a residential area. The aircraft, several homes, and part of a motel were destroyed, and the six occupants of the aircraft and thirteen persons on the ground were killed.

The aircraft had taxied out for take-off only seven minutes before at 0040 hours local time. The night was fine and clear, with no significant wind. A captain-trainee occupied the left hand pilot seat and a DC-8 check captain was in the right hand seat.

At 0043 hours, the crew advised the tower that they were ready for take-off on runway 28, and that they wished to circle and land on runway 01. The tower cleared the aircraft as requested and it took off normally. At 0047 the aircraft reported on base leg for runway 01 and the tower controller cleared it to land. The crew advised they would make a full stop landing and then take-off on runway 19.

The tower controller watched the aircraft as it turned left on to final approach. At first, the turn appeared to be a normal, shallow turn but then the angle of bank increased and the descending turn continued until the aircraft was in a 60 degree bank on a heading of about 320 degrees. At this stage, the aircraft struck power lines and crashed. The aircraft's final manoeuvres were also seen by witnesses on the ground, some directly beneath the aircraft's flight path, who said that just before impact there was a sudden increase in engine noise, which they associated with "full power".

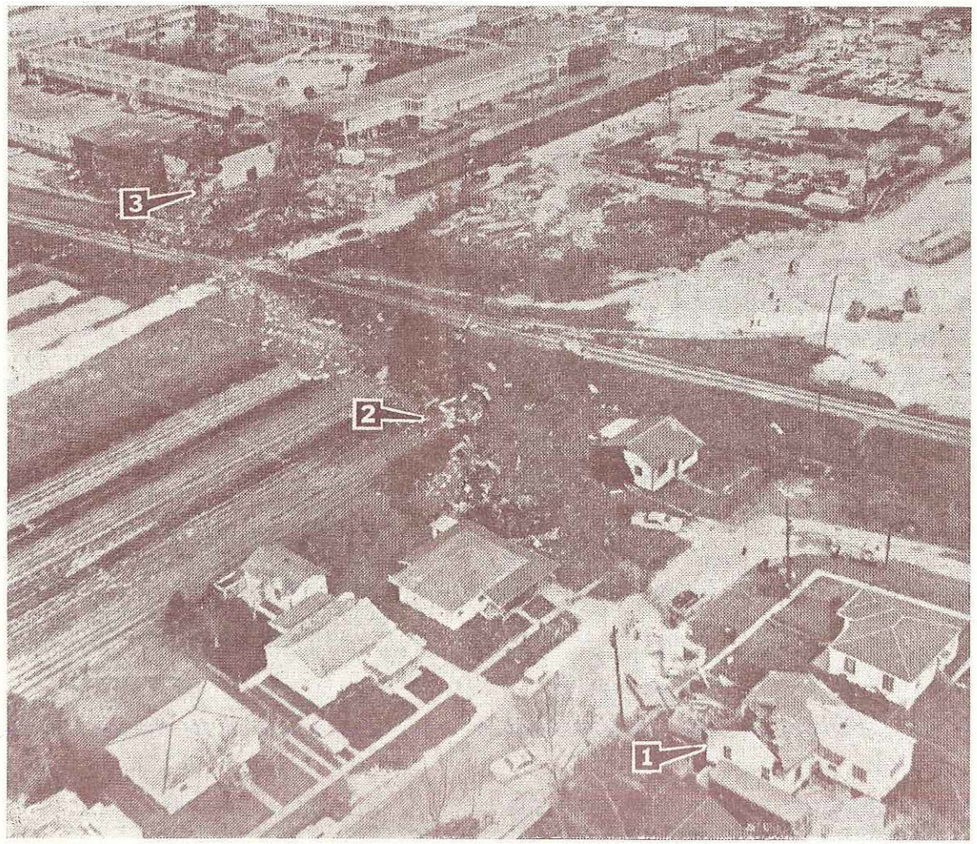
* * *

The site of the crash was 2,300 feet short of the runway threshold and 1,100 feet west of the runway centre line. The initial impact was with a large tree, 40 feet above the ground. After striking two more trees, the aircraft slashed its way through portion of a house and struck the ground on one side of a street. The main impact totally destroyed a second house and gouged a three feet deep depression in the ground for a distance of thirty feet. The wreckage then skidded, disintegrating as it went, along the ground and over a railway embankment, finally coming to rest against the buildings of a motel 700 feet from the initial impact point, where it was consumed by fire. Despite the disintegration and fire damage, the aircraft's flight data recorder and cockpit voice recorder were recovered from the wreckage in a satisfactory condition. Read-outs of these recorders confirmed that at the time of the accident the captain-trainee was executing a simulated two-engine approach.

Investigation showed that the first engine failure was simulated at 0044 as the aircraft reached V_1 (critical engine failure speed). One minute later, as the aircraft was climbing, a second engine failure was simulated. The aircraft was then at a height of 1,200 feet, flying at 200 knots, with Nos. 1 and 2 engines at idle power.

As the aircraft turned left on to base leg at 0048, the flaps were lowered to 25 degrees and airspeed decreased to 180 knots. During this transitional period the instructor began to prompt the captain-trainee on basic airmanship e.g. "don't . . . get below a hundred and sixty . . . Ball in the middle . . . Whatever it takes, put 'er in there now . . . ."

At 0049:20, as the landing checklist was being accomplished, landing flaps were lowered by the instructor, without command from the captain-trainee, and approximately 2.5 miles out from the runway the aircraft descended through 650 feet at 165 knots. From this point, a 2.5 degree glide path, similar to an ILS approach, would have resulted in a normal touchdown on the runway. The optimism of other crew members at this stage was reflected in various comments re-



The trail of destruction left by the aircraft. The house (1) was struck immediately after the initial impact with a tree. The aircraft then struck the ground at (2) completely demolishing a second house. The wreckage finally came to rest against the motel (3). (Associated Press Photograph.)

corded on the cockpit voice recorder type. Unfortunately however, the actual descent angle at this point was three degrees. The captain-trainee did not allow for the increased drag of the extended flaps and failed to increase power to maintain the correct glide angle and rate of descent consistent with the airspeed. The instructor took no corrective action, and allowed the captain-trainee to check the descent by raising the nose rather than by applying power. From this point on, the need for correct action was critical and increased markedly as the landing approach continued. It was not until the airspeed had decreased to approximately 136 knots that the need for power was recognised, and power was applied to engines Nos. 3 and 4. A few seconds later a marked divergence of the aircraft's heading to the left, coincident with a sharp reduction in indicated airspeed and rate of descent, signalled the first stages of loss of control. The aircraft's angle of sideslip increased rapidly from about 13 to 18.5 degrees, and the crew's alarm was reflected in exclamations beginning at 0050:05. Eight seconds later the cockpit voice recording ended.

The section of the company's operations manual prescribing the procedure for a two-engine approach includes the following instruction and guidance—

". . . . Gear may be extended on the base leg and the airspeed be allowed to decrease to 155 knots minimum on final approach. Maintain the final approach airspeed of 155 knots to the point where additional flaps are required and landing is assured without the possibility of undershooting the runway. The final descent angle should be normal or slightly steeper than a normal approach".

"Avoid a flat, high thrust, high flap-drag approach. Before achieving the landing configuration, exercise precise planning and control to prevent placing the aircraft in a condition from which a go-around is impossible, i.e. an airspeed too low to permit applying take-off thrust on the good engines without loss of directional control".

It was obvious from the evidence of the investigation that the cause of the accident lay with the human element, and involved errors in judgement by the captain-trainee and inadequate supervision and exercise of com and on the part of the instructor. Except for the DC-8 qualification, the captain-trainee and the check captain were of equal pilot status. They were engaged in their fifth night training flight together, and their estimation of each other's ability was undoubtedly well established. As a result, the instructor-student relationship was an informal one. The cockpit voice recorder revealed a relaxed atmosphere on the flight deck, and the few suggestions by the instructor were made in a mild prompting manner. There appeared to be complete confidence in the captain-trainee's ability to overcome any problem, including the drastically reduced airspeed, and no apprehension was manifest until the captain-trainee himself recognized the loss of control. By this time however, the accident was inevitable. It is also possible that, because of their near-equal status, the instructor was more hesitant to take over control of the aircraft, than he would have been in other circumstances. Under a stricter instructor-student relationship, it is probable that the instructor would have taken control earlier in the sequence.

It is also probable that the captain-trainee's ability and judgement was affected to some extent by fatigue. In the two days preceding the accident, he had been engaged in an extensive period of training, both on the ground and in the air, and he had taken only short rest periods during this time. Although fatigue and its effects are difficult to assess, the investigation considered that the captain-trainee's disturbed work cycle, superimposed on the natural stresses of the training environment, was undoubtedly reflected in his performance.

