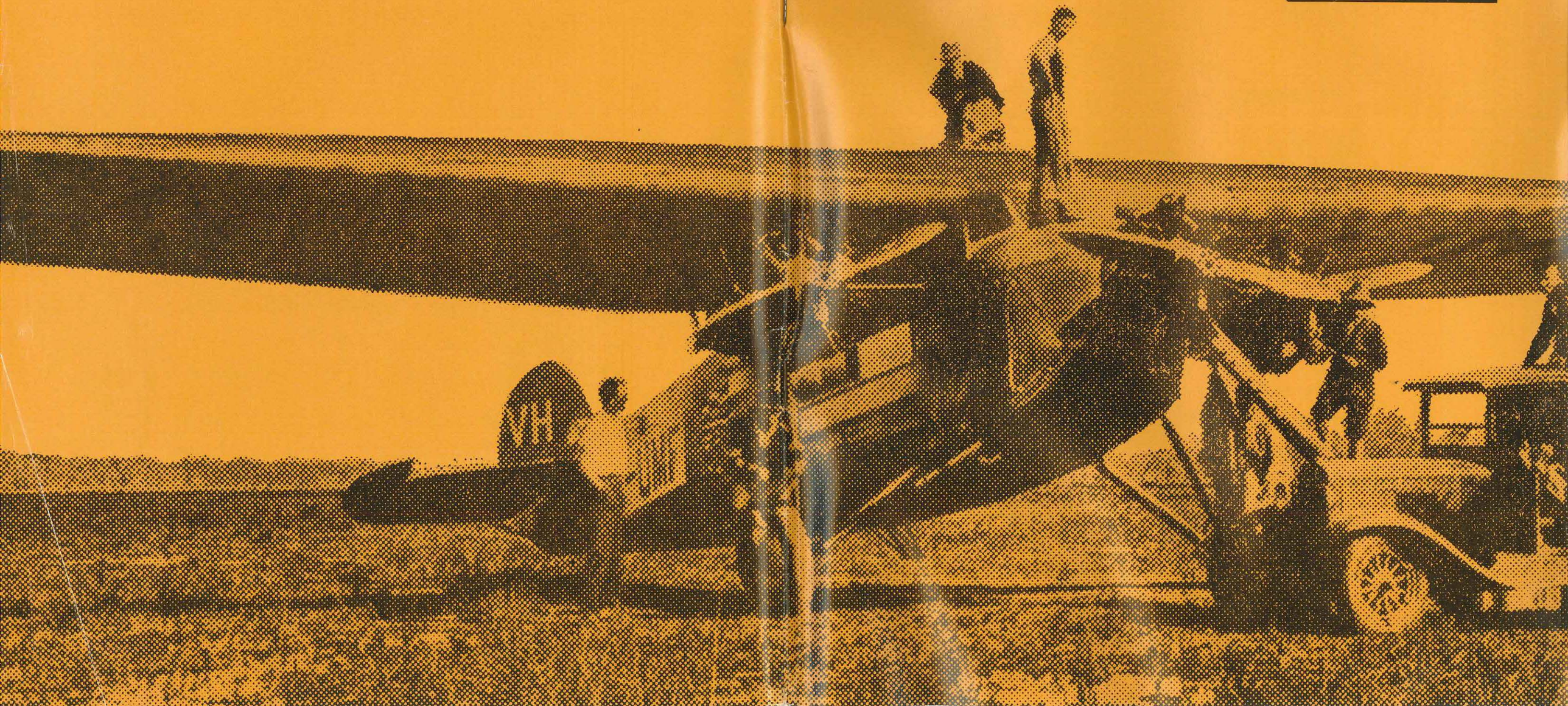
Number 73 March 1971 DEPARTMENT OF CIVIL AVIATION AUSTRALIA

AVIATION SAFETY DIGEST



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Contents

COVER: Australian National Airways' Avro 10 "Southern Cloud" refuelling at a country aerodrome shortly before its last flight, 40 years ago this month. This historic accident and the message it still has for pilots today, is reviewed in this issue.
—Sydney Morning Herald Photograph

ABOVE: The interstate airline's headquarters at Mascot in 1931, about the time the "Southern Cloud" was lost. The Avro 10 in front of the hangar is a sister aircraft, "Southern Moon".

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AUSTRALIA

Editorial

Forty Years Experience — what has it taught us?

Forty years is a long time in anyone's life. Perhaps to a few older readers it will seem hard to believe that on the 21st day of this month, precisely that length of time has passed since the now legendary "Southern Cloud" took off from Sydney and flew into oblivion — an oblivion that seemed absolute until a young hiker stumbled by chance upon the aircraft's remains in a remote part of the Snowy Mountains in October, 1958. But to the majority of readers of the Digest today, especially those in the younger age group, the saga of the "Southern Cloud", with its five once-famous sister aircraft and the pioneer interstate airline that operated them, probably seems shrouded in the mists of antiquity.

In any case, what possible relevance can this disaster of so long ago have to safety in aviation today? Surely to compare the conditions under which the "Southern Cloud" and her sister aircraft operated with the operational standards of our present airways system is almost meaningless? Something like comparing a clipper ship of the last century with the huge, automated container vessels of this decade?

This is perfectly true. From a technical point of view, the shortcomings and inadequacies that contributed to the loss of the "Southern Cloud" have been overcome. The inadequate meteorological services; the lack of air-ground communications; inadequate maps; the complete lack of any method of position fixing other than by visual means, or of any way of knowing if the aircraft was flying into the extreme turbulence of a thunderstorm when already flying "blind"; the lack of aircraft instruments and equipment to fly safely and accurately in such conditions and to maintain adequate separation from ground and other aircraft; and lastly, the lack of any air traffic control, operational control or search and rescue organisation. The facilities that now exist to provide all these services, together with other components of today's airways operations systems, ensure that flights conducted on Australian air routes today are as safe as it is humanly possible to make them. But it must never be forgotten these present-day standards of safety have been hard won. They have by no means "just happened", but have been hammered out one by one over the years, more often than not in the harsh light of tragic experience.

The "Southern Cloud" disaster was Australia's first major airline accident and began this painful evolutionary process. But it was certainly not the last. The step by step development of Australia's airways operations system reflects many of the operational lessons that have been learnt from major accidents that have occurred over the years. The DH86s in Bass Strait in 1934, the Stinson in the Macpherson Ranges in 1937, the DC-2 "Kyeema" in 1939, the DC-3 "Lutana" in 1948 and the Viscount VH-TVC in 1961, are some that immediately spring to mind whenever airways development is considered.

With this great fund of operational experience and these hard, costly, but immensely valuable object lessons to build on, it would be perfectly understandable if a newcomer to aviation were to conclude that accidents resulting from bad weather should now be virtually a thing of the past. And so they are—on air routes served by radio navigational aids and flown by properly equipped aircraft that are crewed by appropriately qualified pilots. But on flights which still depend for their safe execution on visual navigation, any attempt to continue in weather conditions that exceed this limitation, will still subject an aircraft to exactly the sort of hazards that destroyed the "Southern Cloud."

Regrettably, this truth is all too evident from the five recent accidents discussed in this issue of the Digest. It is also significant that the type of operations in which these accidents occurred are representative of the whole spectrum of light aircraft travel flights — from scheduled services in "heavyweight" light aircraft to private flights in elementary fixed-undercarriage aircraft. Collectively, these accidents demonstrate that the priceless experience of the years, accumulated at the expense of unnumbered lives and aircraft, can be completely nullified if pilots disregard the very standards that this experience has shown to be necessary.

Weather has always been man's biggest enemy in flying and still remains so, especially for VFR flights. But today, from the accumulated experience that is reflected in our operational standards, we know positively how far we can go in contending with this enemy in different circumstances. The situation was not the same in the era of the "Southern Cloud". The dangers that are so well known today were still largely unexplored then. And if there was then a tendency to be venturesome in bad weather operations, it was of the type that was necessary to progress at that time. There is no excuse for rashness of this sort today. All that had to be learnt about flying an aeroplane safely without visual reference has long since been learnt the hard way. The natural laws and phenomena that impinge upon flight in cloud do not change and what applied 40 years ago, applies just as much to aircraft today if they are flown without the facilities, equipment or pilot qualifications for operations in instrument conditions.

The message of 40 years experience is perfectly clear and cannot be refuted. When circumstances dictate that a flight be conducted in accordance with the visual flight rules, be bound by those rules—experience has established their necessity. To do otherwise is to court disaster.

BELOW VMC...

Twin Otter Destroyed on Hillside

While attempting a low level visual approach to Kainantu in the eastern highlands of New Guinea in deteriorating weather, a Twin Otter collided with trees on a mountain ridge and fell to the ground. The aircraft was destroyed by impact forces and the pilot and seven occupants were killed. Three other passengers were seriously injured.

THE aircraft was engaged in operating a regular public transport service from Mount Hagen to Lae, with intermediate stops at Banz, Minj, Chimbu, Goroka and Kainantu. The aircraft was scheduled to depart Mt. Hagen at 0630 hours and, before departing on the morning of the accident, the pilot was supplied with flight and terminal forecasts which indicated that the en route weather would be generally fine with a visibility of 25 miles, reduced to five miles in rain showers. There was expected to be five eighths of cloud at the flight planned cruising level, while fog and four eighths of stratus cloud were expected to persist in the valleys until 0900 hours. At the en route ports the flight could expect to encounter two eighths of stratus at 1,500 feet and two eighths of cumulus at 2,500 feet. Until 0900 hours, it was also possible that the surface visibility would be reduced at times in fog.

The pilot prepared a VFR flight plan covering all stages of the flight to Lae and the aircraft subsequently departed as scheduled. The service proceeded uneventfully via the first four intermediate ports and the aircraft departed Goroka for Kainantu at 0852 hours. As well as the pilot, the aircraft was carrying a flight traffic officer and nine passengers. According to the pilot's flight plan, it would take 15 minutes to cover the 25 mile sector to Kainantu, cruising at 7,500 feet or about 1,500 feet above the general level of the terrain. The aircraft's endurance was 200 minutes. Four minutes after setting course, the aircraft called the Lae Flight Service Unit and was informed that the area QNH was 1012 millibars.

Nothing more was heard or seen of the aircraft until about 0910 hours, when it was sighted some five miles out from Kainantu. The aircraft was following the normal route from Goroka, but flying very low and just beneath the extremely low cloud that persisted in the area. Flying right at the base of the overcast, the aircraft then entered a saddle in a ridge that lay at right angles to its track. Almost immediately afterwards, the engine noise increased and the aircraft banked steeply into a turn to the left. The turn continued through about 180 degrees until the aircraft, just clearing the slopes of the northern side of the saddle, was heading back in the direction from which it had come. But before it could regain the area of lower terrain to the west of the ridge, the aircraft flew into a stand of tall trees on top of a spur in the saddle. Cutting a swathe through the trees the aircraft cleared the top of the spur itself and crashed on to a grass covered slope on its western side.

The noise of impact was heard in several villages in the vicinity and the news of the crash was quickly conveyed to a nearby mission station, from which it was relayed by radio to Madang. Meanwhile, four men from a trading company adjoining the mission station, drove hurriedly to the scene of the accident to render assistance. They found the aircraft almost demolished and five of its occupants dead. Three other occupants died shortly afterwards, but three seriously injured survivors were rescued from the wreckage and were later evacuated to hospital at Goroka.

* * *

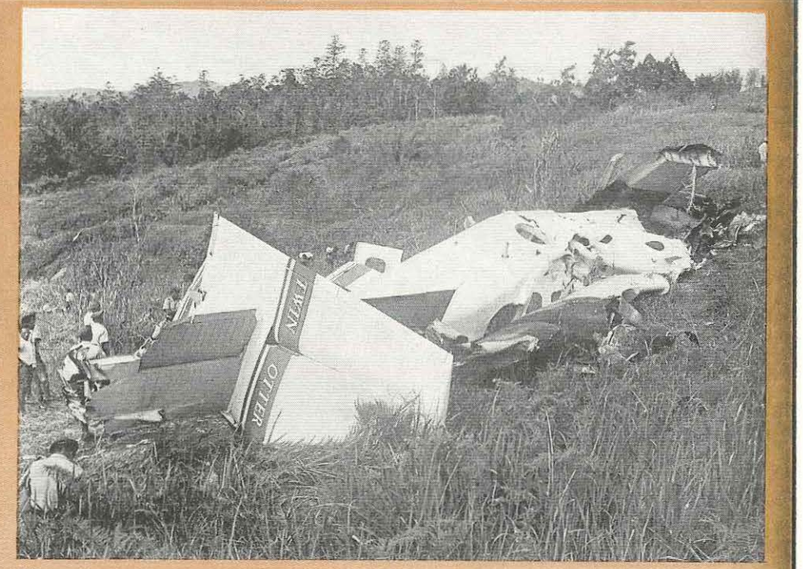
The site of the accident was just to the west of a mountain ridge running north-south, three and a half miles to the west of Kainantu aerodrome. From an examination of the wreckage and the accident site, it was evident that the aircraft had sustained extensive structural damage as a result of striking the trees on top of the ridge, before it finally impacted on grass-covered rising ground some 360 feet on the western side of the ridge and 75 feet below it.

The initial impact had been against the main trunk of a large tree, which caused massive damage to the nose structure of the aircraft. The aircraft had then collided with other trees further up the eastern face of the ridge which had sheared off the outer starboard wing, the port wing tip and outer portions of the starboard tailplane and elevator. On the wings, the impact marks of the trees were predominantly against the lower sections of the leading edge indicating that the aircraft's attitude had been about 10 degrees nose-up when it flew into the trees. At the moment of impact with the ground, the aircraft was descending at an angle of about 30 degrees and banked 45 degrees to starboard. The damage sustained by the aircraft was consistent with the tree and ground impacts and there was no evidence of any defect having existed before the accident. A detailed examination indicated that both engines were operating at high power at the time of the collision with the trees, and established that no fault had existed in either the engines or the propellers before the crash occurred. It was also evident that at the time of the accident, the aircraft's gross weight and centre of gravity were within permissible limits.

