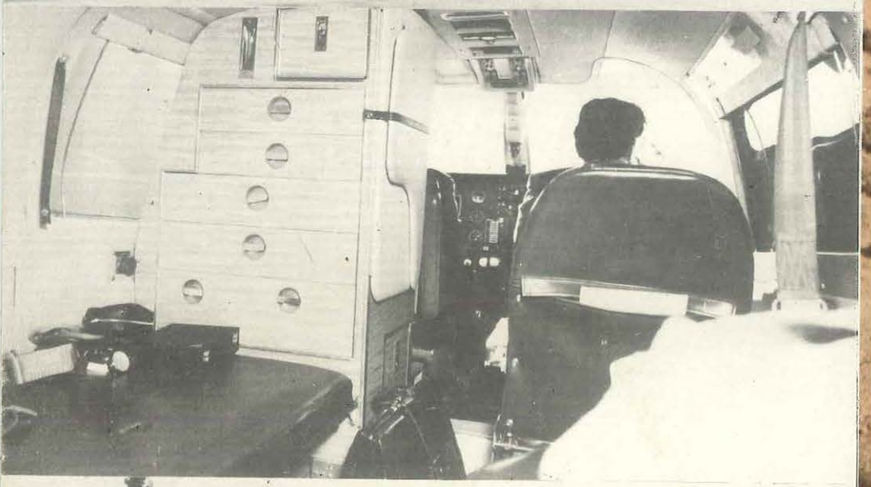


Number 93 1975

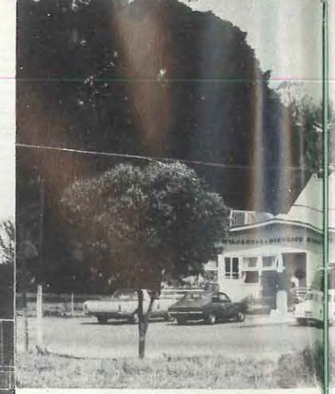
AUSTRALIAN DEPARTMENT OF TRANSPORT

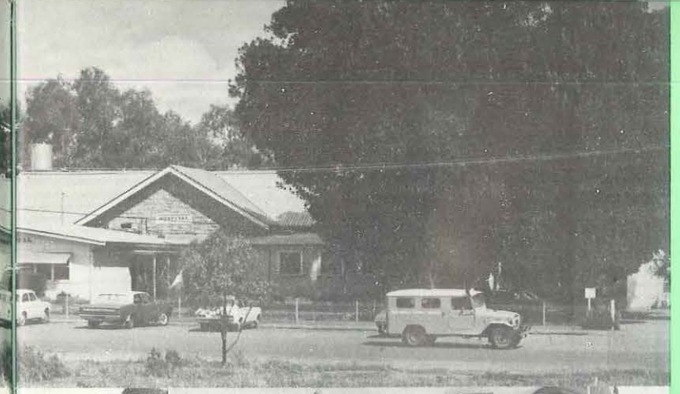
AVIATION SAFETY DIGEST

WILGANNIA

COVER STORY –

THE MANTLE OF SAFETY





So effectively has the Rev'd John Flynn's vision of 50 years ago been realised, that the 'flying doctor' today is simply accepted as part of the way of life in the Australian outback.

From its pioneering beginning in 1928 with a DH-50 chartered from the infant Qantas organisation, the concept of aerial medical services has grown and developed, at times through hardship and personal sacrifice, to the stage where there are now 13 bases administered by seven autonomous State sections, all affiliated under the title of the Royal Flying Doctor Service of Australia.

Originally conceived as an emergency medical service to the people living in the remote inland of Australia, the operation was rendered all the more effective and colourful when Alfred Traeger introduced his famous 'pedal wireless' transceivers to summon this aid from almost any locality, no matter how distant or isolated. Today, emergency medical flights are still of course a most important aspect of the work — indeed the increasing incidence of serious road accidents in Australia's rapidly developing inland areas has made this role even more invaluable. However, for a number of years now, the main emphasis of flying doctor operations in most parts of Australia has been regular medical care for outback dwellers. This has been accomplished by the establishment of regular clinics, held on 'doctor's days' at various centres throughout the area for which the particular flying doctor base is responsible.

The operation depicted in our cover story for this issue is that of the New South Wales section of the Royal Flying Doctor Service which was opened at Broken Hill in 1938, using two DH84 Dragons. These aircraft did much to establish the character of Australian flying doctor operations, giving many years of faithful service before being finally replaced by DHA Drovers in the mid 50s. The Beagle 206s currently operated by the Base have been in service since 1967.