The National Transportation Safety Board determined that the probable cause of the accident was improper supervision by the instructor and improper use of flight and power controls by both the instructor and the captain-trainee during the simulated two-engined out landing approach, which resulted in a loss of control.

Comment

Simulated emergencies during training sequences have been responsible for many serious accidents to aircraft, both large and small. Paradoxically, this is especially true of training sequences in which the trainee concerned is already an experienced and competent pilot, even if inexperienced on the type being flown at the time.

In circumstances such as these, there seems to be a tendency to place too much reliance in the trainee's judgement and ability to cope with unfamiliar emergency situations. This danger is obviously compounded if, as well as being highly experienced, the trainee is a senior person whose rank or status is equal to or greater than that of the pilot responsible for the training. Human nature being what it is, it is hard to resist allowing such a trainee more latitude than would be given a junior, less experienced pilot under training.

Apart from this latter aspect, so tragically exemplified in this accident, other training accidents have too often shown that where such a relationship exists between two pilots, and both are endorsed on the aircraft type, the responsibility for the safety of the aircraft, during a particular training sequence, is not always clearly defined, and as a result, a potentially dangerous situation exists.

The heat of the moment when an actual emergency arises is hardly the time for determining who has this responsibility. In any training exercise, unless there is a perfectly clear distinction in pilot status, (such as an instructor/student or captain/co-pilot relationship) it is essential that, for each exercise, there is a quite positive mutual understanding as to who will be responsible for the safety of the aircraft, in the event of an emergency.

SEARCH FLIGHT ENDS IN DISASTER

ON 10th November, 1967, a geologist and a mineral prospector were working in rugged country 60 miles north of Mt. Isa, Queensland. They were engaged in mapping an area of rocky hills and gullies some five miles west of their base camp when the prospector fell, hurting his back, and became separated from the other member of the party.

A little later the geologist noticed his companion was no longer in sight, but concluded that as the prospector had not been feeling well, he had returned to the camp site. Soon afterwards, the geologist returned to the camp himself but found that his companion was not there.

The day was extremely hot and there was no surface water in the area, and by late afternoon, when the prospector had still not returned to camp, the geologist became anxious for his safety. With the portable transceiver installed in his four wheel drive vehicle, the geologist then contacted Mt. Isa on the flying doctor frequency and passed a message to the mineral exploration company for which they were working, informing them that the man was missing.

Later that night, as a result of further radio messages from the geologist, company officials in Mt. Isa set about making preparations for an aerial and ground search for the missing man as early as possible in the morning. During the night, a member of an aircraft owner group in the town, who was known to the company's executives, was contacted and requested to make his group's aircraft available for the search. After some discussion, it was finally resolved that a Debonair aircraft operated by the group would be used for the search, flown by a commercial pilot which the group employed, and that the group member and two of the exploration company's officials would accompany the pilot as observers.

As a result of these arrangements, the aircraft subsequently departed Mt. Isa a few minutes after first light at 0600 hours and reached the search area at 0625 local time. The weather in the search was fine and warm and windy with the promise of another hot day. The wind was blowing steadily from the north at 20 to 25 knots.

Meanwhile, back at the base camp, the geologist had been out conducting a ground search for the missing prospector. He and the prospector had previously arranged that if either one encountered trouble during their prospecting surveys from base camp, they were to light fires to indicate their position. At 0230 hours that morning, the geologist had sighted a large fire, five miles to the south-west of the base camp. He drove as close as possible to the fire, then set out on foot, reaching the site at about 0530 hours. An hour later, while he was still searching this area, the aircraft approached from the south-west at about 500 feet.

He signalled to the aircraft, and it acknowledged by rocking its wings. The aircraft then flew two circuits of the fire area, but as it was obvious that the occupants of the aircraft had not sighted the missing man, the geologist indicated by hand signals that they should now search another area in the vicinity of a smaller fire further to the north-east in the general direction of the camp. The aircraft flew off in this direction, made two more circuits over the area of the smaller fire, then flew several miles to the north beyond the camp site where it began making a series of sweeps, gradually working its way south again towards the camp site.

The geologist was making his way back to his vehicle when he noticed the distant engine note of the aircraft stop abruptly. Because he was walking into a valley however, he assumed that the rugged intervening terrain had cut off the sound of the aircraft.

* * *

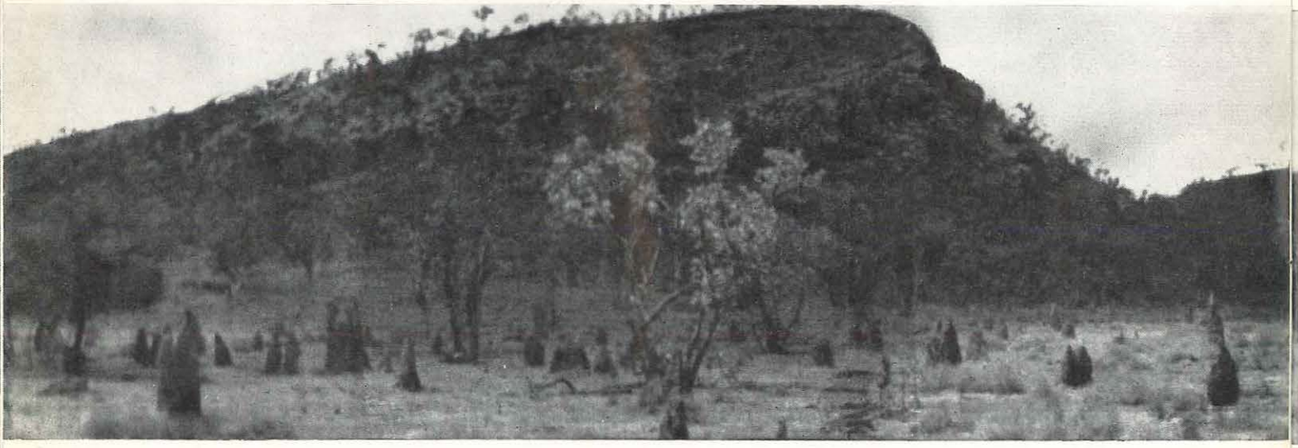
In the intervening time, since losing contact with the geologist the previous morning, the missing prospector had been gradually working his way back towards the camp site by following gullies to avoid clambering over the hills. He finally reached the camp at some time after 0600 hours and found it deserted. He sat down to await the return of his companion and not long afterwards, saw the aircraft approaching from the south-east, at about 500 feet. He took a sheet to signal to the aircraft and it began a series of left hand orbits around the camp, gradually descending lower and lower.

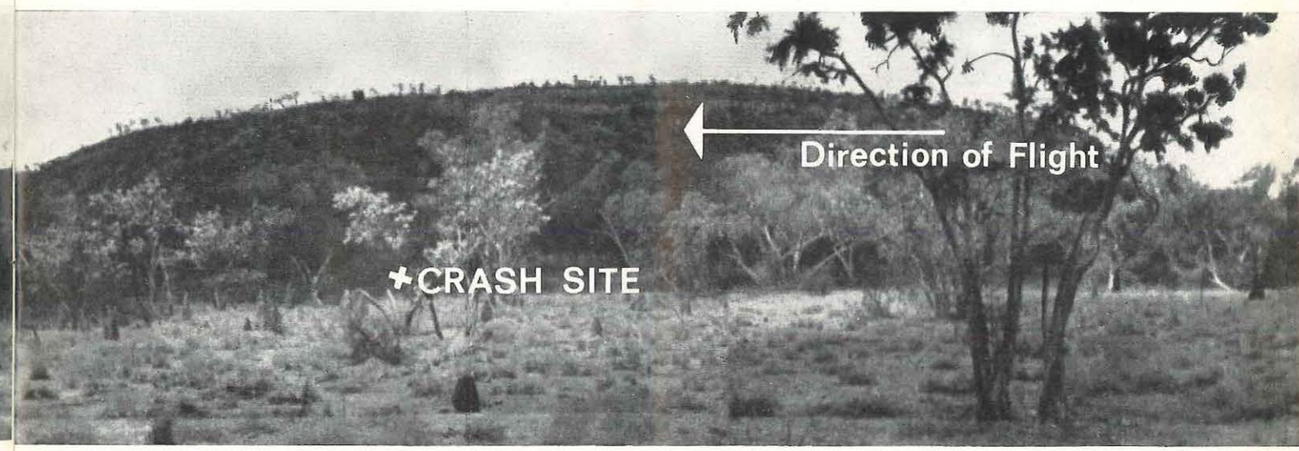
Expecting that a message might be dropped to him, the prospector continued to watch the circling aircraft and noticed that on one circuit the undercarriage was lowered, but was retracted again the next time the aircraft came around. The aircraft continued circling the camp site becoming progressively lower. At times, it was lost to the prospector's view behind trees and he was not able to tell whether or not anyone in the aircraft was attempting to signal to him.