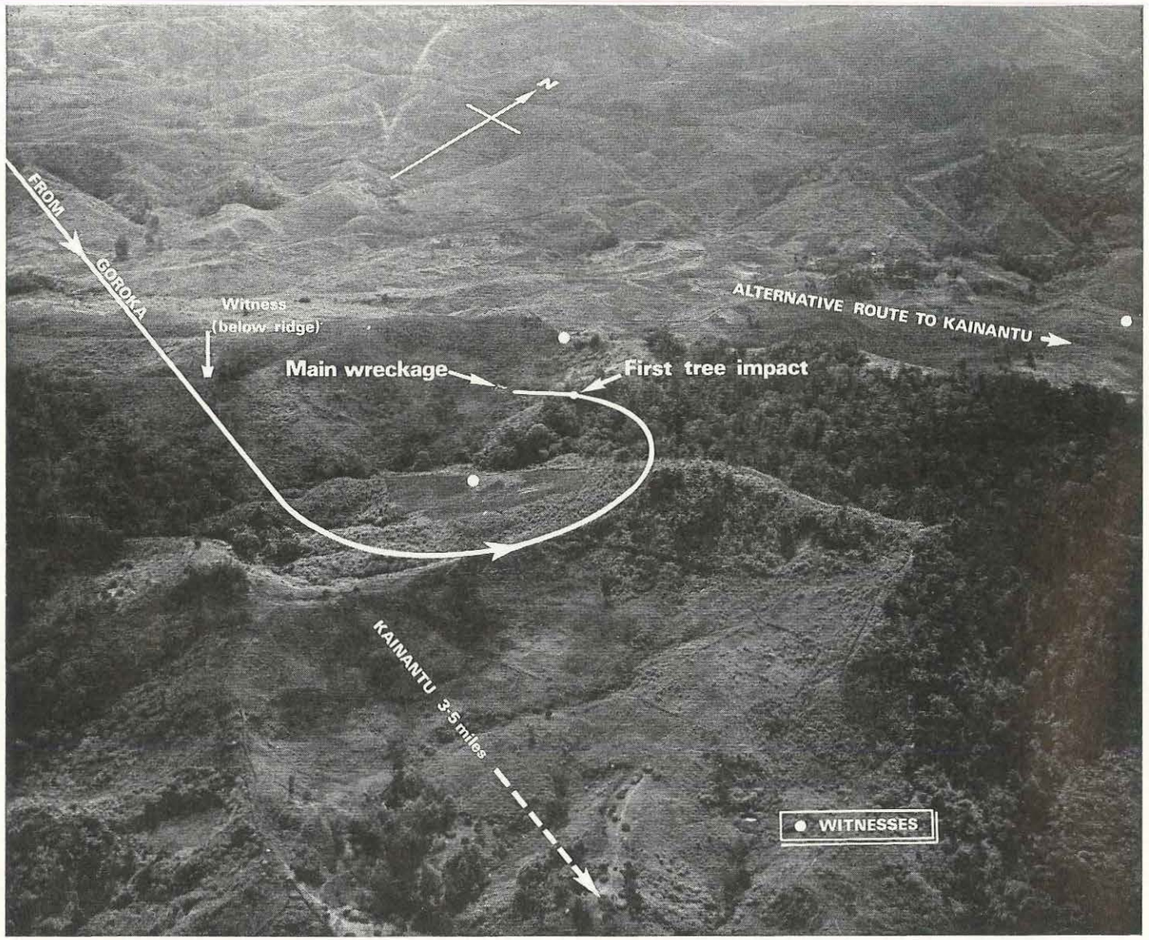
The pilot-in-command of the aircraft held a senior commercial pilot licence endorsed for the aircraft type, and a first class instrument rating. His total flying experience was in excess of 5,000 hours of which more than 3,000 had been flown in command, including some 860 hours on Twin Otter aircraft.

The terrain in which the accident occurred is typical of that in the New Guinea Highlands. In this area the weather, though conforming generally to a regular diurnal pattern, is notable for quite localised changes that can occur over short periods of time. Evidence obtained from a number of witnesses who were in the general area of the accident, enabled the local weather pattern at the time to be reconstructed with reasonable accuracy.

It was apparent that over the last six miles of the intended flight path from Goroka to Kainantu, the cloud base had progressively lowered and the flight visibility had gradually diminished. In the area between six and four miles west of Kainantu aerodrome, there was eight-eighths of cloud with a base only a few hundred feet above the general level of the terrain. Beneath this cloud there were some patches of misty rain but probably not enough to affect in-flight visibility to any extent. Closer to



The main wreckage as it came to rest, looking approximately in the direction of impact. Extensive damage to the starboard side of the fuselage caused by the collapse of the starboard undercarriage when the aircraft struck the ground is evident in this picture.



Kainantu, it was apparent that heavier precipitation existed. The cloud base in this area might also have been lower than further back along the aircraft's route, though this cannot be known for certain as the terrain in this area is a little higher, and the route which the aircraft was attempting to follow is crossed by a series of transverse ridges. There is little doubt however, that in a number of places in this area, virtually no clearance would have existed between the higher sections of the terrain or the trees on it, and the base of the cloud.

In the vicinity of Kainantu aerodrome itself, at the time of the accident, the cloud base was so low that in a number of places the hills and trees were actually in cloud. As well as this, light rain was falling and it was evident that a visual approach to Kainantu would have been impossible while these conditions existed.

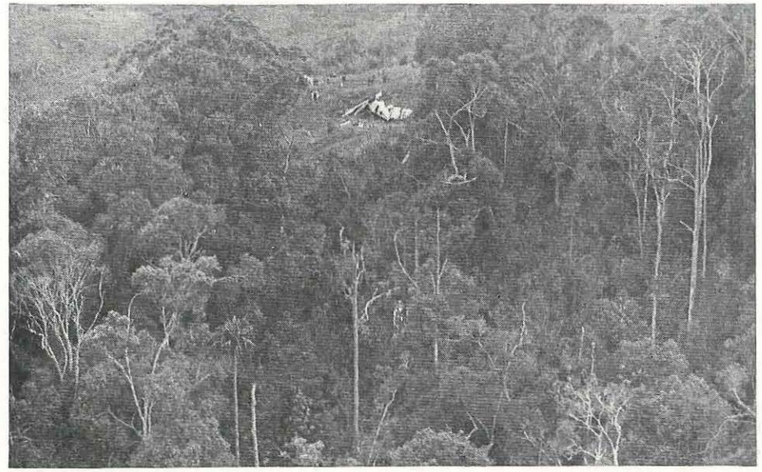
* * *

The investigation was not able to reconstruct in any detail the movements of the aircraft from the time it departed Goroka until it reached the area in which the accident occurred. Reports from ground observers and other pilots who flew the same route on the morning of the accident, indicated that typical fog and low stratus existed in the early hours of the morning but that by the time the aircraft left Goroka, these conditions had already improved in that area. Further along the route towards Kainantu however, the normal diurnal pattern of weather in the lower altitudes was overlaid by a build-up of middle and high level cloud which extended from the coast to the Eastern Highlands, probably as the result of an abnormally strong south-easterly air stream. This cloud development evidently extended westward from Lae at least as far as Kainantu.

The cloud build-up would have been obvious to the pilot on departure from Goroka and he would have seen that, to reach Kainantu, it would be necessary to fly below the cloud base and maintain visual contact with the ground. It is thus quite likely that the pilot decided not to climb to 7,500 feet as planned and this could perhaps explain why he did not subsequently inform Lae Flight Service that he was commencing his descent into Kainantu. Even so, the pilot should have reported the change in cruising level, if in fact he was proceeding at an altitude other than that notified.

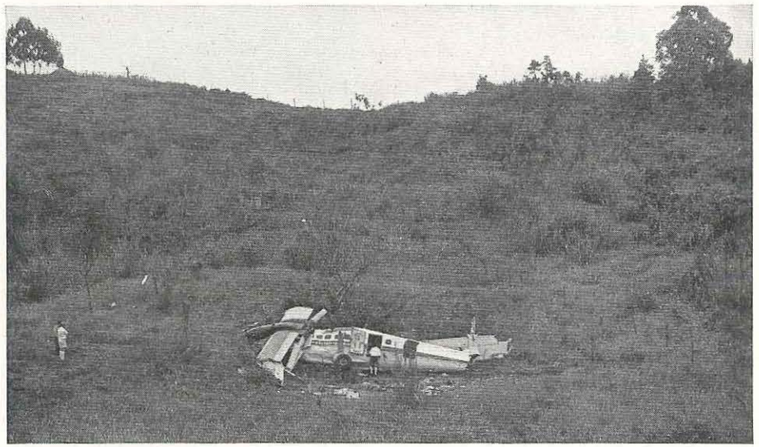
As the aircraft approached Kainantu, the pilot was no doubt forced to descend in order to remain below the cloud base. It is evident from eye witness reports that, by the time the aircraft was

Opposite page: Aerial view of area in which accident occurred showing final flight path and position of witnesses.



This page, top: The main wreckage seen through the gap it cut in the ridge-top vegetation. The tree first struck by the aircraft is in the centre foreground of the picture.

Bottom: General view of accident site showing location of the major structural components. The port wing, lying across the forward section of the fuselage, was dislodged by the aircraft's initial contact with the ground. The direction of impact was from right to left.



within six miles of Kainantu, it was flying within the very shallow layer of clear airspace that existed between the cloud base and the terrain. The eye witness who observed the aircraft at this stage had often seen aircraft following the same route to Kainantu, but had never see one as low as on this occasion.

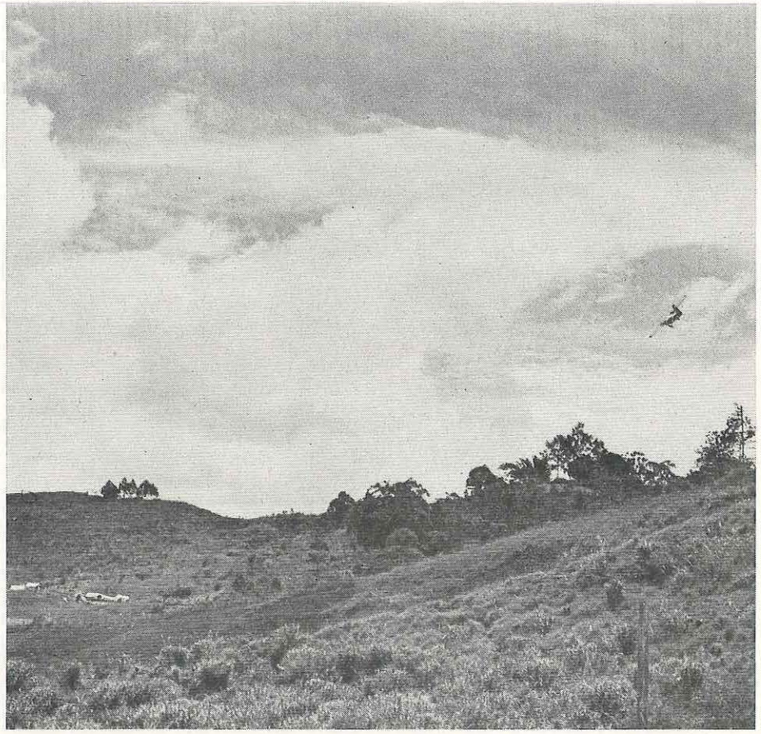
Four miles from Kainantu, the aircraft reached the area of slightly higher terrain formed by the series of partly cleared transverse ridges. Here, immediately to the south of the direct track to Kainantu, there is an extensive stand of tall pine trees, while on the northern side of the track the terrain as well as being tree-covered is higher still. The saddle thus formed in the series of ridges is recognised as being the critical point in a low visibility approach to Kainantu from Goroka. Once the saddle is traversed, the terrain opens out again and a reasonably unobstructed approach path is then available to Kainantu aerodrome. Many of the witness reports indicated that, in the area of the saddle at the time of the accident, the tops of most of the ridges and tall trees were in cloud, and that light rain showers were passing through the area.

The evidence indicates that the aircraft crossed the first of the transverse ridges in the saddle at a very low level, at a time when the trees on the port side of the aircraft were in cloud. The pilot was familiar with the terrain in the area and it is possible that he believed he had only to negotiate a small area of low cloud in the saddle to bring the aircraft over the lower terrain closer to the Kainantu aerodrome, where he would be able to continue visually for a landing. In actual fact however, there was

a considerable build up of low and middle level cloud over the aerodrome with light to moderate rain. It seems likely that, after entering the saddle area, the pilot either found that visibility did not improve as quickly as he had hoped, or he saw that he was about to enter an area of general rain and low cloud that extended to ground level. In either case, the pilot would have had to abandon his approach to Kainantu immediately. It is evident that at this stage, the aircraft was being flown in weather much worse than visual meteorological conditions. Indeed, when the aircraft entered the saddle leading to Kainantu, there would have been occasions when the aircraft was being flown either in cloud or at least with very little forward visibility.

Having realised that there was insufficient visual reference for him to continue, the pilot had the choice of two alternatives. The first was to do what he was apparently attempting when the aircraft collided with trees, i.e. to turn back towards the area of lower terrain over which the aircraft had just passed. Here, although the requirements for VFR could still not be met because of the low cloud, there was at least enough visual reference to avoid the terrain. The other possible course of action which the pilot might have been prompted to take in the critical situation in which his aircraft was placed, was to abandon any attempt to continue to Kainantu and to climb immediately on instruments to a safe altitude and then to continue to Lae. The aircraft was equipped for flight under instrument flight rules and, as the pilot held a first class instrument rating, he was quite capable of flying the aircraft in these conditions.

It is clear that the pilot elected to follow the first of these two alternatives. The eye witness evidence indicates that, while still in the narrow saddle area, the



aircraft began a steep climbing turn to the left. The terrain on the starboard or southern side of the aircraft would normally have offered the safer climb-out path, but on this occasion the pilot had positioned the aircraft below the level and close to the area of tall pine trees on this side. The proximity of these trees would have precluded any possibility of a turn to the right.

Although the pilot would have had some reference to the ground immediately beneath the aircraft, and possibly some intermittent but very limited forward visibility, the aircraft at this point would virtually have been flying in instrument meteorological conditions. To attempt to remain in visual contact with the ground in this situation would thus have been hazardous in the extreme, and could only be achieved by making a turn to the left over rising terrain and towards tree covered ridges. It is evident that the commencement of this turn was

Opposite page, left: Performance tests being conducted during the investigation to reconstruct the Twin Otter's final flight path. This picture was taken from within the saddle area looking west towards Goroka in the direction from which the aircraft had come. The wreckage can be seen at the extreme left of the picture.

accompanied by a substantial increase in power, probably to the maximum available from the engines, and that it was as steep as the pilot was able to make it without stalling the aircraft. Flight tests conducted during the investigation showed in fact that the rate of turn attained by the aircraft would have been very close to the limit of its performance capability.