The Broken Hill Base's two doctors serve as medical officers for the hospitals and nursing centres in the area, as well as holding regular clinics at station homesteads chosen for their strategic location. One of the Base's most demanding and constant responsibilities is the medical work at the Wilcannia District Hospital, 200 kilometres distance by road, but only a little over half an hour away by air, where consultations are held three days a week. Some aspects of this work are shown in the accompanying photographs. In addition, the doctors conduct two radio clinic sessions daily from the Broken Hill Flying Doctor Radio Base. These are the counterpart of a suburban doctor's surgery hours, when patients may consult the doctors and seek their advice. The radio sessions also enable the doctors to maintain contact with their patients under treatment.

Medical emergencies, whenever they arise, obviously take precedence over this regular medical work, and there is no part of the network that cannot be reached in one of the Base's three aircraft in under two hours. The aircraft are all fitted with modern medical equipment to enable patients to receive treatment in the air on their way to hospital.

AVIATION SAFETY DIGEST

Number 93 1975

CONTENTS

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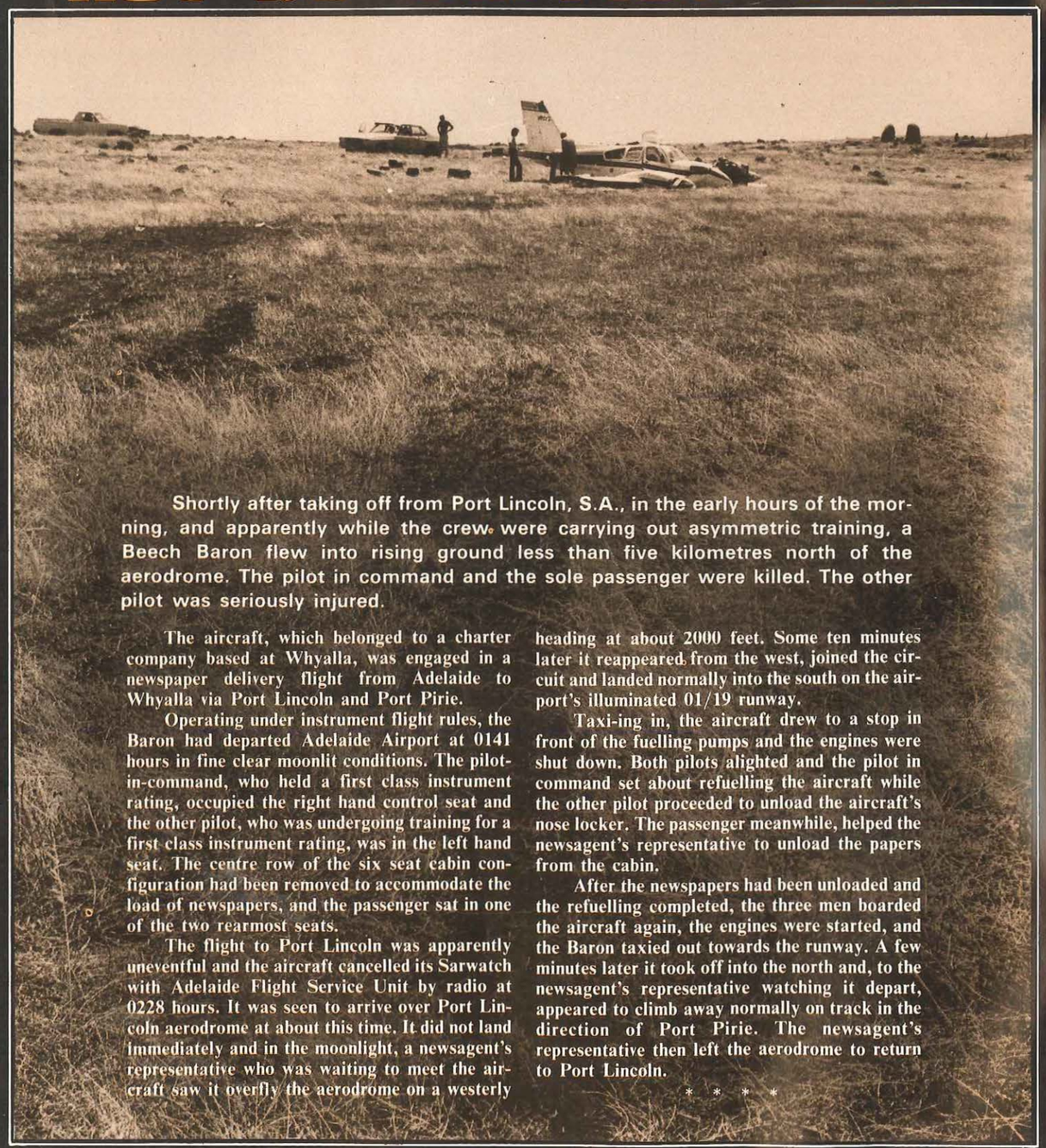
`This exercise should not be carried out.´