After completing about 12 circuits, by which time it was flying at only 20 feet above tree-top height, the aircraft again approached the camp site, flying directly towards an escarpment nearly 300 feet high which lies only a few hundred feet to the north of the camp.

As it drew level with, but a little to the east, of the camp site, the aircraft began turning to the left about 20 to 30 feet above the tree-tops. As the aircraft approached closer to the escarpment, the turn steepened progressively to avoid this ridge of higher terrain, until by the time the aircraft had turned through 90 degrees and was flying parallel with the escarpment, it was banked almost vertically. Still in this attitude, the aircraft flew past a deep gap in the escarpment (see photograph) through which the strong northerly

(Below) The escarpment to the north of the camp site which the aircraft was turning to avoid when it crashed. The photograph was taken a little to the south-west of the camp site.





wind was blowing. As it passed the gap, the aircraft suddenly flicked on to its back and with the engine still delivering power, dived upside down through the branches of a tree and into the ground at the camp site, only 60 feet from where the prospector was sitting. The wreckage somersaulted in an upright position, came to rest and exploded into flames less than 40 feet from the prospector. All four occupants of the aircraft were killed instantly and the blast from the explosion hurled the prospector from his chair and threw him 20 feet.

* * *

Examination of the wreckage confirmed that the engine was delivering substantial power at the moment of impact. It was established that the aircraft was intact when it struck the tree immediately before ground impact, and there was no evidence that any defect or malfunction in the aircraft had contributed to the accident. It was also established that the flaps were lowered about 15 degrees, that the undercarriage was retracted, and that the aircraft was loaded to its maximum weight at the time of the accident. A damaged watch found in the wreckage had stopped at 0649 hours.

A study of the record of radio communications between the aircraft and the Mt. Isa and Longreach Flight Service Units, as well as the evidence of the geologist who saw it from the ground, showed that the aircraft's operations were quite normal during the flight from Mt. Isa and the early part of the search itself.

Later in the examination of the scene of the accident, a half gallon ice cream tin, its lid secured with masking tape and containing a message for the prospector written by one of the occupants of the aircraft, was found in the bush nearly 400 feet east of the point of impact. The tin had evidently been dropped from the aircraft while it was circling the camp site some time before the accident.

* * *

The prospector for whom the search was being made was the only witness to the accident itself and to the aircraft's movements for the few minutes preceding the crash. He was watching the aircraft throughout its progressively lowering circuits around the camp, as he was fully expecting a message to be dropped to him. He did not, however, see the message tin fall from the aircraft and was not aware that it had been dropped until after the accident.

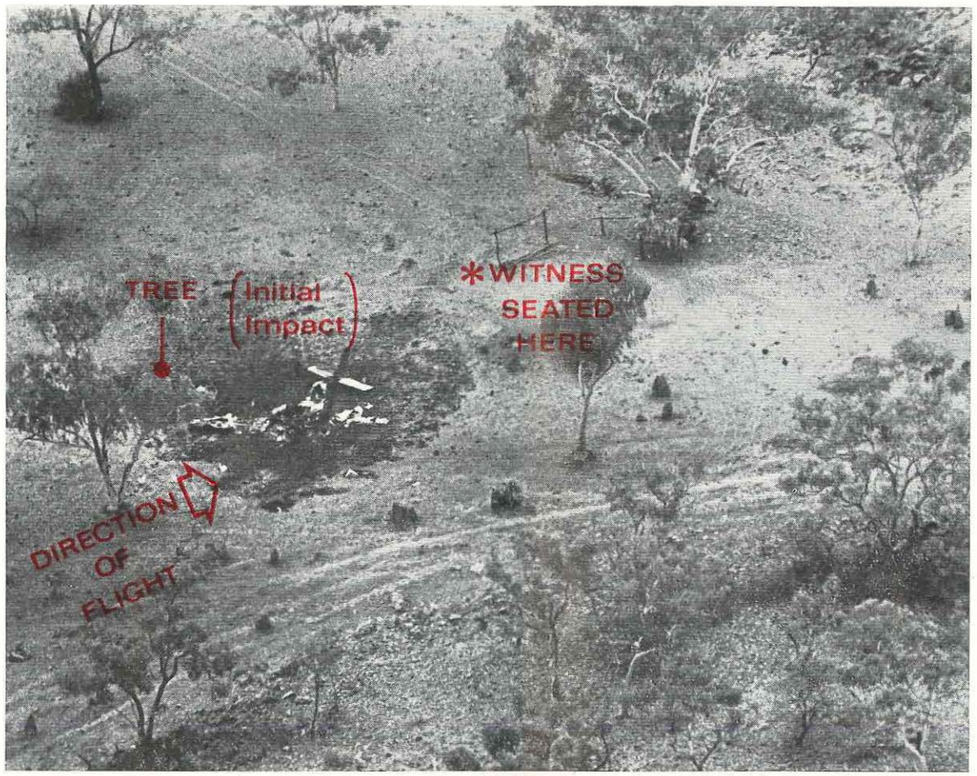
It is evident that the occupants of the aircraft, having located the missing man, prepared the message and placed it in the tin, which was then dropped during one of the earlier circuits made by the aircraft. The prospector's statement that the aircraft's undercarriage was extended during one of these circuits suggests that the pilot had lowered the undercarriage in order to fly the aircraft at the lowest safe speed while the message tin was dropped — probably from the storm window on the port side to achieve as accurate a drop as possible. It seems, however, that the pilot dropped the tin a little too early, not allowing for the fact that the tin, although of comparatively large dimensions was quite light and on being released would be quickly retarded by air resistance.

Having dropped the message, the aircraft occupants no doubt waited to see whether the prospector made any move towards it. When he did not, they apparently decided to circle the spot in an attempt to draw the prospector's attention to it.

In carrying out his circuits of the camp site, the pilot would have been making his turns towards the north into a substantial head wind component and towards the escarpment to the north of the camp. Once the aircraft had descended below the level of the escarpment however, the aircraft might have lost the effect of the headwind component, thus increasing the radius of turn and forcing the pilot to increase the angle of bank to avoid the escarpment. Alternatively, the pilot might have merely misjudged his proximity to the escarpment earlier in this last circuit of the camp site, and was then forced to progressively increase the aircraft's rate of turn to avoid flying into the escarpment.

In circling the camp at low level to attempt to signal to the prospector, the pilot would naturally have flown the aircraft at comparatively low speed. The maximum flap lowering speed for this type of aircraft is 113 knots, and as the flaps were found extended some 15 degrees, it is highly probable that the aircraft was being flown at no more than 113 knots.

Calculations show that at the weight at which the aircraft was operating and at an airspeed of 113 knots the aircraft would stall in a balanced turn at an angle of bank of about 77 degrees. It would of course be impossible to maintain the airspeed during such a turn without a substantial increase in power and at a lower airspeed in this configuration, say 90 knots, the aircraft would stall



The camp site and wreckage of the aircraft as seen from the air, looking south-west.

when the angle of bank reached approximately 69 degrees. It is thus evident that in the situation in which the aircraft was being flown, the operation was becoming extremely critical once the angle of bank increased beyond some 60 degrees.

The witness's evidence indicates that the aircraft's angle of bank as it turned past the escarpment for the last time was near vertical, and that there was no increase in power as the aircraft went into the turn. The aircraft was in this attitude when it drew level with the gap in the escarpment through which the strong northerly wind was blowing. This, in effect, would have amounted to a lateral gust of some 37 feet per second, striking the under surface of the aircraft and thus increasing the effective angle of attack.

There is little doubt that the extremely tight turn into which the pilot was apparently forced to pull the aircraft to avoid the escarpment, and the sudden effect of the northerly wind blowing through the gap in the hill, combined to stall the aircraft, and it flicked into an inverted attitude.

Evidence of other witnesses who had accompanied the pilot on previous search flights involving circuits over a ground party, did not suggest that the pilot made a practice of indulging in steep turns near the ground. It is probable that the only reason for his doing so on this occasion was the fact that he began his final low level turn too close to the escarpment, and was forced to tighten the turn progressively in an attempt to complete it in the space available. In doing so he increased the angle of bank to a critical point and the aircraft stalled. Had the pilot not descended below the level of the escarpment, there would have been no need to turn so steeply and the accident would not have occurred.

Two Similar Accidents Show:

THE IMPORTANCE OF EMERGENCY DRILLS

Damage to the air intake, exhaust system and the lower side of the engine compartment, where both the carburettor and fuel filter bowl are located, is clearly evident in this photograph.