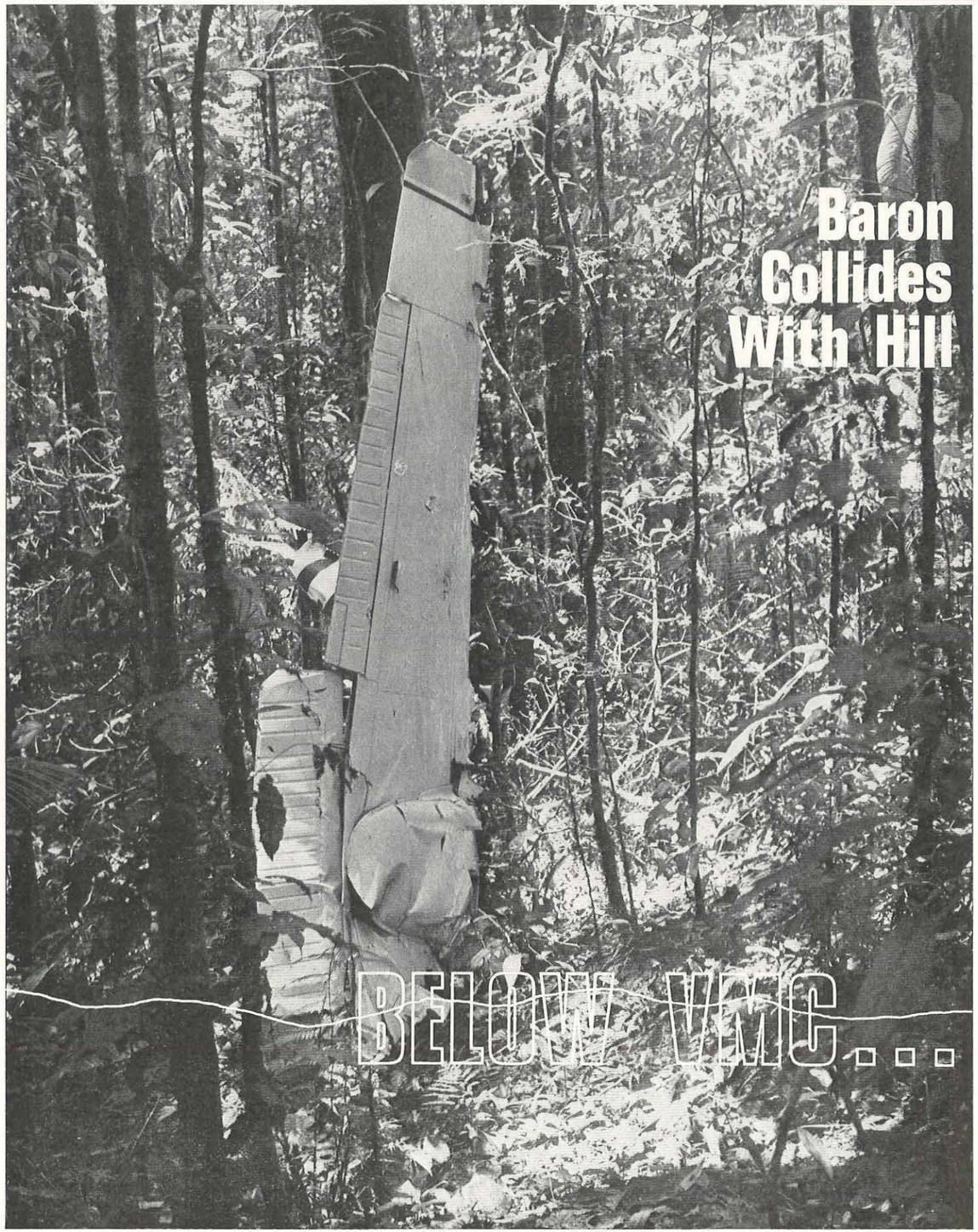
Having completed about 180 degrees of this turn and gained some 70 feet in height, the aircraft collided with the upper portion of a large tree. Collisions with other trees on the ridge followed until finally the severely damaged aircraft broke through the trees and fell out of control on to the cleared hillside immediately beyond the ridge.

Because of the cloud and rain, it is probable that the pilot would not at first have had a full view of the tree-covered ridge which his aircraft would have to clear if the turn was to be accomplished safely. However, the evidence that the aircraft was banked six degrees to starboard at the time of impact with the trees, suggests that at the last moment, the pilot discontinued the turn and brought the aircraft back to a near-level attitude. Just how desperate the situation was at this point is evident from the fact that although the aircraft's attitude was 10 degrees nose-up when it struck the trees, it was actually descending at an angle of five degrees. Having made his decision to turn to the left, the pilot had apparently tried to get every ounce of climb and turn performance out of his aircraft but had already placed himself in a position in which it was impossible to avoid the obstructions in the aircraft's path.

It was clearly evident from the investigation that, in the deteriorating weather conditions that existed, the pilot had persisted too far in his attempt to reach Kainantu. For any aircraft operation to be conducted with an acceptable margin of safety, it is axiomatic that some alternative course of action always be available to the pilot if at any time, or for any reason, the flight does not go according to expectations. In this case, the flight had gone beyond the point where any such alternative course of action could be taken without extreme danger, and its margin of safety had thereby been compromised to the point where it no longer existed.

The probable cause of the accident was that the pilot persisted with such determination or confidence in his attempts to reach his destination in the face of deteriorating weather conditions, that he did not ensure he could safely discontinue the approach at any time and still maintain visual reference to the significant terrain.

Bottom: Composite photograph of the saddle through which the aircraft attempted to pass on the latter stages of its flight from Goroka, looking towards the lower terrain in the direction of Kainantu aerodrome. The accident site is just out of view behind the marker post at left.



Opposite page: The port wing and engine nacelle structure of the Baron as found at the accident site. These components came to rest some 60 feet beyond the aircraft's nose section, in the direction of impact.

While making a charter flight from Port Moresby to Nomad River, Papua, in conditions of poor visibility, a Beech Baron collided with an isolated hill situated in low lying, swampy, jungle country. The pilot and all five passengers were killed and the aircraft was destroyed.

THE aircraft was owned by a charter company, and before departing for the flight, the pilot obtained a weather forecast which indicated that the aircraft would encounter easterly winds of up to 15 knots. The weather over the route was expected to be overcast with strato-cumulus, alto-cumulus, and cumulus cloud, having bases down to 1,300 feet and some cloud tops extending to 16,000 feet. The surface visibility was expected to be 20 miles, generally, with some rain showers present. The terminal forecast for Nomad River was for a wind from 140 degrees at 10 knots, a visibility of 20 miles, and six eighths of strato-cumulus cloud with a base of 1,200 feet and some rain showers. The forecast QNH was 1012 millibars.

The pilot then lodged a flight plan with the Port Moresby Operational Control Centre indicating that the flight was to be conducted VFR, and the aircraft departed from Port Moresby at 0736 hours. The aircraft reported normally at 0808 hours when 100 miles from Port Moresby and again at 0845, when over Morigio. At 0921 hours, when abeam Mount Bosavi, the pilot gave an ETA for Nomad River of 0940.

At 0944 hours however, the pilot reported that he was diverting to Kawito, presumably because of weather, and reported in the circuit area there at 1030. He then advised that he would be continuing to Balimo, seven miles further to the south-east and passed an ETA for Balimo of 1034. The aircraft landed at Balimo at 1035 hours.

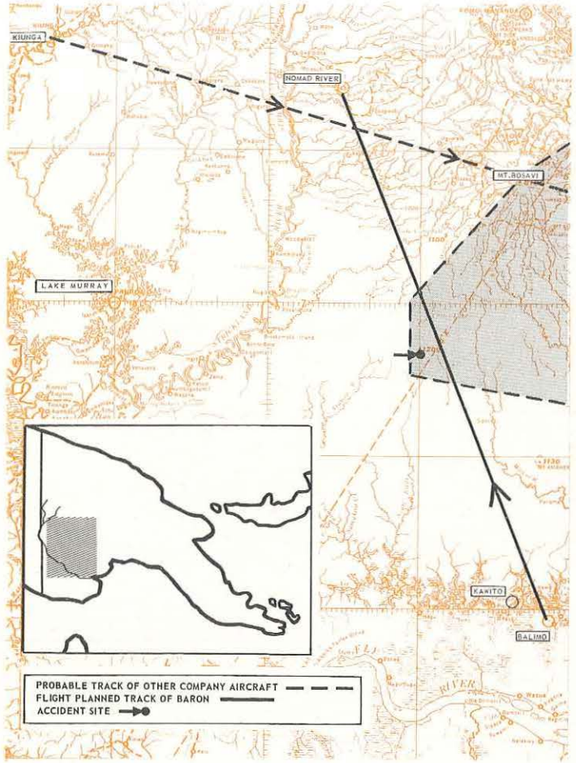
While refuelling the aircraft from drums at Balimo, the pilot mentioned to a local resident that he had attempted to reach Nomad River but the weather was "very bad up that way", and he was going to try again. After remaining on the ground at Balimo only long enough to complete the refuelling, the pilot and his passengers boarded the aircraft again and it taxied out for take-off. At 1131 hours the pilot called Port Moresby to report that he was taxi-ing at Balimo, again bound for Nomad River, and stated that his cruising altitude would be below 5,000 feet, the time interval would be 40 minutes and that the aircraft's endurance was 278 minutes. Five minutes later the pilot called again to report that the aircraft had departed Balimo at 1135. No further transmissions were received from the aircraft and it subsequently did not reach its destination.

The failure of the aircraft to arrive at Nomad River set in motion an extensive search and rescue operation both in the air and on the ground. Because of a prolonged spell of bad weather however, the search effort was repeatedly frustrated and it was not until five days later that the wreckage of the aircraft was sighted, from the air, almost mid-way between Balimo and Nomad River. Even then, because of the continuing unfavourable weather conditions, eight days passed before a specially equipped Army party was able to gain access to the accident site, and then only for a limited period. On reaching the site, it was found that none of the occupants of the aircraft had survived the accident. The accident site and wreckage were examined again two months later by an investigation party when local weather conditions had improved sufficiently for this to be safely undertaken.

* * *

The wreckage was located some 1,450 feet AMSL on the north-western side of a ridge in a small group of hills. These hills are surrounded by flat low lying swampy terrain, extending for at least 30 miles in all directions. The area is overgrown by dense rain forest with many trees more than 100 feet in height. The aircraft's initial impact had been with the tops of trees on the south-eastern side of the ridge and from the swathe which the aircraft cut through the tree tops it was evident that, at the time of first impact, the aircraft was in level flight. After continuing through the tops of trees and across the top of the ridge the aircraft had collided violently with a very large tree some 200 feet high, at a point about 120 feet above the ground. The force of this impact caused the aircraft to break up. The rear fuselage, the starboard wing and the tail section remained wedged in the branches of the tree while the remainder of the structure, together with the engines, continued on in the direction of flight and fell to the ground. The nose section, containing the instrument panel and the nose undercarriage, came to rest upside down in a water-course some 55 feet beyond the tree, while the port wing fell some 60 feet beyond it again. Both engines came to rest at widely separated points on the wreckage trail and sustained major structural damage.

Because the physical difficulties of the accident site precluded the possibility of removing any major components of the aircraft, the wreckage examination had to be carried out on site. It was clearly evident from this examination however, that immediately prior to impact, the aircraft was operating normally in level



cruising flight, with the undercarriage and flaps retracted and both propellers rotating at high speed. The evidence obtained from damage sustained by the trees along the wreckage trail indicated that, immediately prior to the first impact with the tree tops, the aircraft was flying at an altitude of about 1,400 feet AMSL on a heading of 317 degrees magnetic.

From the weather forecasts provided to the pilot before the flight began, as well as from observations made by witnesses in the general area of the accident, and the difficulty which the pilot had obviously experienced during his first attempt to reach Nomad River before turning back to Balimo to refuel, it was quite evident that weather conditions were extremely poor in the area of the accident. Whilst the pilot of the Baron was making his first attempt to reach Nomad River, another company aircraft was approaching Kiunga on a flight from Port Moresby. This aircraft had contacted the Baron by radio and advised that the weather in the Fly River area was fine with a cloud base of 1,000 feet and a visibility of 10 miles. Later in the morning, at 1115 hours the same aircraft departed Kiunga to return to Port Moresby via Kerema. During this flight it was forced to divert to the north of track over Mount Bosavi to avoid large cumulus clouds on the direct track. (See map). Shortly after passing over Mount Bosavi, in visual conditions, the pilot of this aircraft saw that there were numerous large cumulus and cumulonimbus clouds to the south, extending in an east-west line nearly as far as Kikori. In the area of the accident at the time it occurred, the weather was probably overcast with a cloud base of 1,000 to 1,500 feet, and a surface visibility of about 10 miles, considerably reduced in rain showers.

The pilot-in-command of the aircraft was 37 years of age and held a commercial pilot licence endorsed for the aircraft type. He had nearly 4,000 hours experience, of which almost 400 had been gained on Beech Baron aircraft. About five months before the accident, the pilot had undergone a course in instrument flying in Melbourne, which included 43 hours of in-flight training and 40 hours of Link Trainer instruction. Although, at the completion of the course, the pilot's instrument flight instructor assessed him as having reached the standard for a first class instrument rating, he had not undertaken an instrument rating test with a Departmental examiner at the time of the accident.

In view of the circumstances in which the accident occurred, enquiries were made of passengers and other pilots who had recently flown with the pilot concerned, in an endeavour to learn something of his attitude to flying in cloud and in areas of reduced visibility. It was found that, since returning to the Territory after undertaking his instrument flying training, the pilot had frequently flown for long periods in cloud during charter flights and, on at least one occasion while making a positioning flight, he had flown through very heavy cloud which could have been avoided by a slight diversion from the direct track. Another finding of possible significance

Opposite page, left: Map showing flight planned route from Balimo to Nomad River, approximate track of other company aircraft and accident site. The shaded portion denotes the area in which relief data is indicated to be incomplete.

Right: Forward section of the Baron's fuselage, containing the instrument panel and nose undercarriage, as found by the investigation team.

This page: Aerial view of ridge on which accident occurred, showing impact point. In this picture, a large patch of cloud lies below the aircraft's final flight path. The helipad constructed during the investigation is on top of the ridge towards the left of the picture.

was that, despite the fact that the pilot did not hold an instrument rating, he had made several instrument flight time entries in his log book.

The heading of the direct track from Balimo to Nomad River is 333 degrees magnetic and the distance is 113 nautical miles. Apart from Daru and Kerema on the coast, and the privately operated NDB at Kiunga, there are no radio navigation aids in Papua to the west of Port Moresby. Inland navigation in this area has to be conducted entirely on a visual basis.

On the "Fly River" World Aeronautical Chart covering this area, the reliability diagram indicating the accuracy or otherwise of the topographic information on the chart shows that, in the area where the accident occurred, the topographic base is "poor", having been compiled from "sketches, reconnaissance etc.", and is "liable to vertical error". In this section of the chart, a spot height, approximately midway between Balimo and Nomad River, and very close to the point where the accident occurred, is marked "1,200" but the key to the chart tinting for this area contains a distinct warning: "Caution — Relief Data Incomplete".

During the investigation of the accident, a helicopter pad was constructed on the ridge where the aircraft crashed, as close as possible to the accident site itself. From visual observation this helipad appeared to be on the highest point of the ridge. Only about 150 feet away from the helipad, a concrete marker block was discovered in the undergrowth. The block had evidently been placed in position by a surveying party some years before and was probably the point represented on the chart by the 1,200 foot spot height.

While the helicopters were operating from the helipad in the course of the investigation, it was noted that, using the correct QNH settings, their altimeters registered a height of 1,450 feet while the aircraft was standing on the pad. After taking into account the height of the trees on the ridge, it is probable that the highest obstruction in the area of the accident is not less than 1,550 feet AMSL.

* * *

Although the precise nature of the weather conditions in the area of the accident, at the time it occurred, are not known for certain, it is evident that the weather was at least marginal for VFR flight.

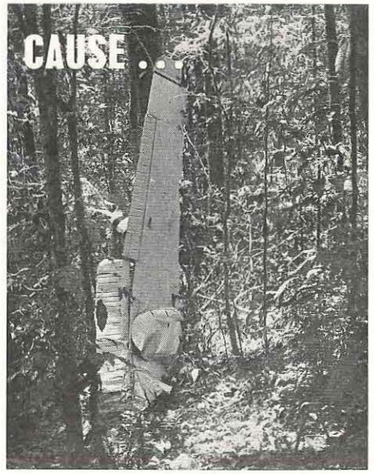
The first attempt to carry out this particular charter flight from Port Moresby to Nomad River had been made the day before the accident, but because of the bad weather brought in with the prevailing south-easterlies, the aircraft had returned to Port Moresby. The second attempt which began early on the day on which the accident occurred, also had to be abandoned because of bad weather and the pilot had turned back to Balimo to refuel before making a further attempt to reach Nomad River. In these circumstances, it is likely that the pilot would have been, or at least would have felt himself to be, under some pressure to complete the flight on this third occasion, if it were at all possible.