Shortly after taking off from Port Lincoln, S.A., in the early hours of the morning, and apparently while the crew were carrying out asymmetric training, a Beech Baron flew into rising ground less than five kilometres north of the aerodrome. The pilot in command and the sole passenger were killed. The other pilot was seriously injured.

The aircraft, which belonged to a charter company based at Whyalla, was engaged in a newspaper delivery flight from Adelaide to Whyalla via Port Lincoln and Port Pirie.

Operating under instrument flight rules, the Baron had departed Adelaide Airport at 0141 hours in fine clear moonlit conditions. The pilot-in-command, who held a first class instrument rating, occupied the right hand control seat and the other pilot, who was undergoing training for a first class instrument rating, was in the left hand seat. The centre row of the six seat cabin configuration had been removed to accommodate the load of newspapers, and the passenger sat in one of the two rearmost seats.

The flight to Port Lincoln was apparently uneventful and the aircraft cancelled its Sarwatch with Adelaide Flight Service Unit by radio at 0228 hours. It was seen to arrive over Port Lincoln aerodrome at about this time. It did not land immediately and in the moonlight, a newsagent's representative who was waiting to meet the aircraft saw it overfly the aerodrome on a westerly heading at about 2000 feet. Some ten minutes later it reappeared from the west, joined the circuit and landed normally into the south on the airport's illuminated 01/19 runway.

Taxi-ing in, the aircraft drew to a stop in front of the fuelling pumps and the engines were shut down. Both pilots alighted and the pilot in command set about refuelling the aircraft while the other pilot proceeded to unload the aircraft's nose locker. The passenger meanwhile, helped the newsagent's representative to unload the papers from the cabin.

After the newspapers had been unloaded and the refuelling completed, the three men boarded the aircraft again, the engines were started, and the Baron taxied out towards the runway. A few minutes later it took off into the north and, to the newsagent's representative watching it depart, appeared to climb away normally on track in the direction of Port Pirie. The newsagent's representative then left the aerodrome to return to Port Lincoln.

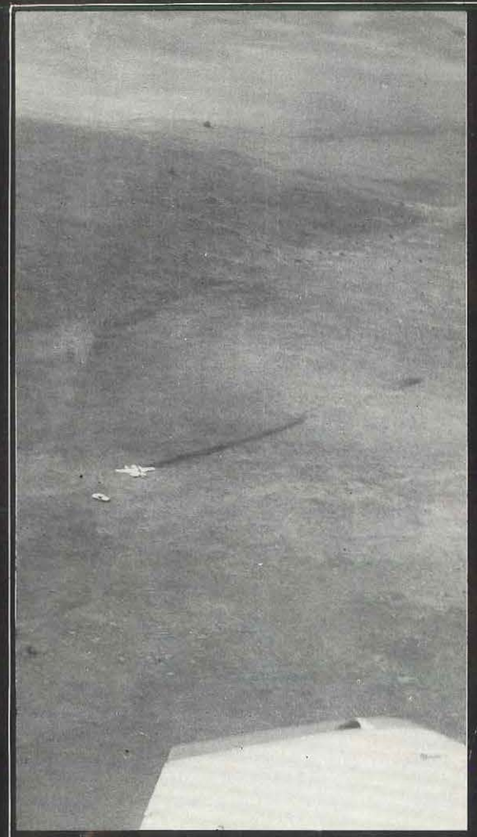
* * * *

The newspaper flight from Adelaide to Port Lincoln, Port Pirie and Whyalla was a regular nightly occurrence, and when Adelaide Flight Service Unit had heard nothing more from the aircraft by 0345 hours, the flight service operator on duty began calling the aircraft. Despite a number of calls, there was no reply, and the flight service operator then requested the Watch Supervisor to telephone the groundsman at Port Lincoln aerodrome to ascertain the reason for the aircraft's delayed departure. When it was learned in Adelaide that the aircraft was no longer on the ground at Port Lincoln, search and rescue procedures were immediately introduced. An air search was arranged to commence from Port Lincoln at first light and, at 0637 hours, five minutes after taking off from Port Lincoln, the pilot of a searching Cherokee reported sighting the missing Baron on a hillside, still substantially intact, approximately five kilometres north of the aerodrome. By 0720 hours a ground party had succeeded in reaching the site of the crash and the surviving pilot was conveyed immediately to the Port Lincoln hospital.