Case One

Approaching to land at a country airstrip near Gosford, N.S.W., the pilot of a Cessna 182 selected full flap, and with the power right off, made a smooth touch down on the grass covered surface.

After running straight for a short distance, the pilot heard a violent rattle from the front of the aircraft and felt the nose leg begin to collapse. Before he could take any action, the propeller tips began striking the ground, but he managed then to raise the nose with elevator and hold it off the ground. As the speed decreased however, the pilot was unable to prevent the nose lowering to the ground. He turned off the fuel, and the aircraft slid to a stop on its nose and main wheels. None of the four occupants was injured.

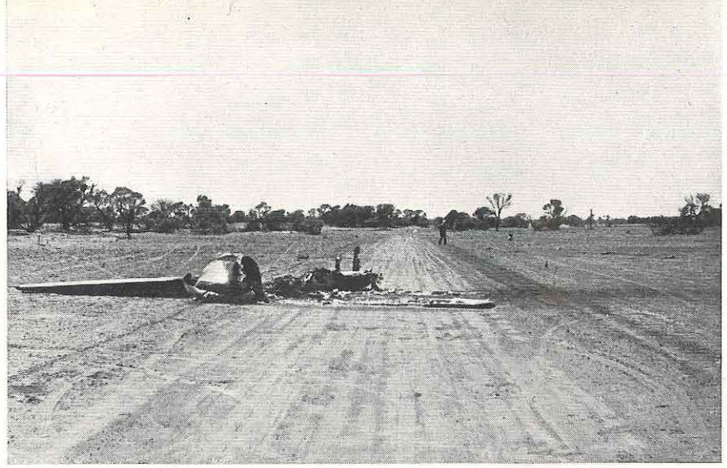
Although the lower portion of the engine compartment was extensively damaged as shown in the photograph above, including breaking the carburettor off the intake manifold, no fire broke out and the aircraft was later repaired and restored to service. The nose leg failure was attributed to damage sustained during a previous landing or take-off.

Case Two

Soon after departing on a cross country flight from Wilcannia, N.S.W., the pilot of a Cessna 182 attempted a landing on a small bush airstrip, in gusty cross-wind conditions.

The strip which was nominally about 60 feet wide proved to be still under construction and only a 15 feet wide section down the centre had been properly graded and was suitable for use. The remaining width consisted of soft soil.

After it had touched down initially on the narrow centre section of the strip, a gust of wind lifted the aircraft. The pilot held it off the ground and crabbed into wind in an attempt to remain over the graded section, but, still in the crabbing attitude, the aircraft then dropped heavily to the ground and the nose wheel dug into soft earth to the right of the intended landing path. The nose leg was torn off, and the aircraft pitched



All that remained of the other Cessna 182 after the accident near Wilcannia. The pilot neglected to turn off the fuel when the nose leg collapsed.

down on to its nose and slid 30 yards on the underside of the nose cowling and main wheels. The pilot and his two passengers were unhurt and hastily left the aircraft.

The pilot then returned to the aircraft, turned off the magneto switches and began to examine the damage. He said as he was doing so, a sudden explosive "puff" of flame leapt out from in front of the engine compartment firewall on the lower starboard side. Fanned by the strong wind, which was blowing from the starboard side of the aircraft, the fire quickly spread. Soon afterwards, the starboard fuel tank exploded and the whole aircraft was engulfed in flame. It was completely burnt out within about 15 minutes.

It was found later that the pilot had not turned off the fuel. It was probable that when the nose leg failed, damage occurred to the fuel system in the vicinity of the carburettor or the fuel filter bowl, which is mounted near the lower starboard side of the firewall. As the fuel was not turned off, it would have then flowed freely into the engine compartment resting on the ground thus making it possible for the fire, once started, to develop uncontrollably.

Comment

It is very likely that, had this pilot adopted the same procedure as the pilot in the first accident, no fire would have broken out and the aircraft would not have been destroyed. Although, the occupants were out of the aircraft before the fire broke out, it is easy to see that in circumstances only a little different, occupants who might otherwise be uninjured could be trapped and incinerated. All because the pilot didn't remember to turn the fuel off when the aircraft ran into difficulties!

Give Them a Wide Berth!

While free falling after jumping from an aircraft at 7,000 feet near Rockingham, Western Australia, a parachutist saw a Cessna 411 below him, apparently on a collision course. He immediately opened his parachute, and the aircraft banked sharply away, but passed close enough for the parachutist to be able to read the operator's name painted on the fuselage. The area in which the parachuting was taking place, like other parachuting and gliding areas, is marked on the relevant visual terminal chart issued by the Department. Although visibility was excellent, the pilot said afterwards that he did not see the parachutist before he opened his canopy.

A parachutist in free fall, being a relatively small object and descending at some 170 feet per second, would remain in a pilot's field of view for a very short time indeed, and it is hardly surprising that the pilot did not see him.

The incident provides a timely reminder of the degree of vigilance necessary when operating an aircraft in the vicinity of those areas marked on the visual and RN charts with the symbol denoting that parachuting may be taking place.

EXPERIENCE SHOWS THEY STILL DESERVE RESPECT

Air BP Photograph

"I didn't treat the 'hot prop' with the respect it deserved," the Digest once reported a maintenance engineer as saying, after his arm had been broken when a DH-82 engine fired momentarily while he was carrying out a compression check immediately after the engine had been run. (see Digest No. 48.)

Now another, more serious accident of the same sort, again shows that careless propeller handling can be extremely dangerous, especially if the engine is still hot from an earlier run:

At Mt. Hagen, New Guinea, the pilot of a Cessna 180 had started the engine and taxied his aircraft from where it had been parked overnight, to a position nearer the terminal building. Here he shut down the engine and left the aircraft while he went to the tower to submit his flight plan.

Returning to the aircraft about 10 minutes later, the pilot began a pre-flight inspection, including a cylinder compression check. The pilot pulled the propeller through once, and expecting that the blades would stop in a near-vertical position, he stepped forward to take hold of the upper blade. But instead of the propeller stopping, the engine fired once and the propeller spun several revolutions, striking the pilot twice on the upper left leg and almost severing it. The propeller also grazed his right hand and thigh, causing minor injuries.

Investigation indicated that the aircraft's ignition was switched off at the time and with the switch in this position, both magnetos were earthing correctly. It was found that the engine had run for about three minutes before the pilot shut it down, which would probably have been sufficient for the cylinders to reach normal operating temperature. During the 10 minutes that elapsed after the engine was shut down, there was no cooling airflow through the engine cowlings and there would have been little decrease in engine temperature. In this situation, all that was required for the engine to fire momentarily, was a piece of hot carbon in one cylinder, plus a sufficient amount of fuel/air mixture. The pilot had shut down the engine in the normal way, by placing the mixture control in the idle cut-off position, but as the engine was fitted with a float type carburettor, there was every possibility of some mixture remaining in the cylinders.

It is probable that this was what occurred. The pilot obviously did not give sufficient thought to the dangers of turning a propeller by hand, and did not adopt a procedure which ensured that his body remained clear of the danger area.

In years now long past, most light aeroplanes (and some not-so-light) had to be started by hand every time they flew. Paradoxically, hand starting accidents in those days were comparatively rare, no doubt because the dangers of hand swinging were well known and much emphasis was placed on "treating the airscrew as alive at all times". To-day, with the luxury of electric starting almost universal, and accepted as the norm, this very sound rule seems to have been forgotten. Accidents such as this one show that propeller hazards haven't changed, even if pilot attitudes have!

FORGOTTEN WIRES!

The pilot of the sorry looking Pawnee in the pictures above, was spraying a crop of cotton in a large level field in Queensland, making his spraying runs north-east, south-west, and parallel to a three wire power line which bounded the south-eastern side of the paddock.

Nearing the end of one load of chemical, the pilot diverted from his spraying pattern to make a "stripping run" along the north-eastern side of the paddock, heading into wind.

Concentrating hard on positioning the spray accurately, the pilot completed the run, commencing a normal "pull up" as he approached the south-eastern side of the paddock.

Almost immediately, the Pawnee flew into the power line. The propeller cut through two of the wires, which fell to the ground, but the third slid over the nose cowling and up over the windscreen, shattering it and bending the frame. The aircraft nosed-up steeply and the pilot momentarily reduced power to regain a level attitude. Retarded by the stretching power cable, the aircraft decelerated and began to sink rapidly. The pilot re-applied almost full power and pulled the control column back hard just before the aircraft struck the ground. It fell down heavily in a level attitude with almost no forward speed, collapsing the undercarriage and dislodging the engine mounting and wing root attachments, but the pilot, who was wearing a crash helmet, escaped with only minor injuries.