The pilot had undergone extensive training in instrument flying only a few months before and, in the conduct of his subsequent flights, he had on a number of occasions demonstrated that he had no hesitation in flying in cloud for long periods, despite the fact that he did not hold an instrument rating. Even so, it is difficult to believe that a pilot with a proper regard for safety, would fly continuously in cloud at a height of only 1,400 feet, even though the en-route terrain was for the most part flat and low-lying. If, as the meteorological assessment indicates however, there were numerous rain showers in the area, it is quite probable that the pilot would have flown through them and perhaps intermittently through associated patches of cloud below the general level of the cloud base. In these circumstances, the pilot's forward visibility would have been very considerably reduced at such times, in some cases, to zero.

Although the relief data on the relevant World Aeronautical Chart for the area in which the accident occurred is incomplete, and the spot height of 1,200 feet shown on this chart is apparently inaccurate, these factors should not have affected the safety of the flight if it had been properly conducted in accordance with the Visual Flight Rules. It is to allow for such inaccuracies that pilots operating in other than Visual Meteorological Conditions are required to provide a minimum vertical clearance of 1,000 feet above the highest terrain within specified distances on either side of the aircraft's track.

The severely damaged port engine as it came to rest some 90 feet forward of the fuselage nose section. The two front cylinders, the associated crankcase area and the crankshaft were completely broken away by the force of impact.

In this case, a flight visibility of even half a mile which, at the aircraft's cruising speed, would represent a time interval of about 10 seconds, should have been sufficient for the pilot to have taken avoiding action on sighting the high terrain in the aircraft's path. It is clear from the investigation however, that no such avoiding action was initiated before the aircraft struck the trees. In the circumstances therefore, it can only be concluded that the accident resulted from operating the aircraft with inadequate terrain clearance and, if not actually in cloud, then in weather conditions that were very substantially worse than the minimum required to conduct operations over the route with an acceptable margin of safety.



The cause of this accident was that the pilot, while operating at a height which did not ensure an adequate terrain clearance would be available at all times, proceeded into weather conditions in which a safe visual reference to the ground could not be maintained. ⟶

While engaged on a charter flight from Kokoda to Port Moresby, Papua, in cloudy conditions, a Piper Aztec collided with the precipitous northern face of a ridge near Mount Scratchley in the Owen Stanley Range, at a point 10,100 feet AMSL. The aircraft disintegrated on impact and all four occupants were killed instantly.

THE aircraft, which was based at Port Moresby, had been chartered by a Government Department to convey three of its officers from Kokoda to Port Moresby.

At 1050 hours on the day of the accident the pilot submitted a flight plan to the Port Moresby Operational Control Centre, covering his proposed flight from Port Moresby to Kokoda and return. Kokoda is only 40 miles north-east of Port Moresby but between them lies the rugged, jungle covered mountain chain of the Owen Stanley Range, the peaks of which in a number of places reach to more than 11,000 feet in height. The normal VFR route between Port Moresby and Kokoda is through The Gap, 30 miles north-east of Port Moresby and 10 miles south of Kokoda, which can be safely negotiated in clear weather at 7,500 feet. The first 20 miles of the flight from Port Moresby to Kokoda via The Gap lies within the Port Moresby control zone but the remainder is outside controlled airspace.

The pilots' flight plan indicated that the flight would be conducted VFR, and that the first stage to Kokoda would be flown at 9,000 feet. According to the flight plan, the estimated time interval from Port Moresby to The Gap was 18 minutes, and from The Gap to Kokoda was 4 minutes. The return flight from Kokoda to Port Moresby was also planned via The Gap at an altitude of 10,000 feet and the estimated enroute times were 5 and 13 minutes respectively.

The aircraft departed Port Moresby at 1218 hours and, 18 minutes later at 1236 hours, the pilot reported over The Gap. After a further three minutes he reported in the circuit area at Kokoda. During the flight the pilot had found it necessary to climb above his flight planned altitude of 9,000 feet to 10,000 feet and later to 11,000 feet, to avoid cloud formations which he encountered en route; but he had no difficulty in descending in the Kokoda Valley and the aircraft landed at 1245 hours.

The three passengers who were to go to Port Moresby were waiting for the aircraft when it arrived and, after their luggage and equipment had been loaded, they boarded the aircraft. At 1258 hours the pilot notified Port Moresby Flight Service that the aircraft was taxi-ing at Kokoda for the return flight and at 1302 hours, reported that the aircraft was climbing in the Kokoda circuit area and that he would advise when setting course. Port Moresby Flight Service then instructed the pilot to report again at 1315 hours or to advise departure, if this occurred before that time. At 1315 hours the pilot reported that he was still orbiting in the Kokoda area and that operations were normal.

Five minutes later, at 1320 hours, the pilot called Port Moresby again and requested a clearance to climb to 11,000 feet. The flight service officer asked if the aircraft was still in the Kokoda area and the pilot replied "departing at this time". The aircraft was then informed "clearance not available, stand-by" and the pilot acknowledged this call. The flight service officer concerned then advised Port Moresby Tower that the aircraft was setting course at this time at 11,000 feet and the information was accepted by the tower.

Two minutes later at 1322 hours, the pilot called Port Moresby Flight Service again, and said that he was still holding in the Kokoda area awaiting a clearance. He was told that he would not require a clearance until he reached The Gap and the pilot replied "Roger, we want to go to 11,000 feet to get over the build-ups". When the message was passed to Port Moresby Tower, the controller

Aztec strikes ridge in Owen Stanleys

...BELOW VMC

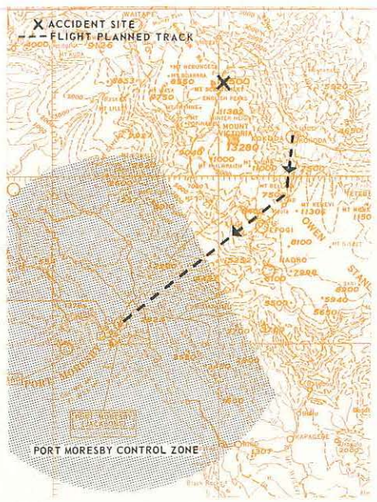
replied that clearances were not given to aircraft before they reached The Gap and issued an instruction for the pilot to call the tower in The Gap for a clearance to enter the control zone.

Port Moresby Flight Service relayed this message to the aircraft at 1324 hours and the pilot acknowledged the call and passed an amended departure time of 1323 hours. The flight service officer on duty queried this time as he had previously recorded it as 1320 hours and the pilot confirmed that the aircraft's departure from Kokoda was now 1323 hours. The flight service officer then reminded the pilot to contact the tower in The Gap and the pilot's acknowledgement proved to be the last transmission received from the aircraft.

Ten minutes after the flight service officer had passed the aircraft's amended departure time to the tower, the tower controller contacted the Flight Service Centre again to inform them that the aircraft had not yet called, and the flight service officer interrupted a transmission to another aircraft to request the Aztec to call on 118.1 MHz, the Port Moresby Tower frequency. But three minutes later at 1337 hours, the controller told the flight service officer that the aircraft had still not contacted the tower. A series of transmissions were then directed to the aircraft without result, and at 1344 hours the Uncertainty Phase was introduced. When the aircraft did not subsequently arrive at Port Moresby and a check by other aircraft confirmed the fact that it was not on the ground at Kokoda, the Distress Phase was introduced at 1359 hours, and search and rescue procedures were initiated.

* * *

After an extensive air search lasting five days, the wreckage of the aircraft was located in the Owen Stanley Range 15 miles north-west of Kokoda, on the north-western side of a ridge which extends in a north-easterly direction into the Kokoda Valley from the eastern slopes of Mount Scratchley. The accident site was 10,100 feet AMSL and 490 feet below the top of the ridge. The main impact had occurred against the precipitous face of the ridge at the end of a blind, steep sided ravine. The area is uninhabited and covered by thick jungle growth. The efforts of ground rescue parties to reach the wreckage were constantly frustrated by extremely bad weather, the high altitude of the crash site and the precipitous terrain. Thirteen days consequently elapsed from the time of the initial sighting before a member of a mountain rescue party



was able to gain access to the main wreckage from the ridge above the accident site, and then only by descending the last 100 feet with the aid of ropes.

The main wreckage, consisting of the fuselage, the inner portion of the starboard wing and the tail section, was found lying against the face of the ridge, 10 feet below the point of main impact. Of this wreckage, the only relatively intact part of the structure was the tail section beneath which lay the starboard engine and propeller. The damage to the propeller blades indicated that they were rotating at high speed at the time of impact.

The wreckage trail extended for some 300 feet back along the flight path from the main impact point and it was apparent that the aircraft had initially struck the tops of trees while climbing at an angle of about six degrees. It had commenced to break up immediately and, after passing through the tops of small trees for a distance of about 100 feet, the aircraft had struck and severed the top of a large tree which tore off the port wing at the wing root. The main section of the aircraft then continued on for a further 100 feet until it struck two large trees growing close together. The violence of this impact had broken the trunks of both these trees, after which the wreckage had continued on until it struck the face of the ridge itself. For it to achieve this path and absorb the impact forces involved, the aircraft must have been travelling initially at something in excess of its normal climbing speed. But as the final flight path derived from the evidence was not compatible with a dive, or a steep climb such as might have occurred in a high speed recovery from a dive, it seems likely that, immediately before the aircraft first struck the trees, it was operating at normal cruising speed.

Because of the extremely rugged terrain and the adverse weather conditions at the time, movement around the accident site was extremely difficult and this precluded the removal of any large or heavy item of wreckage for detailed examination. Even so, the only major components not accounted for were the port engine and propeller, and it seems probable that these fell to the bottom of the ravine at the time the port wing was dislodged. No evidence was found to suggest that any major malfunction of the aircraft or its systems had occurred before the impact with the trees. The aircraft's take-off from Kokoda and the initial stages of its climb had been seen by several witnesses on the ground who had then heard the aircraft, apparently operating quite normally, in the area for some time after take-off. Because the aircraft crashed in an area of virtually inaccessible and totally uninhabited terrain, there were no witnesses who actually saw or heard the accident.

* * *

The pilot-in-command of the aircraft was 28 years of age and held a commercial pilot licence endorsed for the aircraft type, together with a current "C" grade flight instructor rating. He had flown a total of 540 hours of which 53 hours had been gained on multi-engined types, including 5 hours on PA-23-250 aircraft. He did not hold an instrument rating. The pilot was experienced in Papua-New

Opposite page, left: Map showing accident site and relationship of flight planned route to controlled airspace.

Right: Members of the mountain rescue team at the accident site. The steeply sloping face of the ridge is particularly evident in this picture.

This page: This picture of the wrecked fuselage and cabin area of the Aztec graphically illustrates the severity of the impact forces in this accident.

Guinea operations generally and, as he had flown between Port Moresby and Kokoda on ten previous occasions, he was quite familiar with the particular features of this route.

For the flight to Kokoda and return the pilot was not required to obtain a weather forecast but, while compiling his flight plan, he called at the Port Moresby meteorological office and was briefed on the area and terminal forecasts for Port Moresby. This indicated that by 1400 hours, there was expected to be 2/8ths of cumulonimbus cloud over the mountains between 7,000 and 40,000 feet, 4/8ths of cumulus cloud over the mountains from 7,000 to 12,000 feet with isolated tops extending to 20,000 feet and a general visibility of 20 miles.

The evidence of witnesses at Kokoda indicates that, at the time the aircraft was climbing after take-off, the Kokoda valley itself was clear but there was a line of storm clouds over the ranges with bases of between 7,000 and 8,000 feet, and large cumulonimbus build-ups were observed over The Gap area. A weather report received from the pilot of another aircraft in the area at 1356 hours on the day of the accident stated that The Gap appeared to be closed with cloud tops at 15,000 feet.

Weather observations made by the Port Moresby meteorological office at the time recorded cumulonimbus clouds visible in the direction of the Owen Stanley Range from 1300 hours onwards but the Port Moresby weather remained fine until showers in the area were recorded at 1700 hours. Weather radar observations made by the meteorological office at 1445 hours detected numerous areas of scattered moderate echoes with several definite indications of large and medium cumulonimbus clouds at distances of up to 30 miles from Port Moresby in the general direction of Kokoda, and extending along the line of the Owen Stanley Range.

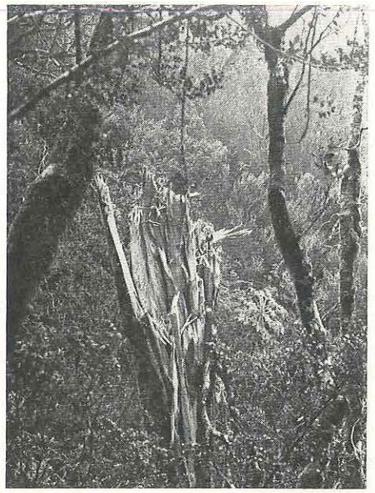
* * *

Before taking-off on its last flight, the aircraft was fully serviceable and operating under a valid maintenance release. It was equipped with an oxygen system that could be used by all the occupants and the engines were turbo-charged for high altitude flight. The aircraft was thus capable of operating at heights of up to 25,000 feet or more. The maximum permissible gross weight for the aircraft was 5,200 lbs. and its gross weight at the time of take-off from Kokoda was calculated to have been just under 5,000 lbs.

On flights operating between Kokoda and Port Moresby in visual conditions, the minimum height at which it is possible to cross The Gap in the Owen Stanley Range is about 7,500 feet. Because the height of the floor of the Kokoda valley is about 1,200 feet, it is normal procedure for aircraft to gain height by orbiting in the valley before setting off almost due south on the 10 mile flight over steeply rising terrain towards The Gap. It was evident from the investigation that after completing a normal take-off, the aircraft continued to gain height in the vicinity of the Kokoda airstrip for about 20 minutes until it reached an altitude of about 10,000 feet. During this time the average rate of climb was less than 500 feet per minute. Performance data for the aircraft type indicates that in the existing conditions, a rate of climb in excess of 1,200 feet per minute could have been achieved. It seems probable that the reason for this apparently reduced performance was that the pilot was obliged to spend some periods in level flight while seeking areas clear of cloud in which he could continue to climb. Numerous layers of stratiform cloud and cumulus build-ups are normal for this area at this time of the day.

The airstrip at Kokoda is located near the south-eastern extremity of the valley from which it takes its name. The valley, which is 20 miles long, is flanked on its south-western side by the Owen Stanley Range and on its north-eastern side by Ajule Kajale Range, and at a height of 5,000 feet the valley is about 8 miles wide. The 10,000 foot contour follows the general line of the Owen Stanley Range, except at a point some 15 miles north-west of Kokoda where a ridge over 10,000 feet high extends into the valley in a north-easterly direction for a distance of $4\frac{1}{2}$ miles. The accident occurred on the north-western face of this ridge.

Although the flight from Kokoda to Port Moresby had been planned at 10,000 feet, the pilot before setting course made three requests for clearance to climb to 11,000 feet. There is no requirement to



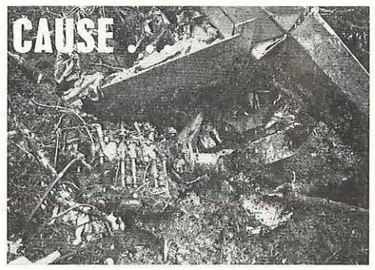
Left: One of the two large trees severed by the aircraft immediately before it struck the face of the ridge. The trunk of this tree was 22 inches in diameter.