The aircraft, with its undercarriage and flaps retracted, had initially struck the upward sloping ground in a wings-level, slightly nose-up attitude, on a heading of 010 degrees magnetic. The aircraft's required heading on this leg of the flight was 047 degrees M. The impact site was a kilometre and a half west of the extended centreline of Port Lincoln's runway 01 from which the aircraft had taken off. Following the initial impact with the hillside, the aircraft had skipped and slid uphill for nearly 130 metres, finally slewing to the right and coming to rest facing south-east. Slash marks on the ground at the impact point indicated that both propellers were under power at the time. The aircraft's clock had obviously stopped on the impact and indicated that the aircraft had crashed at 0302 hours, very soon after it had been seen departing from Port Lincoln airport.

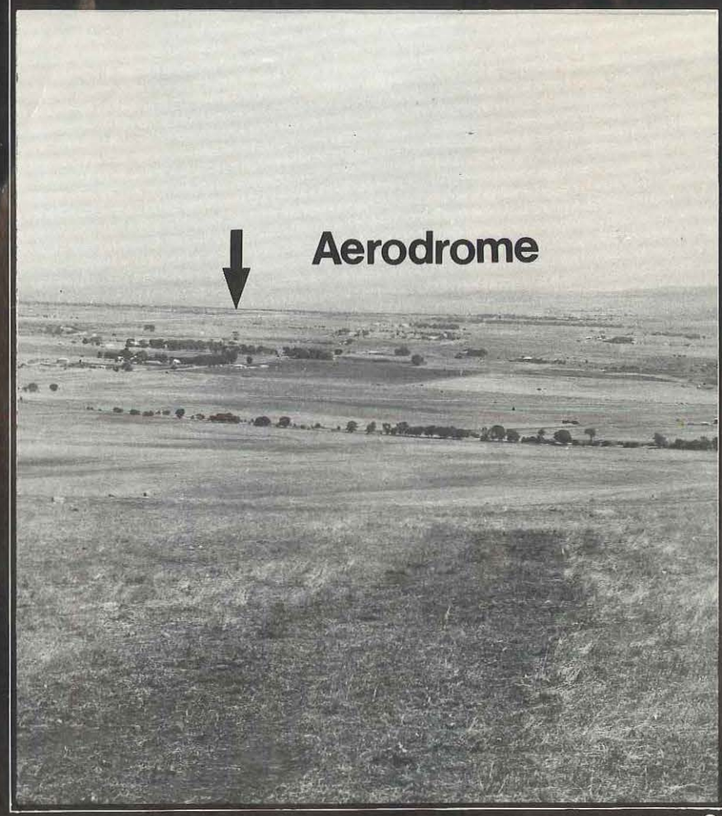
Though at first sight the aircraft appeared to have suffered comparatively little damage for an accident of this type, closer inspection showed that the underside of the fuselage had been badly damaged and torn by contact with the numerous small boulders which littered the hillside.