The pilot said after the accident, that he had been thoroughly briefed on the position of the power line before beginning the spraying operation, and he had carried out several inspections of the area, noting the presence of the wires on each occasion. While making the stripping run however, he had become so engrossed in his task that he had momentarily forgotten the power line was there.

IF IN DOUBT – THROW IT OUT!

IN a recent issue of the Digest we cited two instances of throttle control problems which arose as a result of inadequate maintenance (see "Engine Control Maintenance", Aviation Safety Digest No. 54, January, 1968).

Since that article was written, we have concluded the investigation of two further cases in which the throttle controls of light single-engined aircraft became disconnected in flight, fortunately, in both cases, without ill effect.

The first one occurred in New Guinea when the pilot of a Cessna 185, en route from Mt. Hagen to Mendi, decided to turn back because of deteriorating weather. Attempting to reduce power to commence descent into Mt. Hagen, the pilot found the throttle control was inoperative and the engine continued to run at almost full power. Using the mixture control to apply and remove power as required, the pilot made a successful approach and landing at Mt. Hagen. Inspection showed that the throttle control rod had become detached from the throttle butterfly assembly, after the nut holding it in place had worked loose and fallen off.

The other case occurred to a Cessna 182 in Western Australia, during a flight from Forrest to Kalgoorlie. When only five miles east of Kalgoorlie, the engine lost power without warning. All the engine instruments were reading normally, but the manifold pressure had dropped to about 15 inches and was fluctuating. Although the outside air temperature was above the range in which carburettor icing might be expected, the pilot suspected this might be the reason for the loss of power and applied carburettor heat. It made no difference, so the pilot put the pitch control into full fine and trimmed the aircraft to try and maintain height at an indicated 80 knots.

With Kalgoorlie Aerodrome in sight, the pilot reported he would be making an emergency landing and began a straight-in approach to the main east-west runway. When in a safe position for a landing, the pilot attempted to close the throttle, but this had no effect and the engine continued to maintain the same power setting. Only then did the pilot realise that the throttle linkage had failed, so he turned off the ignition switches and made a gliding approach to land.

As in the previous incident, the failure had occurred when the nut which holds the throttle control rod on to the butterfly assembly, had come off.

It is significant that in these two incidents, as well as in the case of the Maule aircraft involved in the forced landing described in our earlier article, the attachment nuts were all of the self locking type — "stop nuts" as they are commonly known in the aircraft industry.

Nuts of this type have been used in the aviation industry for almost 40 years. They were evolved because of the inadequacy of locking devices such as lock washers, split pins and locking wire. Not only can these items be overlooked during assembly but locking wire and split pins can break under severe vibration. Another advantage of stop nuts is that their torque loading can be set precisely, whereas it is often necessary to vary the torque of castellated type nuts, to insert the split pin or locking wire.

Stop nuts, when used in conjunction with self aligning, control rod ball end bearings, are suitable for use on throttle control linkages. They are extensively used in this and similar applications throughout the industry generally — for example, in almost every reciprocating or articulating joint in the flying control systems of general aviation aircraft. It must be remembered, however, that the efficiency of self-locking nuts deteriorates with repeated cycles of tightening and loosening, and care must be taken to see that this process is not permitted to reach the point where the self locking qualities of the nuts are no longer effective.

L.A.M.E.'s and others concerned with aircraft maintenance should profit from these occurences by taking care to limit the re-use of stop nuts within obviously safe margins, and by making careful checks of the condition of these nuts during aircraft inspections. *Remember — new stop nuts are cheaper than new aeroplanes!*

There's DANGER down low !

Most pilots probably associate collisions with power lines and other earth-bound obstacles, with agricultural flying — not altogether unreasonably, but many may not realize how many accidents still occur to other general aviation aircraft as a result of unauthorised low flying. The actual reasons for all these unnecessary collisions vary greatly but they all have at least one point in common — disregard for the regulations that have been framed for the express purpose of preventing such accidents.

It is not for nothing that 500 feet has been stipulated as the minimum height at which an aircraft may fly. Illegal, unplanned, spur-of-the-moment aircraft operations at low level have been responsible for innumerable, frequently fatal accidents, almost from the earliest days of aviation.

The dangers inherent in this form of exhibitionism have certainly not changed in character as the light aeroplane has developed over the years—it is just as easy to kill yourself today flying into a tree in a Victa as it was in an Avro 504K, 50 years ago. If anything *has* changed, it is the likelihood of running into something, particularly power lines. Power lines today are literally everywhere there is habitation. They criss-cross the countryside in sizes and shapes ranging from multi-cable, high tension transmission lines carried on massive steel pylons, to the homely, pole supported, single wire lines, now so widely used in rural electrification schemes. Power lines span rivers, often far above the water, and cross valleys from hilltop to hilltop. In such locations they can be found at heights up to 300 or 400 feet above the valley floor. Worst of all, with the possible exception of the main high voltage lines, which are more easily identified because of their rows of steel pylons, power lines are notoriously difficult to see. Experience shows in fact, that they nearly always remain unseen from a low flying aircraft unless the pilot is expecting them and is deliberately looking out for them. This is especially true of single wire power lines which, though not usually far above ground level, have extremely long spans between inconspicuous poles and are deliberately routed away from roads and buildings to minimize electrical interference to telephone circuits.

Logically, with a history of low flying accidents extending back more than 50 years, and with the greatly increased hazard now posed by the proliferation of power lines in rural areas, one could be excused for imagining that pilots of today would be wise enough to withstand the temptation to go dashing around the countryside at tree-top height (usually for the benefit of lesser mortals watching from the ground). But human nature being what it is, some are unwilling to profit by the experience of others and think they know better — hence they remain unconvinced until it HAS happened to them. Unfortunately, as often as not, they don't get a second chance. This unpleasant subject has been discussed many times before in the Digest (see in particular Digest No. 47 September, 1966) but it is painfully obvious that there are still a lot of pilots who haven't learnt this vital lesson. Here are a few more examples to illustrate what we mean:—

This was a hired Cessna 172, in which a private pilot was making a local flight in Queensland, with three friends as passengers, when he decided to inspect a dam he had built on a nearby farm.

The aircraft flew around the property at a very low level, then climbed to about 150 feet over a power line. The engine was then throttled back abruptly and the aircraft descended again. At a height of 30 feet it collided with another power line on the boundary of a paddock, and dived into the ground in a near vertical attitude and somersaulted. The engine and rear fuselage broke off and the aircraft came to rest in an upright position. The pilot later died of the injuries he received and his three passengers suffered serious injuries.

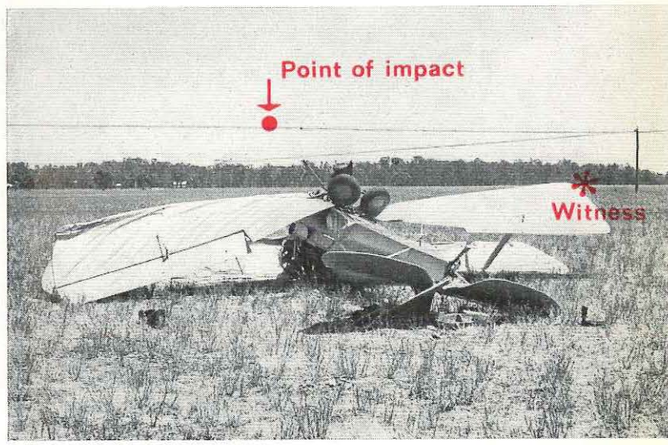
* * *

In N.S.W. a private pilot and a friend had flown to a property in this Tiger Moth to visit some friends. When it was time to go the two men boarded the aircraft in the paddock where it was parked and took off.

The aircraft flew around the homestead then turned back towards the party of friends who had gathered in the paddock to farewell the men. The aircraft descended as it approached the group, passing in front of them about 20 feet above the ground. It then began to climb, but the undercarriage struck a single wire pole line and the aircraft dived steeply into the ground and overturned. The passenger was killed and the pilot seriously injured.

* * *

Towards the end of a training flight in Queensland, this Victa, with a young "C" rated instructor and a pupil on board, was seen returning towards the aerodrome from the training area, at low level. The weather was fine and the aircraft was functioning normally. After flying for some distance at an average height of about 15 feet, which varied only enough to avoid obstacles, the aircraft flew into a power line. Taking one wire with it, the aircraft then climbed steeply into a near vertical attitude, fell over on its back, and crashed to the ground inverted. Both occupants were killed and the aircraft was burnt out.



There's DANGER down low !