Right: View looking back along the impact path, showing the swathe cut by the aircraft in the jungle growth.

obtain a clearance before changing altitude during flights outside controlled airspace and it is difficult to understand, in view of the pilot's experience, why he sought such a clearance. It is possible that the flight service officer's reply to the first of these requests "clearance not available, stand-by", could have conditioned the pilot to think that he was following the correct procedure, but the way in which subsequent replies were worded should have removed any misunderstanding from the pilot's mind which could have arisen from the reply to his initial request. It is apparent that the flight service officer interpreted the pilot's request as meaning a clearance to enter the control zone, despite the fact that the aircraft was outside controlled airspace and had not yet reached the point where the transfer to the air traffic control frequency is usually made and a clearance to enter the Port Moresby control zone obtained. His reply to the pilot's second and third requests were clearly based on this assumption.

The location of the wreckage and the heading of the aircraft at impact suggests that, after climbing between cloud formations for some time, the pilot became uncertain of his exact position. This is a situation which can occur when flying VFR on top of cloud or between cloud layers and within limits, it is not unsafe, provided the aircraft is being flown in accordance with the Visual Flight Rules.

Flight at this altitude in accordance with the Visual Flight Rules requires that an aircraft be flown not closer than one mile horizontally and 1,000 feet vertically from cloud and that it has a flight visibility of at least five miles at all times. If these requirements are met and normal pilot vigilance is exercised, there is no possibility of a collision occurring with terrain, even if it is obscured by cloud at the time. From the evidence of the investigation it is apparent that, while the aircraft was climbing around areas of cloud and, no doubt, between cloud layers, the pilot would have lost visual reference with the ground. During his subsequent manoeuvres to maintain his altitude of 10,000 feet in conditions where there were serious restrictions to visual flight, it is apparent that the aircraft was inadvertently flown close to the Owen Stanley Range to the north-west of Kokoda, and between the range and the ridge on which the accident occurred. In this area, the weather conditions had apparently deteriorated to the point where they were considerably less than the minimum prescribed for VFR flight and as well as this, the aircraft's altitude was below the height of the highest terrain in the area. In continuing the flight under these conditions, the pilot placed himself in a situation where he was unable to see the high terrain which lay in the aircraft's path in sufficient time to take avoiding action.



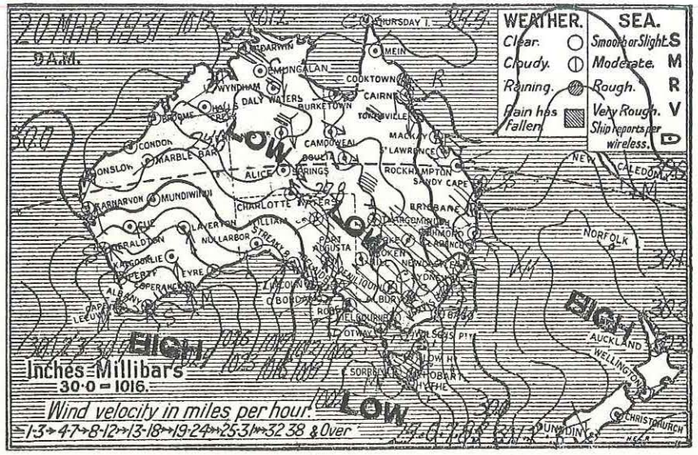
The cause of the accident was that the pilot, while operating without adequate terrain clearance, proceeded into conditions in which visual flight could not be maintained. ——➥

Below VMC – 40 years ago

Flight into Oblivion

The accident reviewed on the following pages was Australia's first major airline accident. The story has long since passed into Australian aviation history, but it is now examined afresh in the Digest for two reasons:
Firstly, because it seems appropriate to recognise the 40th Anniversary of an event that has become a significant milestone in Australian aviation history, and to reflect on the courage and resourcefulness of the early airline operators and pilots who helped pave the way for the standards of airline safety we enjoy today.
Secondly, because there is value in comparing the circumstances in which this accident occurred with a serious operational problem that still exists today — as exemplified by the other five Australian accidents reviewed in this issue of the Digest, all of which occurred during the last 12 months. This aspect is the theme of the Editorial "Forty Years Experience — what has it taught us?" on page 1.

Flight into Oblivion



After departing from Sydney on a regular public transport flight to Melbourne, the three-engined Avro 10 aircraft "Southern Cloud" failed to reach its destination. Weather conditions over the route on the day of the flight were particularly severe with thunderstorms, low cloud and heavy rain. A large scale air and ground search subsequently failed to find any trace of the missing aircraft or its eight occupants, and their fate was to remain a mystery for almost 28 years.

THE aircraft, registered VH-UMF, was one of five Avro 10's owned by Australian National Airways Limited and engaged on scheduled daily passenger services between Brisbane, Sydney, Melbourne and Launceston. The company, under the joint managing-directorship of Charles Kingsford-Smith and C. T. P. Ulm, had commenced operations some 15 months previously, and had operated successfully throughout this period without serious incident.

On Saturday, 21st March 1931, the aircraft was scheduled to depart Sydney for Melbourne at 0815 hours. In Sydney early that morning there had been heavy rain but this quickly cleared and by 0800 hours the weather was fine but still cloudy to overcast with a cloud base of about 3,000 feet. The wind was blowing from the north and although only light at ground level early in the day, it was obviously much stronger at altitude.

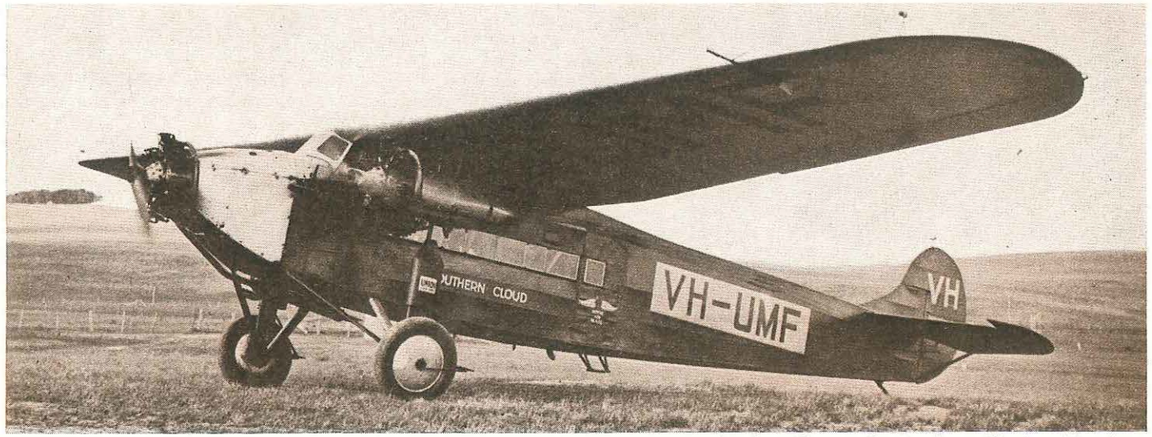
No aviation meteorological service existed in Australia at that time, but in New South Wales there was a standing arrangement with the Sydney Weather Bureau for a detailed forecast of the weather for the ensuing 24 hours to be available to the various air services at 1030 hours daily. As well as this, a detailed report of weather conditions between Melbourne and Sydney, and Brisbane and Sydney, was prepared each morning for Australian National Airways Ltd. The senior pilots of this company had established a close working relationship with the staff of the Sydney Weather Bureau and made a practice of telephoning for this report before departing on a flight. In the event of unexpected or unusually severe weather conditions, the Weather Bureau would prepare a special advice and telephone it to the operators concerned.

From an aviation point of view however, the value of these forecasts was limited by the fact that a full set of weather observations from throughout New South Wales was received at the Bureau only once each day at 0900 hours and there was little exchange of weather information with forecasters in other States.

Because the Weather Bureau did not open until 0900 hours each morning it was the practice of the company's pilots when departing on early morning flights, to rely on the Bureau's general forecast and synoptic chart as published in the press. This information had been prepared late the previous afternoon and was in fact, the latest weather information available. From Mondays to Fridays inclusive, the company's service to Melbourne departed each day at 1130 hours, after the special forecast for the day had been obtained, but at weekends the service departed at 0815 hours. (See reproduction of company's timetable). On these occasions therefore, the pilot-in-command's forecast for the flight was that published in the Saturday morning paper.

The forecast for Saturday, 21st March 1931 indicated cloudy and unsettled weather with rain and thunderstorms, and strong winds from the north at first, but with a cool squally southerly change spreading over the State from the west over the weekend. For the pilot rostered to command the service to Melbourne that day, Captain T. W. Shortridge, the weather, though by no means favourable, appeared to be no worse than on many other occasions when the company's services had operated normally and there seemed no reason why the flight should not proceed as planned.

At Mascot Aerodrome soon after 0700 hours that morning, VH-UMF was pushed out on to the tarmac from the company's hangar and, with a maintenance engineer at the controls, a mechanic began the laborious task of hand-cranking the three engines. They started normally and while they were being warmed up, the co-pilot, Mr. C. Dunell, joined the engineer in the cockpit. After some 15 minutes the engines were run-up to the complete satisfaction of the engineer and co-pilot. Soon afterwards Captain Shortridge arrived and boarded the aircraft. Going up to the cockpit, he accepted the certificate of inspection from the engineer and took over the left hand seat. With the co-pilot he then taxied the aircraft around to the passenger embarkation office, where, while the engines were left running, the passengers' luggage was loaded and, under



Opposite page: Synoptic chart as published in the morning newspaper on the day of the accident. It was on the basis of the forecast accompanying this chart, that the pilot planned the flight.

Below: Time table of Australian National Airways' scheduled services between Sydney and Melbourne.

Above: The Southern Cloud taxi-ing in to refuel at an intermediate port during an interstate flight not long before its disappearance.

—Courtesy N. Follett, Moorabbin Air Museum.

the supervision of another ground engineer, the six passengers boarded the aircraft. The engineer closed the door, the captain acknowledged his signal and the aircraft taxied out at 0810 hours. Shortly afterwards it took off into the north, circled to the right over the hangars, and set course towards the west below the cloud base.

More than twenty-seven years were to pass before any trace of it was seen again.

* * *

In Melbourne that morning, the weather was extremely poor with driving rain and strong winds blowing from the south-west. The visibility was varying from a few yards to about three miles, and the cloud base from 300 to 1,500 feet. Throughout north-eastern Victoria and southern N.S.W. the weather was much the same, with continuous rain, low cloud, extremely poor visibility and exceptionally strong winds.

Later that morning at the Sydney Weather Bureau, when the 0900 hours observations from throughout the State had been received, it became apparent that meteorological conditions between Sydney and Melbourne were far more severe than had been forecast, and a detailed report was telephoned to Australian National Airways Ltd. By this time however, the Melbourne-bound aircraft was well on its way and there were no means by which the weather warning could be communicated to the pilot.

The failure of the aircraft to arrive at Essendon Aerodrome by early afternoon was not at first any cause for alarm, as it was thought that Captain Shortridge had probably landed at an intermediate aerodrome to refuel, and might have decided against continuing the flight to Melbourne that day because of the extremely poor visibiilty. But by late afternoon, when there was no further news of the aircraft, there was grave disquiet. By this time it was clearly evident that the appalling weather being experienced in Melbourne was widespread. As well as this, the severity of the conditions had been confirmed by another company pilot, Captain G. U. Allen, who had commanded the scheduled service from Melbourne to Sydney that day in a sister aircraft, the "Southern Sun".

At that time no official search and rescue organisation existed but the company immediately made plans to commence a search early the following morning using three of its aircraft and officially notified senior officers of the Civil Aviation Department, which at that time was a division of the Department of Defence. The news that the "Southern Cloud" was overdue on the regular run to Melbourne produced an immediate response from the infant Australian aviation industry and, within hours, the company's aircraft had been joined by numerous private, club, business and service aircraft and the search was being co-ordinated by the Civil Aviation Department.

As the search continued day after day to no avail, the mystery of the aircraft's disappearance captured the imagination

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SYDNEY — MELBOURNE — SYDNEY
AIRMAIL, PASSENGER AND FREIGHT SERVICE
DAILY EACH WAY (Including Sundays)
TIME TABLE

DOWN JOURNEY:

MONDAYS TO FRIDAYS (inclusive)

Leave A.N.A. Office, Challis House (opp. G.P.O.), Sydney, by Parlor Coach ..	11.00 a.m.
Leave Mascot Aerodrome, Sydney	11.30 a.m.
Arrive G.P.O., Spencer Street, Melbourne, by Parlor Coach	5.30 p.m.

SATURDAYS AND SUNDAYS

Leave A.N.A. Office, Challis House (opp. G.P.O.), Sydney, by Parlor Coach ..	7.30 a.m.
Leave Mascot Aerodrome	8.15 a.m.
Arrive G.P.O., Spencer Street, Melbourne, by Parlor Coach	2.15 p.m.

UP JOURNEY:

MONDAYS TO FRIDAYS (inclusive)

Leave G.P.O., Spencer Street, Melbourne, by Parlor Coach	11.00 a.m.
Leave Essendon Aerodrome, Melbourne ..	11.30 a.m.
Arrive A.N.A. Office, Challis House (opp. G.P.O.), Sydney	5.30 p.m.

SATURDAYS AND SUNDAYS

Leave G.P.O., Spencer Street, Melbourne, by Parlor Coach	7.30 a.m.
Leave Essendon Aerodrome, Melbourne ..	8.15 a.m.
Arrive A.N.A. Office (opp. G.P.O., Sydney)	2.15 p.m.

FARES

Single Fare ..... £8 Return Fare £16

Includes First Class Motor Transportation for passengers and their luggage to and from the centre of the Cities to the aerodromes at each terminal.

PASSENGERS BAGGAGE

Each passenger is allowed to carry 30lbs. of baggage free and excess luggage may be carried at an additional charge of 1/- per lb.

The Company reserves the right to vary the above Time Table without notice and to refuse to carry extra baggage

CANCELLATION FEE

A cancellation fee of 20 per cent. is charged by the Company, provided notice of cancellation is given at least 24 hours before commencement of flight. If such notice is not given, a ticket cannot be cancelled, and no refund from the full fare will be made.

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of the public and an enormous number of sighting reports were received, the vast majority of which indicated that the aircraft had at least reached Victoria. So wide-spread and numerous were the reports however, that it became extremely difficult, if not impossible, to reconstruct the aircraft's flight path with any degree of confidence. As a result, the air search had to be extended to cover a much wider area.

In the meantime, a number of ground searches, organised locally in different areas, were being carried out in some of the ranges in the north-east of Victoria, but equally without result. Finally, after 18 days of searching by more than 20 aircraft, during which every possible area in which the "Southern Cloud" could have made a forced landing, had been checked at least once and in many places two or three times, it was reluctantly concluded that the occupants of the aircraft could no longer be alive and the search was officially brought to a close. But the company refused to give up and for several weeks longer continued to carry on the search with one of its own aircraft, in the hope that some trace would be found of the missing Avro 10.