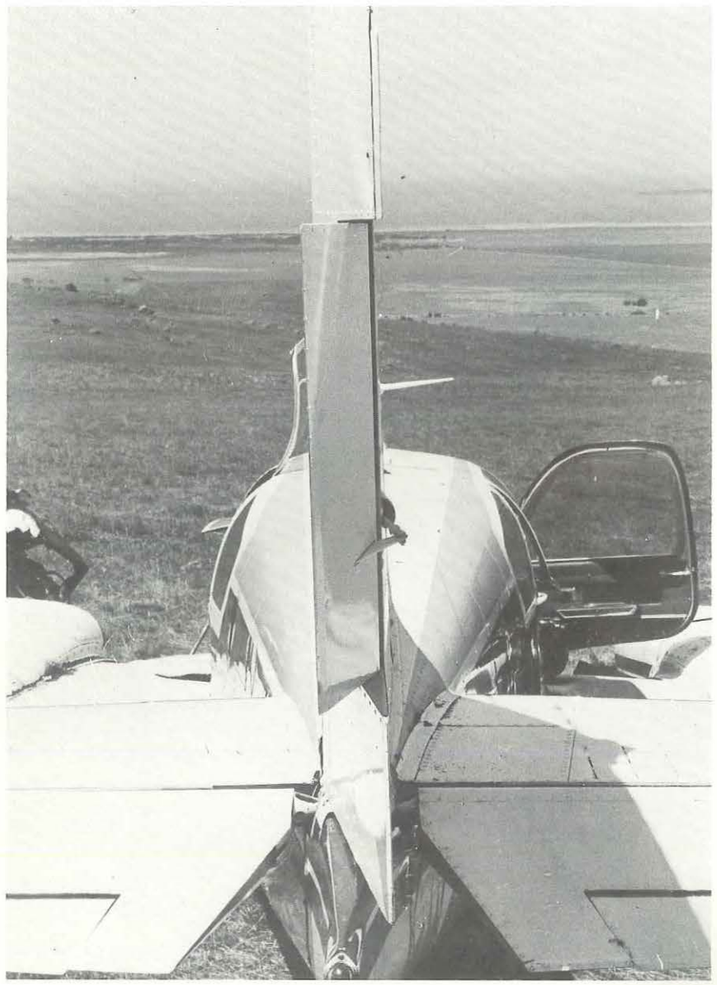
During the subsequent detailed examination of the damaged aircraft, no evidence could be found of any defect in the Baron's engines, airframe or systems, which could have contributed to the accident. Both engines appeared to have been capable of delivering full power up to the moment impact. A highly significant finding, however, was that although both engines were obviously under power when the aircraft flew into the ground, the rudder trim was set 20 degrees to the right and the aileron trim seven degrees to the right. Another finding of significance was the fact that the lower left hand portion of the aircraft's windscreen, in front of the left hand seat, was obscured by aeronautical charts which had been affixed to the inside of the windscreen with masking tape. From the way in which the charts were mounted, it was obvious



Top: Aerial view of accident site looking south-east. The initial impact point can be seen on the right of the picture.

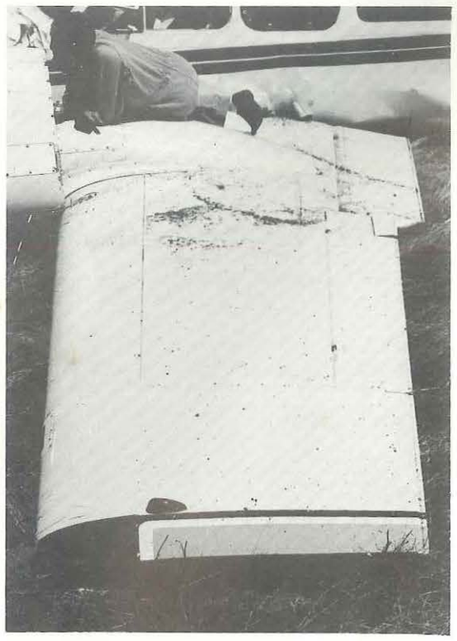
Below: View from hillside on which aircraft crashed, looking back in direction of approach. Runway 01/19 at Port Lincoln from which the aircraft took off can be seen in the distance. The initial impact point is in the foreground.





Above: Rear view of aircraft, showing rudder trim tab deflected to full 'right rudder' position.

Right: Port wing showing aileron trim tab fully deflected 'right wing down'.



that they were intended to block the pilot's forward vision for the purpose of instrument training.

The newsagent's representative, who was the last person to see the aircraft before the accident, said that the aircraft was taking off as he began to drive away with his load of papers. He estimated it had reached a height of 250 feet by the time it was halfway along the runway. As he drove towards the aerodrome gate, the aircraft appeared to be climbing on track towards Spencer Gulf with the engines operating normally. The time would then have been very close to 0300 hours.

Port Lincoln aerodrome is close to sea level and almost on the shoreline of Spencer Gulf. The rising ground commences immediately to the west and north of the aerodrome reaching a height of 832 feet, eight kilometres to the north, and 950 feet, nine kilometres to the west. From runway 01 on which the aircraft took off, the direct track to Port Pirie lies almost entirely over water, closely paralleling the western coast of Spencer Gulf. Aircraft taking off from this runway are required to carry out right hand circuits and thus it is normal procedure for an aircraft departing Port Lincoln for Port Pirie or Whyalla to turn slightly right to take up the direct track. Both pilots on board the Baron were entirely familiar with Port Lincoln aerodrome.

The height of the aircraft when the newsagent's representative saw it about midway down the runway, was consistent with its expected performance, and continuation of this rate of climb should have placed the aircraft at a height of at least 3000 feet abeam the accident site. As the accident site was only 414 feet above the elevation of the aerodrome, it is clear there must have been a considerable reduction in aircraft performance very soon after take-off for the Baron to have struck the ground at the point where the accident occurred.