(Continued)

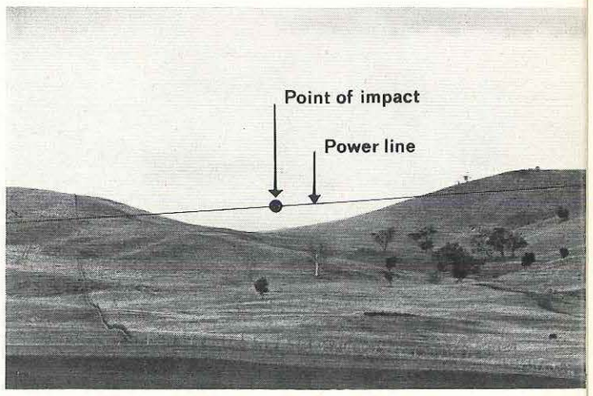
* * *

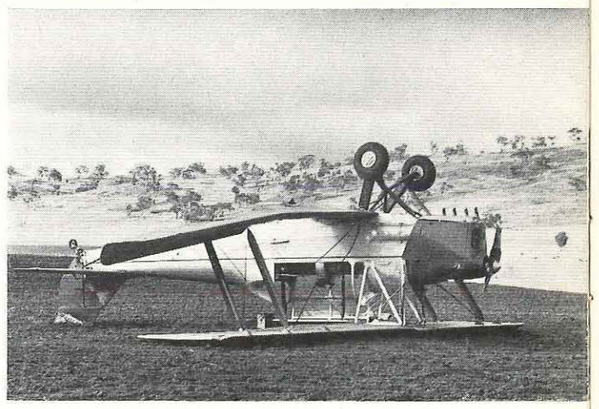
Shortly after this Tiger Moth had taken off from a private airstrip in Tasmania, the two pilots on board saw that there was cloud close to the high ground on their proposed track, and decided it would be better to track via lower country in the Derwent River Valley. The aircraft was accordingly turned to cross a saddle in the hills that lay between their position and the river valley.

As the aircraft flew through the saddle, it struck a single wire power line, suspended about 150 feet above the ground. The impact shattered the propeller, and the cable broke in two places some 900 feet on either side of the aircraft and trailed from the engine cowling. Some control of the aircraft remained and the pilot-in-command force landed in a ploughed paddock directly ahead. Shortly after touching down the aircraft nosed over onto its back, but neither occupant was injured. The crew stated afterwards that there had been no deliberate intention to fly low as the ground in the river valley slopes quite steeply away from the hills and the aircraft would have been above 500 feet very soon after passing over the saddle. Both pilots admitted however, that although there was low cloud and rain in the area, there was no real necessity for the aircraft to be flown below 500 feet between the hills.

Ferrying a Musketeer, with a student pilot as a passenger, to a country centre in Queensland, a "C" class instructor followed the course of a dry river at 500 feet to point out suitable forced landing areas to the student. In answer to a question by the student, the instructor set out to demonstrate a forced landing approach to a sand bar in the river bed, allowing the aircraft to descend below the level of the trees flanking either side of the river. As he was about to climb out of the river course, the occupants heard a loud "TWANG", and saw that the H/F aerial had been severed. The aircraft continued to fly normally however, and thinking the aircraft had struck a bird, the pilot continued to his destination where he made a straight-in approach.

Unknown to the pilot until after he landed, the aircraft had struck and broken two telephone lines strung across the river and these were trailing for 600 feet behind the aircraft. As the aircraft approached to land, the wires dragged across a power line, shorting it out and breaking several wires. Fortunately, no great damage was done and no-one was injured, but it is easy to imagine similar circumstances creating an extreme hazard for persons or property in the vicinity of the power line.



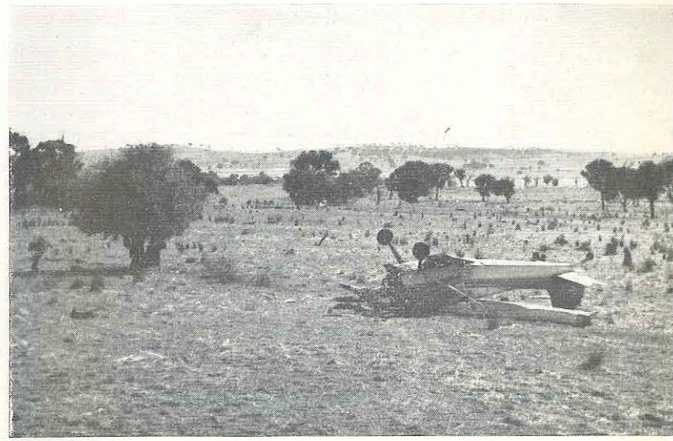


While ferrying this aircraft to an agricultural strip to begin spreading operations in central N.S.W., the pilot apparently sighted his loader vehicle travelling along a road ahead of him. The aircraft descended and flew at low level, overtaking the vehicle, which was some distance in front of the aircraft.

Just before drawing level with the vehicle, and while flying at about 25 feet above the ground, the aircraft collided with a power line traversing the road, dived to the ground and came to rest inverted. The pilot was killed.

* * *

When this accident occurred a private pilot was taking a friend for a flight in a Victa from a country aerodrome in Victoria. Sighting a farm house where a friend of the passenger lived, the pilot descended, as he said later, "to allow the passenger to have a good look at his friend's property". The aircraft approached the house at low level, converging at an acute angle with an unseen single wire power line which supplied the property. The aircraft's undercarriage caught on the power line and the aircraft skidded along the wire, lifting it clear of the supporting poles. The pilot attempted to land in a field beyond the house, but the aircraft, still restrained by the power line struck the ground heavily, cartwheeled through a fence and came to rest facing the direction of the flight. As the photograph shows, the aircraft was destroyed. Both occupants were severely injured.



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Although, as these instances so forcibly demonstrate, striking power lines has been the principal cause of trouble in low flying accidents in recent years, it is by no means the only problem likely to be encountered in the course of ill-considered excursions into unauthorized low flying. The article "Search Flight Ends in Disaster" on page 8 of this issue, provides a grim example of the extreme danger of unplanned low flying, even when operating in an area where there are no unseen obstructions. Unfortunately however, this accident is far from being the only one with which the Department has been concerned in the last two years or so. The following cases give some idea of the diverse nature of other dangers, that await low flying aircraft:—

There's DANGER down low !

(Continued)

Late in the afternoon, a private pilot was taking some friends on a sight-seeing flight from Ballarat, Victoria. After flying around the city, the aircraft flew to nearby Lake Burrumbeet and began a low run across the lake from south to north, the aircraft crossing a southern shore at about 100 feet and descending further as it flew out over the water.

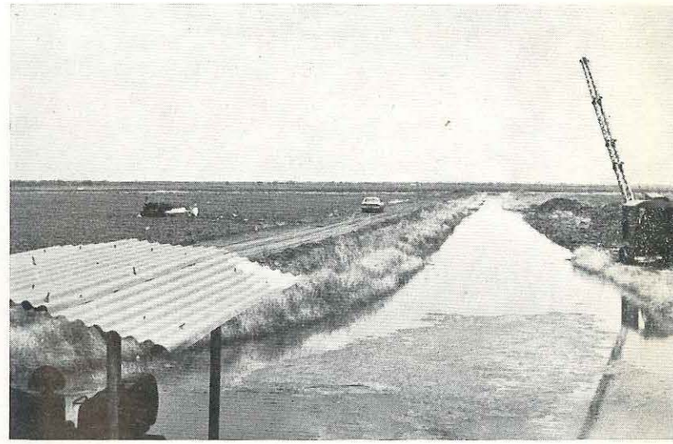
The sun was just setting at the time, and the visibility was hazy. There was no wind and the surface of the lake was mirror-like and almost translucent in appearance. A quarter of a mile out from the shore, the aircraft levelled out and flew very low above the water. It continued at this height for a short time, but then about a mile out from the shore the undercarriage touched the surface of the lake and without further warning the aircraft plunged into the water. The pilot and one passenger escaped from the submerged cabin and were later rescued by a motor boat, but the two other passengers were drowned.

* * *

During a ferry flight in deteriorating weather, to Toowoomba, Queensland, the pilot of a Grumman Agcat descended to a low altitude to try and remain below the lowering cloud base. But when only four miles from his destination, he saw it would be impossible to continue the flight visually because of even lower cloud and reduced visibility on the hills ahead, and he began a turn back on to a reciprocal heading. In the course of the turn, the pilot unintentionally entered a patch of cloud, and while still turning, the aircraft collided with the upper section of a 220 feet high radio mast belonging to a local broadcasting station. The mast collapsed, taking the aircraft with it, which then struck the ground in a steep nose down attitude. Miraculously the pilot, though seriously injured survived the crash and was able to extricate himself from the wreckage.