In the meantime, the Minister for Defence, who at that time was also responsible for Civil Aviation affairs, had requested the Air Accidents Committee to conduct an open investigation into the loss of the aircraft, with a view to recommending any action which might prevent a similar occurrence in the future. After sitting for three weeks and hearing a great deal of evidence from company executives, meteorologists, pilots, ground engineers and Departmental officers, the Committee found that it could not be established what had happened to the missing aircraft, but was of the opinion that the extreme weather conditions had contributed to its loss. The Committee also found that the aircraft was fully airworthy, that it was properly loaded and that the crew were appropriately qualified and medically fit. The Committee believed that the pilot had probably anticipated moderately bad conditions over the route but that he had no warning of the extreme conditions which actually existed. Under the existing arrangements, these extreme conditions could not have been foreseen before the aircraft departed.

The Committee went on to make a large number of recommendations the most significant of which were that "two-way wireless . . . be made compulsory in aircraft engaged in regular scheduled passenger services", and that a "Departmental scheme for a ground wireless D/F organisation be proceeded with . . . as an urgent measure".

There were also a number of important recommendations aimed at improving meteorological services for aircraft.

The loss of one of its airline aircraft, the heavy expense incurred by the protracted search which the company carried on from its own resources, the damage to its reputation and the loss of public confidence which resulted, and the developing financial depression of the thirties was to prove too much for the company. A few months later, Australia's pioneer inter-capital airline, which had begun with such promise, was forced out of business.

In the years that followed other interstate airlines were established and more modern aircraft were gradually introduced. Inevitably, as these early domestic air services struggled to build the successful airline networks which are so much taken for granted today, other, more costly accidents occurred. But the mystery of the "Southern Cloud's" disappearance was never forgotten and from time to time as the years passed, the widespread interest with which it was regarded would manifest itself in a news item or story in the press, telling of the "discovery" of some further possible "clue" to the aircraft's whereabouts.

But it was not until the 26th October, 1958, nearly three decades after the aircraft had vanished, that all the speculation and wondering of the years was brought to an unexpected and dramatic conclusion. On that Sunday afternoon a young workman, employed by a contractor to the Snowy Mountains Authority and living at a construction camp near the Tooma Dam, set out with his camera for a walk in the surrounding ranges, hoping to obtain some colour photographs of the mountain scenery. As he was clambering through the undergrowth on a steeply sloping valley side high above a tributary of the Tooma River, he almost tripped over a structure of rusted tubular steel lying amongst the trees. The mystery of the "Southern Cloud" was solved at last.

The site of the crash was 16 miles east of the direct Sydney-Melbourne track, and on the south-western side of a densely timbered mountain ridge aligned north-west, south-east. The impact had occurred 250 feet below the top of the ridge and 4,500 feet AMSL. It was apparent that at the time of the accident, the ridge was heavily timbered with trees 100 to 150 feet high. Many of these trees had been burnt out in subsequent bush fires, and the timber had since regrown to a height of some 40 feet. Some trees with trunks of up to eight inches in diameter, had grown up through the wreckage itself.

The tubular steel fuselage frame was lying on its starboard side facing up the slope, with the starboard undercarriage beneath it but about seven feet rearward of its normal position. The forward and centre sections of the fuselage were badly telescoped. The remains of the windscreen frame and instrument panel were found immediately behind the firewall of the centre engine, which was embedded some three feet in the ground. The starboard engine was also embedded in the ground in approximately its correct position relative to the centre engine, but the port engine was located some four feet forward of the centre engine. The frame of the tail plane, fin and rudder had been twisted from its normal position and lay at right angles to the fuselage frame. Apart from the effects of corrosion and fire, all the elevator and rudder hinges were intact.

Except for a number of brass hinges, the wooden wing structure had been completely destroyed by fire and, with the exception of a piece of the wooden centre propeller that was still attached to this engine, the wreckage was entirely devoid of fabric and wooden fittings.

Some two feet of rubble, consisting of leaf mould, ash, charcoal and soil covered the remains of the telescoped cockpit and cabin area. None of the cabin fittings could be identified but during the sifting of the rubble, a number of relics, including two watches and the aircraft's clock were recovered. The clock and one watch were badly burnt and were of no value in providing any indication of the time of the crash, but the hands of the other watch indicated 1315 hours. A number of the aircraft's instruments were also recovered, but of these only one tachometer and the altimeter were readily identifiable. The corroded lens section of a bellows-type camera, which had apparently belonged to one of the passengers, was found some 50 feet down the slope from the cabin area, evidently having tumbled from the wreckage when the aircraft crashed. Another find of interest, though of no significance to the investigation, was a badly corroded thermos flask, still containing a quantity of fluid.

From globules of molten metal found amongst the main section of wreckage, the melted face of one of the wrist watches and other indications, it was evident that the wreckage had been subjected to a fire of much greater intensity than a bush fire, and indicated that the aircraft had burnt after impact.

From the location of the engines, the general distribution of the wreckage, and the angle at which it was lying relative to the slope of the valley side, it was evident that the aircraft was in a level turn, but steeply banked to starboard at the time of impact. Although it was not possible to establish the exact heading of the aircraft immediately before it struck the ground, it was clear that it was heading in a north to north-east direction. The attitude of the aircraft at impact was not indicative of any loss of control, and collectively the evidence indicated that the aircraft was intact at the time of impact and that the flight controls were functioning.

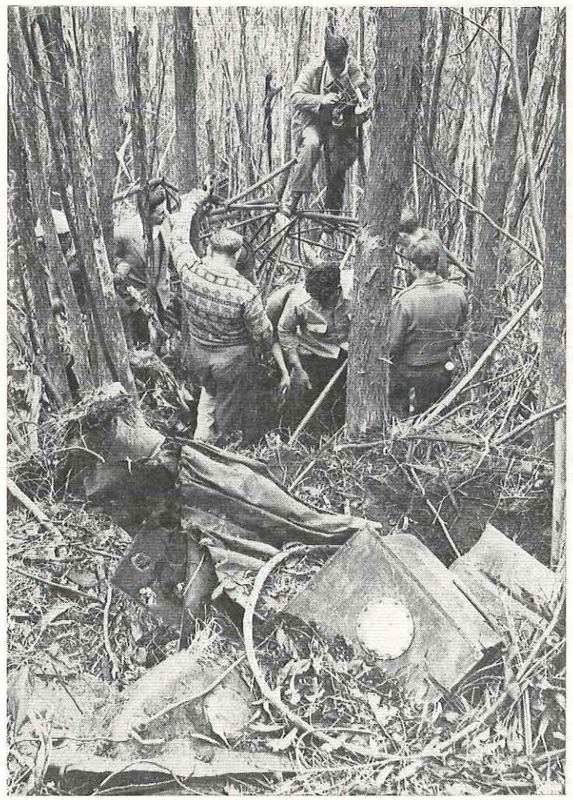
Because of the fire and impact damage however, as well as the effects of corrosion over the years, it was not possible to determine if there had been any pre-crash malfunction in the engines which could have caused the aircraft to lose height.

* * *

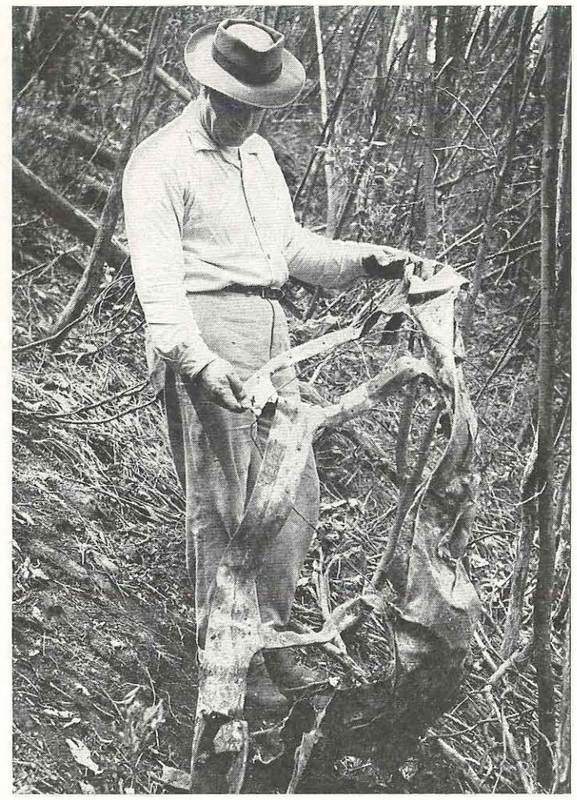
The depth to which the engines were buried and the degree of telescoping sustained by the fuselage, indicates that at the time of impact the aircraft was flying at considerable speed. From the general weather situation that existed at the time of the accident and the heading of the aircraft at impact, it is evident the aircraft would have had a tail wind component of some magnitude when it struck the ridge. The evidence that the aircraft was steeply banked to starboard at the time, also suggests that the pilot only became aware of his close proximity to the ridge when almost upon it, and that the steep turn was a last desperate attempt to avoid it. It is thus apparent that the pilot had either unwittingly flown into the ridge while in instrument conditions, or had been forced by some circumstance to descend in cloud over the mountainous terrain.

It was the practice of the company's pilots, when the weather was unfavourable, not to fly the direct route between Sydney and Melbourne, but to divert further inland after passing Goulburn so as to pass to the west of the mountainous terrain on the direct route. This inland route was some 30 miles longer and lay approximately 32 miles further to the west. On the basis of the weather information available to the pilot when he departed on the day of the accident, the inland route would have been the obvious one to follow after passing Goulburn, so that in the event of encountering worsening conditions, it would be possible to turn due west towards lower terrain until a break in the clouds was found. During the proceedings of the Air Accidents Investigation Committee shortly after the accident, the pilot's colleagues gave evidence that he invariably flew the inland route when the weather was bad, and that he flew the

Left: Members of the investigation party at the accident site shortly after the wreckage of the "Southern Cloud" was discovered. The aircraft's fuel tanks are visible in the foreground.
—"Herald-Sun" photograph.



Right: A Departmental investigator examining the aircraft's badly distorted windscreen frame.
—The "Age" photograph.



direct route only in good weather. Thus, in view of the conditions that existed that day, it seems certain that the pilot would have followed his usual practice, and diverted inland after passing Goulburn.

Soon after passing Goulburn, the aircraft would have encountered frontal conditions, necessitating flight on instruments, and with the passage of the front, the wind would have backed from north-west towards the west-south-west. Although this change in wind direction, so characteristic of the passage of frontal conditions in this area, would undoubtedly have been anticipated by the pilot, he would have had no way of knowing to what extent the speed and direction of the wind had changed, and would therefore have had to estimate the amount of drift to allow. In doing this, the pilot would have been guided by what he had experienced before reaching Goulburn.

Weather observations indicate that the weather was mostly fine between Sydney and Goulburn at the time of the flight and depending on the altitude at which the aircraft was flying, a correction from 15 to 20 degrees of drift would have been necessary to maintain the aircraft on track. Thus it seems unlikely that after passing through the front the pilot would have allowed for much less than 20 degrees of drift, because a westerly wind of greater speed than estimated, could drift the aircraft to the east over the mountainous terrain. At the same time, the pilot would have no doubt considered the possibility of the wind backing further to the south-west, in which case if too much easterly drift were allowed for, the wind could actually be on the port side of the aircraft, and it would track too far to the west and away from, rather than towards Melbourne. It therefore seems a reasonable assumption the pilot would have held about 20 degrees of drift, even after the passage of the front. In this case the aircraft's heading would have been about 270 degrees true, the required track at this stage of the flight being 250 degrees true. What the pilot did not know, and had no way of determining without adequate visual reference to the ground after the passage of the front, was that the wind speed was greatly in excess of that predicted.

The evidence given by Captain Allen who flew the "Southern Sun" from Melbourne to Sydney that day, and by an officer of the Meteorological Bureau in Melbourne, leaves no doubt that, as well as the wide-spread low cloud and rain, there were exceptionally strong squally winds from the west-south-west. The most significant variation from the predicted conditions was in fact this wind strength. The Melbourne Meteorological Bureau's evidence shows that wind speeds of at least 60 mph were experienced at ground level along the route and that speeds much in excess of that figure were likely at the levels at which the aircraft would have been flying. Captain Allen said that between Holbrook and Goulburn he had a drift angle of some 45 degrees and later in the flight had been forced to increase this to 55 degrees. On the basis of his aircraft's flight time, and the approximate track flown, it is evident that the winds encountered by this aircraft between Holbrook and Goulburn, were from about 290 degrees true at 80 mph. Experience over this route in the years since the accident occurred, has established that speeds of this order are not rare in severe cyclonic conditions.

An attempt was made to calculate the wind velocity which could have put the aircraft in the position in which it was found. On the basis of the post-accident analysis of the weather, and the wind velocities actually observed in eastern N.S.W. on the day of the accident, it is estimated that the aircraft would have been near Goulburn between 0920 and 0945 hours, depending on the altitude being flown. If, after passing Goulburn, the pilot had maintained a heading of 270 degrees true, a wind velocity of 285 degrees true at 80 mph would have placed the aircraft in the vicinity of the accident site at 1315 hours. It is significant that not only is this the time indicated on the watch found in the wreckage, but this wind velocity is of the order experienced by Captain Allen during his flight from Melbourne to Sydney that day.

Having no means of knowing the gross discrepancy that existed between the predicted and actual wind speeds, but fully prepared for widespread rain and cloud, Captain Shortridge would probably have been prepared to continue on instruments for as much as two or even three hours, before being able to get a definite fix. Whether in fact this is what happened, can of course never be known but it seems a reasonable assumption, from what is known of the manner in which the company's flights were usually conducted in bad weather. Similarly, it is not possible to establish at this late stage, the route by which the aircraft reached the area it did, but from all the evidence it is highly probable that, unknown to the pilot, the aircraft was blown off course into mountainous terrain, despite all reasonable precautions that Captain Shortridge could, and undoubtedly did, take to follow a safe route.

Once over the terrain in which the aircraft was found, in the weather conditions that existed at the time, the aircraft was in a hazardous situation. Turbulence would have been severe and probably violent at times, with icing conditions above 6,000 ft. In addition, heavy rain and hail would almost certainly have been encountered. In such circumstances the pilot, with only elementary flight instruments to assist him would have been fully occupied in even maintaining control of the aircraft. If, as would have been quite possible, pitot tube icing deprived the pilot of any airspeed indication, his difficulties would have been greatly compounded. It is also likely that there would have been airframe and propeller icing. In these circumstances, the possibility of one or more engines losing power as a result of carburettor icing cannot be disregarded. If such a loss of power had occurred, this alone could have forced the aircraft down below a safe altitude.

* * *

By comparison with today's multi-engined aircraft, aircraft of the type and era to which the "Southern Cloud" belonged were simple and unsophisticated but, when operated within their capabilities, they were no less safe than the aircraft of today. But in common with many light aircraft of today without radio navigational aids, adequate flight instruments or even radio communication equipment, it is obvious that they were not capable of being operated safely without adequate visual reference to the ground.

Such equipment and facilities however, did not exist in Australia when the company commenced its regular public transport operations. Possibly even the need for these facilities was not fully understood and the conduct of operations without them was accepted as normal practice. Flights were in fact being conducted regularly at times and in weather which, except for the abnormal wind strength encountered by the "Southern Cloud", must have been equally as bad as the weather on the day of the accident.