The pilot occupying the left hand seat had joined the operating company only three weeks before the accident, and during this time he had carried out eight similar flights with the pilot-in-command. It was known that he was training for his first class instrument rating and, from casual remarks the two pilots made to the briefing officer while they were flight planning at Adelaide Airport before departure, it was apparent that the junior pilot was nearing the end of his instrument training. Because of this, the pilot-in-command intended giving him a thorough 'workout' during the flight in question and some lighthearted comments were made about 'pulling an engine' during the flight. The fact that the aircraft did not immediately join the circuit and land on arrival at Port Lincoln, but first continued to the west of the aerodrome for several minutes also adds weight to the belief that instrument training was being carried out during the flight.

Discussion with other pilots who had worked with the pilot-in-command of the Baron, established that he required a high standard of asymmetric skill in those whom he trained, and

that it was his practice to simulate instrument conditions for this training by affixing charts to the windscreen in front of the pilot undergoing training. It was also established that the pilot-in-command's asymmetric training procedure was to simulate engine failures by closing one mixture control lever to the idle cut-off position, though this was never done during take-off below an indicated airspeed of 100 knots. The pilot under training was then expected to identify the 'failed' engine and indicate the feathering and shutdown drill. The pilot-in-command would then set up zero thrust on the 'failed' engine for the continuation of the exercise. Pilots under training were briefed not to actually feather a propeller below 1000 feet. The whole circumstances of the accident, together with the information revealed during the investigation, suggests that very soon after take-off from Port Lincoln, a failure of the port engine was simulated by the pilot-in-command, after which the 'defective' engine was set to zero thrust. The pilot under training then trimmed out the rudder and aileron forces and continued a single-engine climb under simulated instrument conditions.

In view of the crew's familiarity with Port Lincoln aerodrome and its surrounding terrain, it is difficult to explain why the aircraft, after taking off in the dark from runway 01, was allowed to divert to the left towards the higher ground lying to the north. This is especially so when the low altitude at which the asymmetric condition was apparently introduced, is considered. It can only be surmised that the kilometre or so drift to port from the runway heading, was unintentional and probably undetected by the crew. A simulated failure of the port engine would certainly tend to drift the aircraft towards the accident site, particularly in the early stages of the exercise, when the pilot might not have compensated fully for the asymmetric thrust.

Though the surviving pilot eventually recovered from his injuries, he could remember nothing of the circumstances of the flight immediately preceding the accident. For this reason, the precise sequence of events which resulted in the aircraft being in the position it was, can never be fully known. Nevertheless they could hardly have been other than within the broad concept of the circumstances as revealed by the investigation.

Even though the night was clear, with the moon in its gibbous phase about to set on the western horizon, it is apparent that the crew did not recognise the developing danger until too late. A number of witnesses in farmhouses in the area reported hearing the sound of engines in the early hours of the morning. Several in fact commented that there was a surge of engine power shortly before they heard a series of thumps, which, viewed in retrospect, were undoubtedly the sounds of impact. However, though some of the witnesses were disturbed by these noises, and one actually went outside to investigate, they did not identify them with an aircraft accident until they heard some hours later that the Baron had crashed.

This witness evidence tends to suggest that the crew, or more likely the pilot-in-command, whose vision from the right hand seat was relatively unobstructed, caught sight of the hillside at the last moment and applied power to the 'failed' engine. But though the engine responded, as is evident from the slash marks on the ground at the impact site, his action obviously came too late to prevent the aircraft flying into the ground.

Although the investigation was unable to determine the cause of the accident with absolute certainty, there can be little doubt that it was associated with an asymmetric exercise. Concerning this type of training, the Department's 'Flight Instruction Manual', (Publication No. 45), under the heading 'Asymmetric Flight at Night', states quite categorically, 'This exercise should not be carried out'.

The wisdom of that advice is borne out all too well by the accident to the Baron.

Left: General view of aircraft as found. The chart obscuring the port windscreen panel can be seen still in position. Note the surprisingly intact appearance of the aircraft for this type of accident.

Below: Initial impact point on the hillside.

ASKING TOO MUCH?

While engaged in sheep mustering operations at low altitude, the pilot of a Cessna 150 Aerobat lost control of the aircraft and it dived almost vertically into the ground. Both pilot and passenger were killed, and the aircraft destroyed. The pilot, who was relatively inexperienced, was not qualified to engage in low level operations, and it is probable that he allowed the aircraft to stall at a height too low for recovery.