After completing some agricultural spraying in northern N.S.W., the pilot of a Pawnee flew over each of the two markers, one of whom was the pilot's son, to signal that operations were finished for the day. After doing so, the aircraft set course for the airstrip but the pilot was seen looking back and waving towards where his son was standing in the paddock.

Almost immediately afterwards, as the aircraft climbed away, it collided with the boom of the crane located by the irrigation channel in the picture. The impact tore off the port wing and the aircraft crashed into the adjoining paddock and caught fire. The pilot was rescued with serious injuries and burns.



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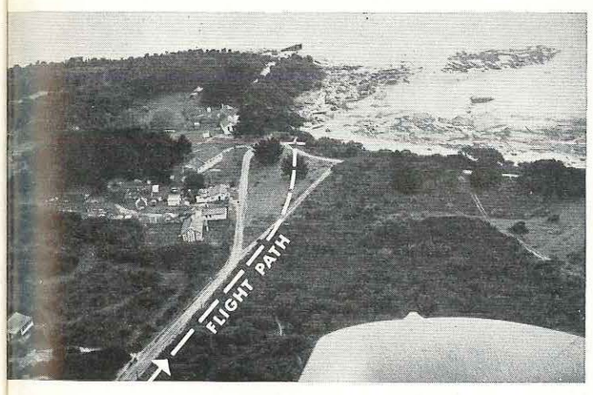
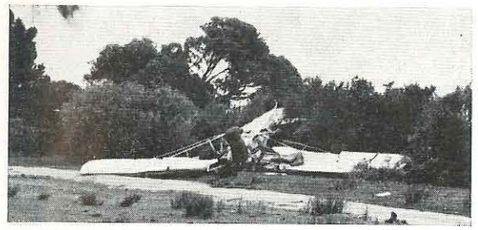
At Flinders Island, Bass Strait, the owner-pilot of an Auster was asked to deliver a part for a lighting plant to the settlement on Cape Barren Island, 20 miles to the south. The pilot offered to air-drop the part instead of landing on the island and this arrangement was accepted.

After flying to the island, the pilot made a wide circuit and then began a run-in over the settlement at about 40 feet. Just before reaching the dropping point in front of the island's store, the pilot leant out the side window, holding the article to be dropped. As he did so, the aircraft turned to the left towards a 50 feet high pine tree, a little over 200 feet away. The pilot released the package but continued looking back towards where it fell. The aircraft then straightened up, but it did not climb, nor was there any change in the engine note, and it flew straight into the pine tree, 37 feet above the ground. The top of the tree was lopped off at the trunk and the aircraft dived to the ground 150 feet further on, coming to rest upside down. The pilot, who was the only occupant was fatally injured.





What more need we say on the hazards of low flying? The accidents we have quoted surely speak for themselves. Indeed it is doubtful if any other accident history establishes the danger of a particular practice so clearly as does the record of low flying accidents.

What will be **your** attitude then, next time you are tempted to "bend the regulations" and indulge in a bit of off the record low flying? Let us be frank, no one will deny it is exciting — even exhilarating. But is it worth the risk? It is no good thinking "it won't happen to me" — You are only deluding yourself if you do. The cases we have examined in this article, together with a long list of others that have occurred before and since, show irrefutably that if you do decide to run the risk, you have a first rate chance of finishing up in the same way as the aircraft illustrated on these pages.

OIL LINE ADRIFT

EN route from Sydney to Port Moresby, the pilot of a Piper Cherokee landed at Horn Island to refuel. Before departing again, he checked the engine oil level and all four fuel tanks. He then made a normal take-off.

On reaching 2,000 feet as the aircraft was climbing out, the pilot noticed a small quantity of oil seeping along the lower edge of the port side window. He checked the oil pressure gauge and saw the needle rapidly dropping below the safe minimum pressure of 60 pounds per square inch.

The pilot immediately closed the throttle, turned the aircraft back towards Horn Island and made a gliding descent back to the aerodrome. After landing safely, the pilot stopped the engine and let the aircraft roll to the parking area. Here he checked the oil level again and found the sump was empty. The oil had been lost because a flexible oil line to the oil cooler had become disconnected. Further inspection later revealed that the engine's No. 4 big end bearing had failed as a result of oil starvation.

Although the aircraft was new and had flown only 35 hours the reason for the disconnection was simply that the gland nuts securing either end of the flexible oil line, had worked loose. One end of the hose had completely separated from the oil cooler connection, allowing the engine oil to be pumped overboard at system pressure, and the other end was held by only two threads. The flexible hose had evidently become twisted during the original assembly, and the torque applied to the gland nuts by this twisting, together with the vibration of the engine, had gradually loosened them. The full power vibration of the engine during the take-off from Horn Island, had apparently been the "last straw" in causing one end of the line to separate from the oil cooler connection, thus allowing the engine oil to be lost very quickly.

This incident is a good example of the degree of care necessary in installing flexible fuel and oil hoses and shows how undesirable stresses can be introduced when an installation is made incorrectly.

The diagrams opposite are taken from a hose manufacturers' handbook and show some common installation faults. The case illustrated in Fig. 2 is the one which is believed to have caused this incident. The linear stripe referred to in this diagram, or some other system of marking, is painted along the full length of most flexible hoses, and is there to ensure that the hose is not installed in a twisted condition. Tests have shown that hot engine oil under pressure can produce quite a considerable leak when the securing nut is loosened only a quarter of a turn, so that when tightening gland nuts on the ends of a flexible hose assembly, it is advisable to grip the metal socket on the hose itself to ensure that no twisting occurs.

A further difficulty arises when a fire sleeve is installed over the flexible hose, as was the case with the Cherokee at Horn Island. Because (as shown in Fig. 4) the fire sleeve completely covers the end socket of the hose to ensure full protection, it is often very difficult to grip the hose socket satisfactorily when tightening the gland nuts. The clamp securing the fire sleeve to the end socket can sometimes be used to hold the hose in place, and some fire sleeves themselves have a linear stripe painted along their length. A stripe or similar markings on a fire sleeve is not always a reliable guide however, for it is possible for the hose itself to become twisted inside the sleeve.

For this reason, when installing hoses with fire sleeves on aircraft, it is good practice to release the fire sleeve clamp and push back the sleeve far enough to hold the end socket securely while the gland nut is tightened. This method should help to ensure that no twisting of the hose occcurs beneath the fire sleeve, and that hoses are always installed correctly.

Flexible Hose Installations:

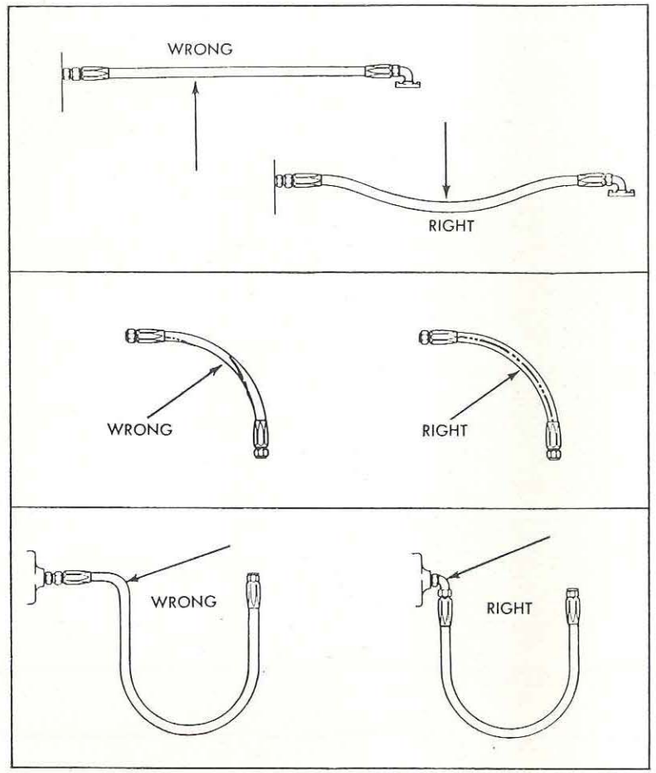


Fig. 1

Allow sufficient slack in the hose to provide for changes in length that can occur when pressure is applied to the line.

Fig. 2

Note the position of the linear stripe. Care must be taken to ensure that the hose is not twisted. High pressure applied to a twisted hose can loosen the gland nuts, or even cause the hose itself to fail.

Fig. 3

Relieve sharp bends and avoid straining the hose by using elbow or other adapter fittings as necessary. Allow generous bend radii and never use less than the minimum bend radius specified for the hose. Additional bend radius should be allowed when a line is subject to flexing in service.