Thus, although the accident demonstrated the need for radio navigational facilities, the lack of them at that time cannot properly be considered as a causal factor in this context. The whole tenor of the available evidence suggests that the pilot was particularly able and responsible, and it can only be assumed he would have taken every reasonable care during the flight. At the same time, there is ample evidence that the severity of the weather, particularly the strength of the winds, was abnormal. It is evident that this abnormal weather was unpredictable at the time the flight departed, and that its unforeseen occurrence produced a situation that was beyond the capability of both aircraft and pilot. In the context in which this accident occurred it is this unpredicted development of severe cyclonic weather that must be regarded as its primary cause.

Comment

The reader, finishing this epic of the "Southern Cloud", is left with the feeling that there is something more to be said.

Had this accident occurred today, its cause could no doubt be expressed in terms similar to those prescribed for the other five accidents reported in this issue. But it would be anomalous and unjust to measure the circumstances of 40 years ago, when aviation was still in its infancy, by the operational standards of today. The accident to the "Southern Cloud" is clearly in a category far removed from those that occur in "Below VMC" weather today, and the ability and judgement of Shortridge and his fellow pilots must be recognised for what it was by the standards of that time. The investigator himself, closing off the baffling case in 1958 wrote:

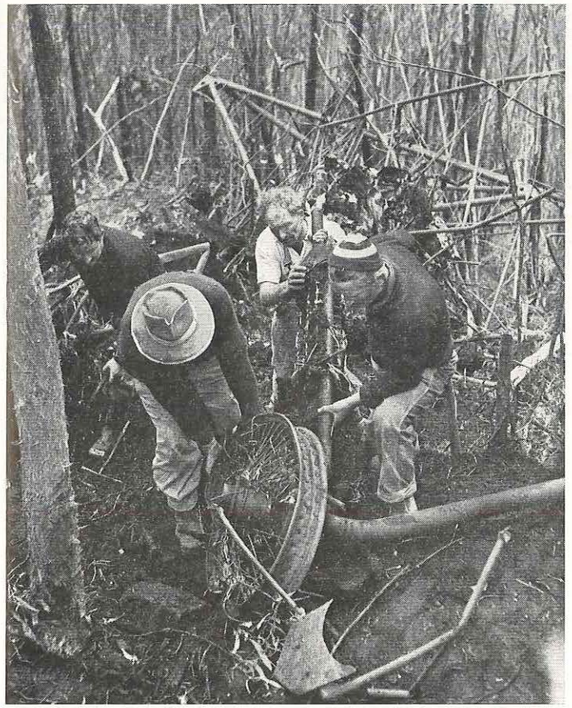
> "The lessons of this accident have been well and truly learnt, and I have no recommendations from the investigation. On the historical side, the accident is a cornerstone in Australian Civil Aviation and, looking back now, I cannot but admire the courage of Shortridge and his contemporaries. If there was any foolhardiness in the way they operated, it was of a sort that is necessary to progress."

All readers will echo this note of admiration. But is it completely true to say that "the lessons of this accident have been well and truly learnt"? Well and truly by the industry and the regulatory bodies, by the providers of communications equipment, of radio aids, of better maps, better weather forecasts, better aircraft. But if recent experience is any guide, hardly "well and truly" by some of those who fly today.

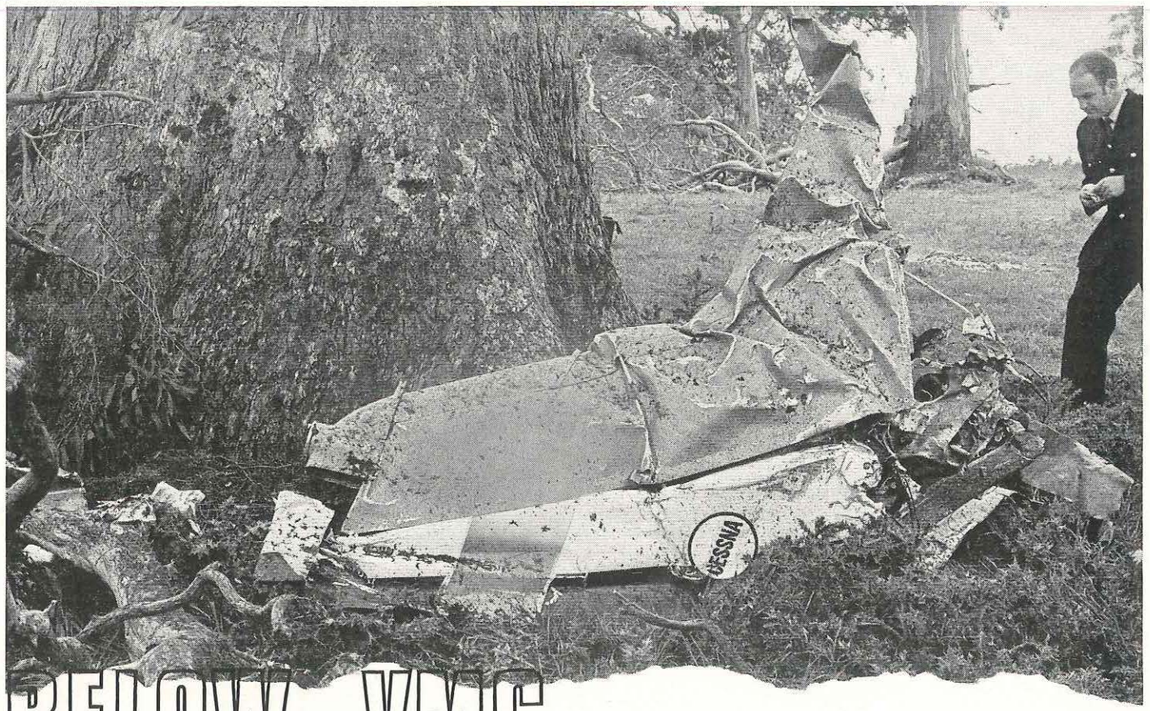
Why then are some pilots so ready to disregard the gains in safety paid for so dearly by Shortridge and his colleagues and the many others that followed them? The inescapable conclusion is that in today's society, all must be quick and easy with no requirement for any form of self-discipline. All too many general aviation pilots are apparently willing to "give it a go" even when indications are all against safe completion of a flight. Some are obviously too impatient to prepare adequately for the journey they are undertaking — delays cannot be tolerated — while to qualify properly to operate in more adverse weather conditions is often too much trouble.

But the air, like the sea, is indifferent to mortals. If a man fails to prepare himself to meet them, then sooner or later they will conquer. Captain Shortridge was reputedly a man of superb airmanship, obliged by the standards of the day to try and get through. Clearly, when lesser mortals today unnecessarily take similar risks, they have begun to write their own epitaphs.

Left: Workmen digging out the starboard undercarriage. The fuselage frame can be seen in the background.
—"Australian Consolidated Press" photograph.



Right: The port engine excavated from the hillside in which it was embedded.
—"The Age" photograph.



BELOW VMC...

Control Lost in Cloud

Twenty minutes after taking off from a private aerodrome near Geelong, Victoria for a flight to Mildura, a Cessna 210 dived steeply into the ground at very high speed. The aircraft was fragmented and the four occupants were killed. At the time the cloud base in the vicinity of the accident site was low and there were rain showers in the area.

THE aircraft was privately owned and was under the command of a private pilot who had some 150 hours aeronautical experience, which included 9 hours on the Cessna 210, but no formal instrument flying. The passenger occupying the right hand control seat also held a private pilot licence but was relatively inexperienced and was not endorsed on this aircraft type. He also lacked any instrument flying experience. The other two passengers, who occupied the rear seats, had no formal aeronautical experience and for one of them it was his first flight.

The aircraft's maintenance release was valid and, at the time the flight began, the aircraft was fully serviceable. In preparation for the flight, a flying instructor at the aerodrome where the aircraft was based, physically checked the contents of both fuel tanks and found they were each within a gallon or so of full. The usable fuel load was thus about 42 gallons.

Shortly after 1300 hours on the day of the accident, the two pilots arrived at the aerodrome where the passengers who were to accompany them were already waiting. The men were in a hurry as they were running an hour late, but they did not allow this fact to detract from their preparation. The pilot who was to command the flight then telephoned his flight details to the Moorabbin briefing office. The flight plan indicated that the aircraft would be cruising below 5,000 ft. tracking direct to Mildura with a time interval of 104 minutes and a SARTIME of 1600 hours EST.

After the pilot and passengers had loaded their luggage, the party boarded the aircraft and it subsequently took off at 1330 hours. Four minutes later the aircraft called Melbourne to report its departure and gave an estimate for Maryborough "on the hour". No further calls were received from it.

Some 20 minutes after this last transmission a number of people, located on different properties in the area between Lal Lal and Dunnstown, a few miles to the south-east of Ballarat, heard an aircraft approaching. Although from the noise of the engine the aircraft sounded as though it was flying low, they were not able to see it because the sky was completely overcast by low cloud. The aircraft at first seemed to be operating normally but shortly afterwards the engine noise increased in pitch. The sound quickly rose to a screaming note which ended suddenly a few seconds later in a dull thud. Silence followed. Fearing that the aircraft had crashed, some of the witnesses immediately set out to look for it. Ten minutes later the wife of a grazier and her daughter came upon the scattered remains of the aircraft in a paddock on rising ground half a mile from their homestead.

* * *

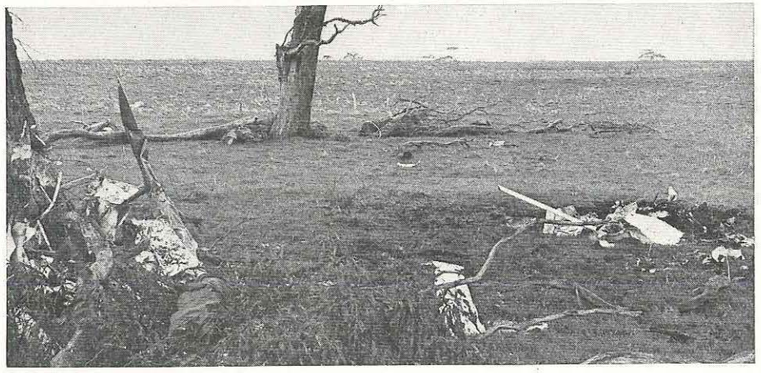
The site of the accident was within two miles of the flight planned track in undulating, lightly timbered grazing country, 1,600 feet AMSL. It was clearly evident from the disposition of the wreckage and the deep crater made by the impact, that the aircraft had dived into the ground at a very steep angle and very high speed. Little remained of the aircraft's structure which was recognisable and so great were the impact forces that even the engine structure had largely disintegrated.

It could not be determined what, if any, weather information the pilot obtained before departing on the flight, but the area forecast current at the time indicated that there would be three-eighths of strato-cumulus cloud at 4,500 feet AMSL, and two-eighths of cumulus, with a base of 3,500 feet AMSL, was expected to develop an hour and a half before the flight began. An analysis of the weather prepared after the accident, based on observations made at Ballarat on the same day, showed that at 1200 hours there was four-eighths of stratus cloud at 1,000 to 2,000 feet above the terrain, and that by 1500 hours the cloud base had lowered to between 650 and 1,000 feet. From this and the evidence of the witnesses who heard the aircraft, some of whom variously described the cloud cover at the time as "low", "dark", and "black", it is apparent that cloud conditions were variable, but in the area of the accident the base was probably less than 500 feet above the general level of the terrain as a result of the passage of some heavy cloud.

Another pilot, who was flying a few miles to the south of the area a short time before the accident occurred, and who had been forced to turn back because of deteriorating weather conditions, said that there were rain showers in the vicinity and that there was no clear delineation between the rain and the cloud.

In these conditions, it is quite probable that the aircraft was being flown in reduced visibility because of rain and that, as the pilot approached the area in which the accident occurred, he did not see the cloud in time to avoid penetrating it unintentionally. It was evident from statements made by the witnesses and from the general pattern of the weather at the time that the cloud was cumuloform. It also seems probable, therefore, that the pilot would have encountered turbulent conditions within the cloud itself. In these circumstances a pilot with no instrument flying experience whatever, could quickly become disorientated and lose control of the aircraft, even while attempting only to maintain straight and level flight. If he tried to turn back in this situation, it is almost certain that he would tend to overbank the aircraft, the nose would then drop, the speed would build up and the aircraft would quickly enter a spiral dive, which would continue to tighten and steepen as the aircraft lost height. The heading of the aircraft at the time of impact differed significantly from the flight planned heading and this fact, together with the steepness of the impact path and the aircraft's obviously very high speed at impact, strongly suggests that just such a spiral dive did develop. In a very clean, retractable undercarriage aircraft such as a Cessna 210, already cruising at high speed, a disorientated pilot, deprived of visual reference and untrained in instrument flying, could precipitate such a loss of control in a matter of seconds.

Although none of the witnesses who heard the high pitched engine note and the sound of impact caught sight of the aircraft at the time of the crash, it had been seen a short time before nearly three and a half miles south of the accident site. At this stage it was flying straight and level at an estimated height of between 200 and 300 feet above the ground. The witnesses in the vicinity of



Top: The main wreckage of the Cessna 210 lying in the deep crater made by the impact. Bottom: General view of the accident site. The main wreckage and crater are towards the right of the picture, while the fin and rudder are resting against the tree at extreme left.

the accident site who heard the engine noise increasing in pitch, had looked for the aircraft but none of them had been able to see it despite the fact that, apart from the overcast cloud, they had an unobstructed view in the direction from which the sound was coming. Some of the witnesses stated that they thought the aircraft was actually in cloud at the time.

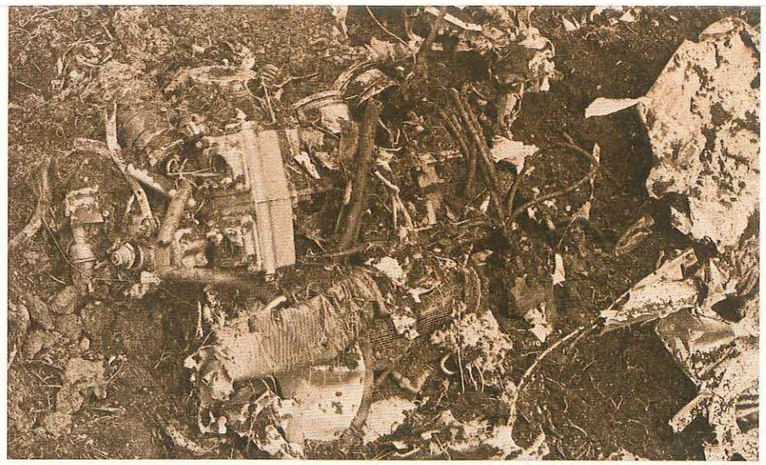
Considering all the evidence, it seems probable that the pilot, flying comparatively low in an attempt to maintain visual reference with the ground as the aircraft proceeded over rising terrain towards a lowering cloud base, continued into an area of rain where the visibility would have been considerably reduced. From this situation, where the pilot would have had some visual reference to the ground beneath him, but little forward visibility, he could suddenly have found himself completely enveloped in cloud, without having realised that he was entering it. Thus deprived of all visual reference the pilot's natural reaction would have been to turn back. In doing so he would very likely have lost control of the aircraft in the manner described and a high speed spiral dive would have resulted. The height of the cloud base above the ground was obviously too low for the pilot to effect any sort of recovery after the aircraft emerged from the base of the cloud.