The muster, on a station property in Western Australia, was a large scale one, occupying several weeks. At the time of the accident, six stockmen, three of them on horseback and the others on motor cycles, were working in conjunction with the Cessna. All were able to communicate with the aircraft by portable two-way radio. On board the aircraft with the pilot was the station manager, who was acting as the spotter for the mustering operation.

The day's work had begun at first light and four hours later, about mid-morning, the aircraft had flown to a neighbouring station's airstrip to refuel. It then returned to the area being worked and continued mustering for a further two and three quarter hours before once again diverting to the other property to refuel. This time, the wife of the manager of the neighbouring station drove down to the strip to meet the aircraft and offered the two men a cup of tea.

The manager's wife thought the pilot was looking extremely tired. Nevertheless the men declined, saying they were too busy, and after they had finished refuelling, they boarded the aircraft again and departed once more for the mustering area.

Meanwhile, one of the motor cycle stockmen had been waiting for the aircraft to return and had lit a fire to guide the pilot back to his position amid light scrub. The aircraft arrived back over him shortly after 1300 hours, and immediately dived towards the main flock of sheep which the stockman was working. Pulling out of the dive, the pilot called the stockman on the radio to round up some straggling sheep nearby. The stockman rode a short distance in the direction the aircraft indicated then, because he was having difficulty hearing the pilot's transmissions, he stopped his motor cycle and switched off the engine.

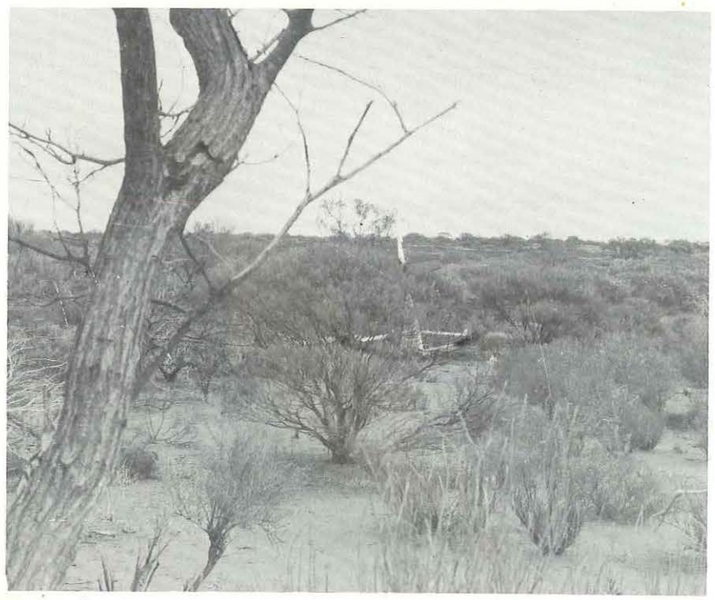
Watching the aircraft as he sat astride his machine, the stockman saw it dive low again to indicate the position of the stragglers. As it pulled out of the dive, the pilot reported that he had lost sight of the sheep, and would dive again to show the stockman where they were. The aircraft continued climbing to a height of about 400 feet, but as it levelled out, the engine noise ceased and the aircraft passed from the stockman's view behind a tree. Moments later he heard the sound of a heavy impact. Hurriedly starting his engine, the stockman rode quickly through the scrub in the direction of the crash. Leaving his machine a safe distance away, he ran to the wrecked Cessna but both occupants had been fatally injured.

* * * *

As is obvious from the accompanying photographs, the aircraft had impacted in an almost vertically nose down attitude.

A detailed inspection of the aircraft did not reveal any defect or malfunction which could have contributed to the accident. Although the stockman said the engine sound ceased suddenly before the aircraft went out of sight, the wreckage examination revealed that the throttle was at least three quarters open on impact and the propeller was turning. The tachometer was jammed at 2300 rpm and it could only be concluded that either the pilot had closed the throttle for some unknown reason and then re-opened it just before impact, or that the apparent change in engine sound might have been caused by a rapid change in attitude after the aircraft was lost to view.

General view of terrain, showing low scrub typical of the country in which the accident occurred.



The pilot was 30 years old and held a restricted private licence which had been issued some nine months before the accident. He had a total of over 200 hours aeronautical experience, of which 65 hours had been flown in the course of obtaining his licence. His log book had not been entered up to date since that time but there was evidence to suggest that most of the remaining hours had been flown in mustering operations.

Aerial mustering of livestock normally involves flight below 500 feet and as such, requires special approval from the Department. Pilots wishing to engage in this work must first complete a course in low flying and practical mustering training, then pass a flight test with a Departmental examiner. In this case the pilot had never received any formal mustering training and had not been granted any approval for that purpose.