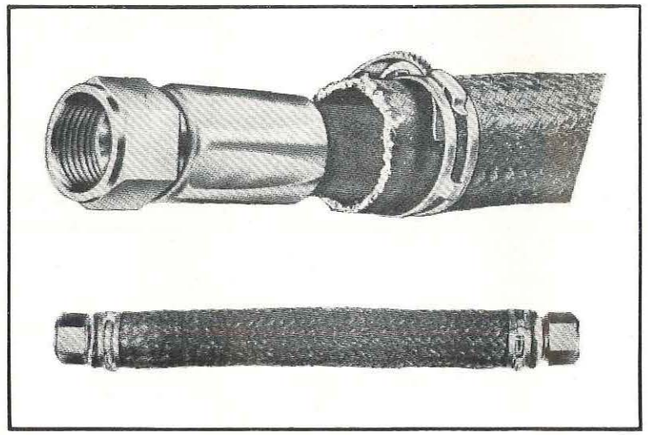


Fig. 4

A fire sleeve fitted to a flexible hose. Note how the sleeve may be pushed back after releasing the clamp, to enable the end socket to be gripped while installing the hose.

WILL **YOUR** LOAD DUMP?

WE posed this question three years ago in Digest No. 41. As some readers will remember, it was prompted by an accident in which a piece of reinforced packing paper, used for containing bulk superphosphate in rail trucks etc., found its way into the hopper of an agricultural Cessna 180 and prevented the pilot dumping the load when the aircraft failed to climb away after take-off. The article concluded . . . "all agricultural operators and pilots should be conscious of the hazard and should implement preventative measures which ensure that the safety of their operations is not prejudiced".

Two further accidents of a substantially similar nature now suggest that it is timely to include another reminder of the importance of ensuring that agricultural loads can be dumped when the need arises.

This 180 was working on a farming property in Western Australia, and had almost completed the spreading of what had been a 50 ton heap of bulk superphosphate, uplifting nine hundredweight per load. While the aircraft was carrying out the second last sortie, the loader driver, enthusiastically assisted by the farmer, scraped up the remains of the heap and shovelled the scattered superphosphate into the loader bucket. This filled the loader bucket to 14 cwt. When the aircraft returned and landed, the driver moved the loader vehicle into position by the aircraft and opened the loading gate intending to drop only the usual nine cwt. into the aircraft hopper. But as he tried to close the gate of the loader bucket, a stone jammed in it, preventing it closing. The superphosphate continued to pour into the hopper, so the driver hastily backed the vehicle away from the aircraft.

The pilot however, took this as a signal that the loading had been completed, and before the driver could warn him that the aircraft was overloaded, opened the throttle and began to take-off. The aircraft became airborne but failed to climb normally and the pilot tried to dump the load. There was no response and the aircraft sank into trees and scrub and crashed. As is evident from the picture, the aircraft was virtually destroyed. The pilot sustained serious injuries.

The aircraft's hopper was found to be blocked with several pieces of tree root, up to eight inches in length. Further investigation revealed that, before the operation began, the bulk superphosphate had been heaped on the natural surface of the ground beside the airstrip, and not on a prepared area. The pieces of tree root were obviously shovelled into the loader bucket while the driver and the farmer were clearing up the remains of the heap.

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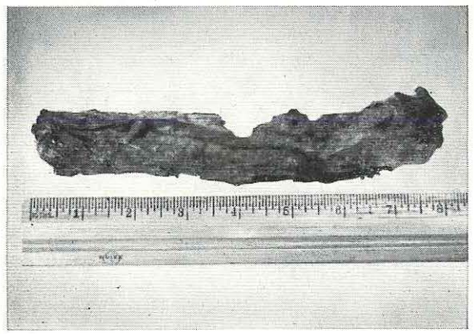

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Before it struck the ground as shown, the Pawnee illustrated on the next page was also engaged on a super-spreading operation in Western Australia, in company with another aircraft of the same type.

The bulk superphosphate being used was freshly manufactured ("green" as it is known in the industry), and was of a fine powdery texture with a high moisture content. Superphosphate in this state tends to compact easily and does not flow as freely as more "matured", granulated superphosphate.

Unknown to the pilot, nearly half his aircraft's load on the preceding sortie had compacted in the aircraft's hopper and had failed to spread. In accordance with his normal practice, the pilot had landed with the hopper dump flap open, but because the landing was a smooth one, the superphosphate that had "hung up" in the hopper, was still not dislodged. The aircraft was then re-loaded again for the next sortie, and this load, on top of the remaining portion of the previous load, resulted in the aircraft being substantially overloaded.

One of the pieces of tree root found blocking the aircraft's hopper after the accident.

During the ensuing take-off, the pilot realised the aircraft was overloaded and attempted to dump the contents of the hopper, but without success. It was too late to discontinue the take-off and the aircraft became airborne just above stalling speed. The pilot continued his efforts to dump the load by working the dump lever to and fro, and at the same time tried to climb the aircraft to avoid trees ahead. The aircraft would not climb however, and the pilot had to weave his way between the trees. He then decided to try and land in a clear area to the left of his flight path, but as he turned the aircraft, it stalled at a height of about 15 feet. The aircraft fell heavily to the ground, slid 55 feet, and came to rest facing the direction of flight.

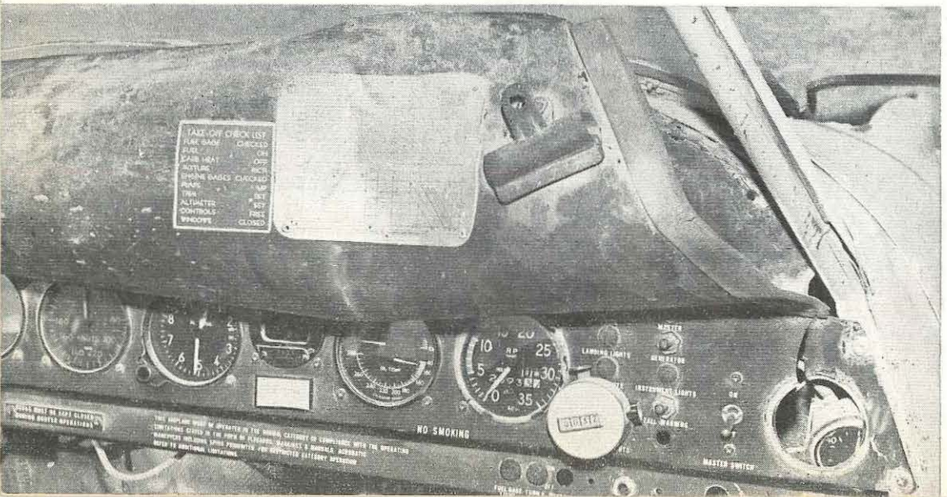
The aircraft was damaged beyond economical repair but the pilot escaped with minor injuries. Investigation showed that the "green" superphosphate had packed down in the throat of the hopper, preventing the load from discharging.

It is notable that in this second accident, the operator's manager, the pilots of both Pawnees and the loader driver, were all well aware of the compacting and bridging characteristics of "green" superphosphate and the consequent difficulties and dangers involved in spreading it from an aircraft. It was also evident during the course of the investigation that before the accident occurred they had some misgivings about using it. The loader driver had already experienced difficulty in dispensing it from the loader bucket because of its moisture content and had gone to the trouble of shovelling away some of the damper superphosphate in the heap to avoid using it. Had it not been for the commercial pressure imposed by the operator's commitments, there is little doubt that the operator and pilots would have declined to use the superphosphate while it was in that condition.

Despite all this knowledge however, neither the pilots, nor the loader driver, took any positive action to avoid the situation they feared and which in fact eventuated. In the known circumstances, it surely would have been prudent to institute some way of visually checking that the aircraft's hopper had emptied properly before it was reloaded for the next sortie. Admittedly this would incur some small penalty in turn-around time while working with "green" superphosphate, but is this not a small price to pay, compared to the cost of an aircraft — and perhaps even a life?

NOTE:—

It is worth mentioning that the pilot's injuries in this case were mainly facial and were evidently caused by striking a bulldog clip (used to hold notes, sketch maps, etc.) which was screwed to the padded instrument panel coaming. (See Photograph). The placing of sharp objects in the cockpit, where they can cause injuries in the event of an accident is an obviously dangerous practice and completely nullifies any advantage gained by incorporating crash pads and other protective medium, in the design of the cockpit.



The instrument panel of the Pawnee, showing the bulldog clip attached to the crash pad.

JUST MAKING IT?

- COLD FROSTY CONDITIONS
- AIRCRAFT PARKED OVERNIGHT IN THE OPEN
- EARLY MORNING TAKE-OFF

Even a light coating of frost on the wings can increase the take-off distance and reduce the aircraft's speed margin above the stall. See that all frost is removed from your aircraft BEFORE you attempt to take-off.