Comment

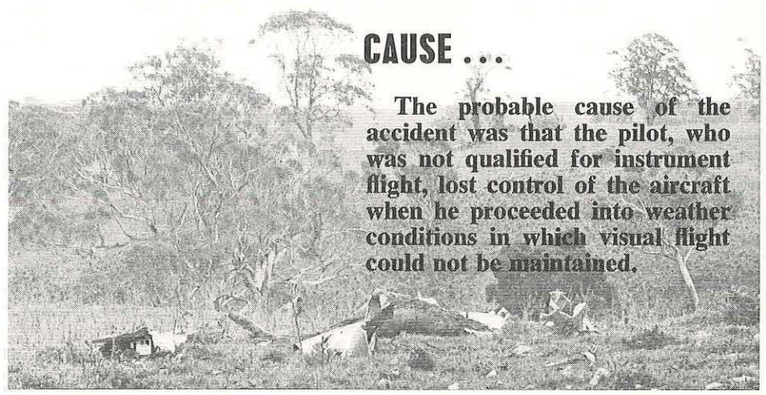
It is extremely difficult to persuade pilots who have no instrument flying experience, but are otherwise fully competent in every way, that they are simply not capable of controlling an aircraft when deprived of all visual reference. They believe in all sincerity that they would be able to interpret the indications of the artificial horizon, directional gyro, and the slip and turn indicator in such conditions and thus be able to maintain a reasonable measure of control. Perhaps some experience of flying in conditions where they might have had very little visual reference, and been forced to rely to some extent on these instruments, may have reinforced this conviction. It is surprising however, how very little a pilot's visual reference can be, yet still be sufficient to maintain **some** orientation. But once **all** visual reference is lost it is immediately a very different matter. Suddenly the world outside becomes nothing but a grey, wet swirling mass, despite how hard he tries to obtain some glimpse of reality through the windscreen. All of a sudden the feeling that that aircraft is turning, in complete contradiction to what the instruments seem to be saying, is overpowering great. There isn't time to sort out which is right, or to interpret what the instruments really do show, even if he does remember that feelings have to be completely disregarded in instrument conditions! In a matter of seconds the aircraft is indeed turning, and the directional gyro and compass are swinging around at an increasing rate. Sweating with apprehension, the pilot desperately tries to remember which way he should correct the turn, but suddenly notices that the speed has increased. Instinctively he pulls back on the control column and the speed eases back—for the moment. But now the directional gyro is spinning faster than ever and the "g" force is increasing. The speed increases again and now the altimeter is unwinding quickly as well . . . .

What happens next need not be further dramatised—its inevitable results are all too evident from this and other accidents which have occurred in similar circumstances. There is only one way that pilots who are not qualified for instrument flight can be sure of avoiding this insidious snare, and that is to adhere rigidly to the minima laid down for VFR flight.

Pilots who still feel unconvinced by these tragic object lessons that have been spelt out so often in the Digest would be well advised, even if they cannot accept the reasoning, to at least accept the **facts** at their face value. If they do not, and simply go on believing that, while "other people" may come to grief in such conditions, **they** are sure that **they** could get themselves out of trouble, there is an excellent chance of their becoming yet another entry in the long list of accidents for which the cause is prescribed as follows:



The force with which the aircraft struck the ground was so great that even the engine structure was fragmented. The rear of the engine is to the left of the picture.



CAUSE . . .

The probable cause of the accident was that the pilot, who was not qualified for instrument flight, lost control of the aircraft when he proceeded into weather conditions in which visual flight could not be maintained.

While making a private flight from Lae, New Guinea to Talasea, New Britain, a Piper Tri-Pacer disappeared while crossing the Vitiaz Strait. At the time there were thunderstorms near the western end of New Britain. The base of the cloud was very low and below it there was heavy rain. Pieces of wreckage from the aircraft were subsequently recovered from the sea in the vicinity of Umboi Island between New Guinea and New Britain. No trace was found of the aircraft's two occupants.

TRI-PACER DISAPPEARS . . . BELOW VMC

THE aircraft was owned by the pilot and, at the time of the accident, was engaged on a private travel flight from Vanimo, New Guinea to Rabaul, New Britain, via Lae and Talasea. On the day preceding the accident, the pilot, accompanied by one passenger, had flown from Vanimo to Lae where they had remained overnight. The pilot had intended to depart Lae about mid-morning to continue the flight to Rabaul but he was delayed, and after he had submitted a VFR flight plan to the Lae Flight Service Unit, the aircraft finally departed at 1152 hours EST.

The pilot's flight plan indicated that the aircraft would be cruising below 5,000 feet and reporting at Finschhafen, abeam Lab Lab on Umboi Island, and at Rudiger Point on the north-western coast of New Britain. The aircraft's time interval to Talasea was to be 152 minutes.

The flight proceeded normally in accordance with the flight plan and at 1227 hours the aircraft reported over Finschhafen at 5,000 feet, estimating abeam Lab Lab at 1257 hours. At 1256 hours the pilot reported the aircraft was abeam Lab Lab and descending and he passed an estimate for Cape Gloucester of 1313 hours. Because of jamming by other aircraft, the report was not acknowledged and two minutes later the pilot repeated his abeam Lab Lab position report, and stated that the aircraft was climbing. Lae Flight Service acknowledged the call and instructed the aircraft to call Rabaul on reaching Cape Gloucester.

Neither of the pilot's Lab Lab position reports had contained any hint of anxiety on his part, but only two minutes later, at 1259 hours the pilot called Lae again saying "I am in strife, I have run into heavy cloud. I am climbing. I am not visual, I am not visual. Do you copy please?" Lae Flight Service were not able to read this transmission and requested the aircraft to "go ahead again." The pilot replied "I am in heavy cloud, I have flown into heavy cloud, I am climbing". Lae Flight Service then acknowledged the call but no further transmissions came from the aircraft and despite repeated calls from Lae no further contact could be established with it. The Uncertainty Phase was therefore declared and, at 1325 hours when nothing further had been heard from the aircraft, this was upgraded to the Distress Phase and search and rescue action was begun.

After an extensive air and sea search lasting two days, the rear seat squab from the aircraft was found floating in the sea near Cape King, the northernmost point of Umboi Island. The following morning the aircraft's nose wheel strut complete with the nose wheel and tyre was found in the water in the same area. No further sign was found of the aircraft or of its occupants.

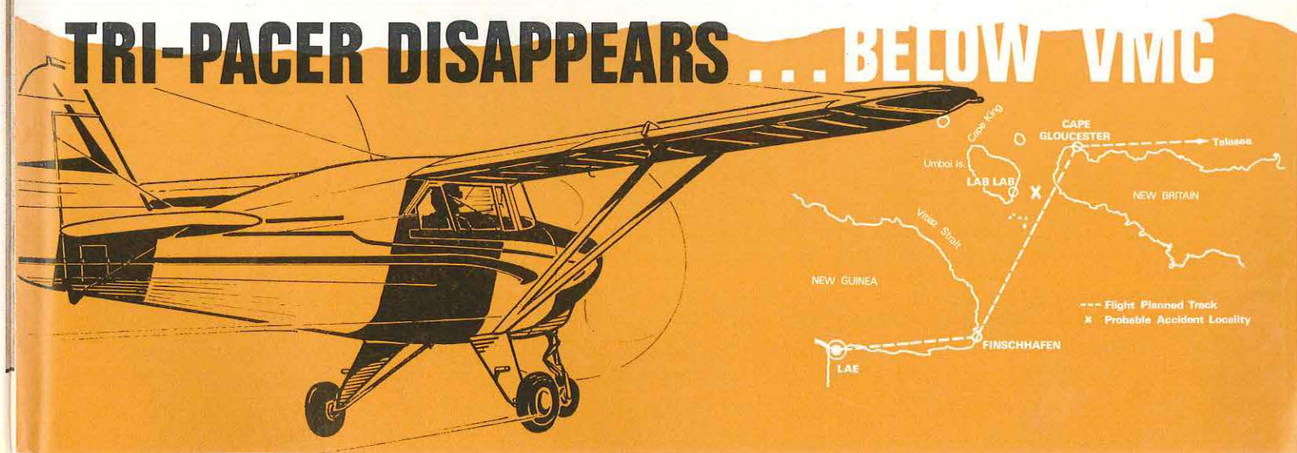
* * *

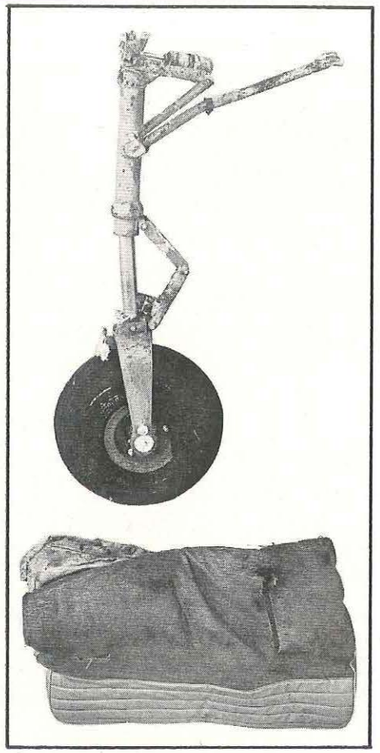
At the time of the accident the aircraft had been operating under a Current Certificate of Airworthiness and enquiries made during the investigation produced no evidence that the aircraft was other than in an airworthy condition. Similarly, there was no evidence to indicate that the aircraft had been loaded beyond limits prescribed for it.

Both the seat squab and the nose wheel leg that were recovered from the sea displayed unmistakable signs of impact damage, as well as other damage that was obviously the result of immersion. It was clear that, for this degree of impact damage to be sustained, particularly that evident on the nose leg, the aircraft must have struck the water with catastrophic force, and the conclusion that both occupants would have been killed in the impact is inescapable.

The pilot in command of the aircraft was 33 years of age and held a valid private licence endorsed for the aircraft type. His total flying experience amounted to little more than 108 hours of which 20 hours had been gained on PA-22 aircraft. He did not hold an instrument rating.

Before departing from Lae for the flight to Talasea, the pilot did not request a route forecast, but the area forecast for the New Guinea Islands, covering the period of the intended flight, indicated that there would be three eighths of cumulus cloud over coastal areas with a base of 2,000 feet and tops of 15,000 feet. The cloud was expected to increase to six eighths over the south-eastern coasts and adjacent mountains, with a base of 1,000 feet and tops of 12,000 feet. Over mountainous areas, isolated cumulo-nimbus clouds were forecast with tops reaching to 30,000 feet. As well, in the vicinity of thunderstorms forecast over the mountains, and occasionally over the





The damaged nose-wheel strut and rear seat squab from the Tri-Pacer found in the sea near Cape King on Umboi Island, were the only parts of the aircraft recovered.

south-east coasts, five eighths of stratus cloud with a base of 500 feet and heavy rain was expected. Other than in the cloud and rain, the visibility was expected to be 20 miles. Moderate turbulence was forecast below 3,000 feet with severe turbulence expected near cumulo-nimbus clouds. The area forecast indicated that a flight could be made between Lae and Talasea in visual meteorological conditions, but that it would probably be necessary to make some diversions to avoid areas of cloud.

It cannot be known for certain whether the pilot saw this area forecast before his departure from Lae but it is believed that he did not. Earlier that morning, the Lae Meteorological Office had received a telephone call from a person who did not identify himself, requesting the winds between Lae and New Britain. It is believed that this person was the pilot of the aircraft.

At about the time that the PA-22 was expected to reach Cape Gloucester, a Piper Aztec was departing Sialum on the northern coast of the Huon Peninsula for a charter flight to Lab Lab. As this aircraft was approaching Umboi Island, it was contacted by Lae Flight Service and asked for a report on the weather on the south coast of New Britain. The pilot replied that the weather was fine and cloudless on the north-east coast of Huon Peninsula and across the Vitiaz Strait but that there was cloud along the south coast of New Britain and a thunderstorm towards Cape Gloucester. Although the pilot said that this storm had not developed fully it was, nevertheless, one which "should be avoided at all costs". The pilot estimated the tops between 15,000 and 20,000 feet and said the base of the cloud was down to about 300 feet with extremely heavy precipitation beneath it. At the request of the Lae Flight Service Unit the aircraft then diverted to search for the missing PA-22 and carried out a series of sweeps between the small islands to the south-east of Lab Lab and the south-east corner of New Britain. During these sweeps the aircraft was forced to fly beneath a layer of stratus cloud which lowered as the coast of New Britain was approached, but by the time the aircraft returned to Lab Lab the storm had abated to some extent.

The engine noise of what was undoubtedly the PA-22 was heard by a number of native witnesses on the islands to the south-east of Lab Lab. One witness, a native pastor and school teacher, heard the noise coming from the south-east at about 1200 hours as he was teaching school and his attention was drawn to it by its particular sound which he described as "much louder than normal", but then "stopped suddenly". Shortly afterwards, it began to rain on the island and the rain was accompanied by high winds. Three other witnesses on nearby islands gave similar evidence. One of them said the engine was normal at first, but then the RPM increased for a short time and stopped suddenly. At the time there was a storm in the direction from which the noise was coming with heavy rain. One of the other witnesses said that he heard a loud aircraft noise from the south-east which "didn't last very long" and "stopped suddenly". A little later he saw the Piper Aztec flying beneath "a large black cloud" in the direction from which the noise had come, and he assumed that the first aircraft he heard must have been in the cloud.

The evidence of the investigation indicated that there were, in fact, two thunderstorms located in the Umboi Island area at the time of the accident. The smaller storm evidently passed to the south-east of the island and dissipated within about 15 minutes, but the larger storm remained in the area between Umboi Island and the coast of New Britain for some time.

Although there was no apprehension evident in the pilot's voice when he transmitted his two abeam Lab Lab position reports, his initial report stated that the aircraft was descending at this point but when asked to repeat his message, the pilot reported climbing. This could suggest that, at the time, the aircraft was quite close to cloud which the pilot was taking action to avoid, but which he did not believe would pose any particular danger. Even so, only two minutes later, the pilot reported that he was in trouble and flying in cloud. It is not possible to know how or in what circumstances the aircraft became caught in cloud, but there can be no doubt that this was in fact, what happened. It also seems likely that whether or not the pilot had recognised it as such, the cloud which he had been trying to avoid entering was actually the edge of a well developed thunderstorm.

Once having entered such a cloud, the situation would no doubt have quickly got out of hand and utterly beyond the pilot's ability. His complete lack of instrument flying experience and the violent turbulence which the aircraft would have encountered in such a thunderstorm, would combine to precipitate a loss of control very quickly. The increase in engine RPM heard by the witnesses on the nearby islands followed by the sudden silence is just what could be expected in such circumstances as the aircraft dived out of control and finally struck the water.

Despite the fact that the main wreckage of the aircraft was not found there seems little doubt from the evidence brought to light during the investigation that, in attempting to continue his flight to New Britain, the pilot continued too far into deteriorating weather conditions and in so doing entered turbulent cloud. His inability to control the aircraft by reference to instruments, as well as the turbulence, resulted in a catastrophic loss of control and the aircraft dived into the sea.

Cause

It has not been possible, from the evidence available, to determine the reason for the disappearance of the aircraft, but the most likely explanation is that the pilot, who was not qualified for instrument flight, proceeded into weather conditions in which visual flight could not be safely maintained.