A pilot who had previously been employed flying the same aircraft on mustering operations, said the normal mustering technique was to fly the aircraft back and forth behind the sheep at about 500 feet above the ground, to move them in the required direction. At times however, it was necessary to dive low near a flock of sheep to start them moving. In these cases, having passed beyond the sheep, the aircraft was held level for about 150 to 200 metres, then pulled up into a steep climbing turn away from the flock at full power. At the top of the climb, at about 65 knots, the bank would be reversed and the aircraft turned back in the opposite direction to make a further run across the rear of the flock. The reversing manoeuvre was generally similar to the procedure turn used for agricultural operations.

Another experienced mustering pilot was deeply concerned that the accident was the third to occur in this area of Western Australia in almost identical circumstances. From his own extensive knowledge of the operation, he believed that having pulled out of a dive during aerial mustering, a pilot could very easily find himself in the situation of attempting too steep a climbing turn at too low an airspeed. If the turn were then tightened sufficiently, the pilot suggested the aircraft could stall and flick out of the turn into an almost vertical dive.

During the investigation therefore, a flight was made in another Cessna 150 Aerobat to explore the possible sequence which, from the manoeuvres being carried out, could have led to a steep nose-down attitude close to the ground.

For the purpose of the flight, the turning manoeuvre as used in the mustering operation was entered from level flight at a safe height and about 60 knots. The aircraft was pulled up into a steep climb of about 45 degrees, and full power applied. Rolling on 60 to 65 degrees of bank, the aircraft was held in the steep turn and the angle of attack increased by applying 'UP' elevator control.

It was found that when the speed fell to about 35 to 40 knots, the aircraft, without any form of aerodynamic warning, would flick violently **out** of the turn and pitch vertically nose down. The result was the same as though the aircraft had been bunted with the wings level along the original direction of flight. The manoeuvre was repeated several times in both directions and in every case the aircraft flicked out of the turn, sometimes going past the vertically downwards attitude. Misuse of out-of-turn rudder accentuated the flick which, once it had developed, could not be immediately arrested by the correct use of rudder. With the throttle closed, 500 feet was needed for recovery to level flight even when the manoeuvre was anticipated.

* * * *

Because the stockman was the only witness to the aircraft's final flight path, and even he did not actually see it strike the ground, it was not possible to determine the precise sequence of events which led to the Cessna's fatal steep nose-down attitude in this case. However, from the relative positions of the stockman, the main flock of sheep and the reported stragglers, the approximate final flight path could be reconstructed.

It is likely that, towards the top of its last climb as seen by the stockman, the aircraft would have turned away from the main flock to pass behind the stragglers. Also, even if the pilot had reduced the angle of climb, as the stockman believed, before commencing the turn, it is likely that the airspeed was low at this stage.

Thus, although the available evidence is insufficient to positively establish the cause of the accident, it is probable that the Cessna was placed in a steep turn at low airspeed. It is apparent that the turn was then tightened to the extent that the aircraft stalled, flicked out of the turn, and into a steep nose-down attitude. At the height at which the aircraft was flying, there was no hope of recovery before it struck the ground.

There is one other point in the events leading to this accident which is worthy of comment from a safety education aspect.

The crew of the aircraft commenced operations at about 0600 hours, and when they landed for fuel the second time, they had been engaged in intensive, low level flying in warm weather for nearly seven hours. The woman who offered them tea at this stage, commented that the pilot looked extremely tired, yet they refused this offer because they were 'too busy'.

The wisdom of continuing such a sustained and demanding task, without break or refreshment, can only be questioned, and it is difficult to avoid the impression that perhaps too much was being expected of the man, as well as the machine.

The degree of compression of the nose and cabin area is evident in both of these photographs.

CAUSE:

The probable cause of the accident was that the pilot, who was relatively inexperienced and not qualified to engage in low level operations, allowed the aircraft to stall at a height too low for recovery to be effected.

MORE ABOUT MUSTERING

Following the investigation of the accident reviewed in the Digest article "Asking Too Much?", the Department wrote to the owners of station property aircraft in Western Australia, emphasising the dangers inherent in aerial mustering operations, and stressing the need for proper training before a pilot could be granted a mustering authorisation.

One of the encouraging responses to this letter came from the experienced mustering pilot interviewed during that investigation, who offered to set down his thoughts on the accident for the benefit of others. His contribution to a better understanding and knowledge of the pitfalls of aerial mustering appears below. The views he has expressed only emphasise the dangers of engaging in this type of flying without proper training for the task.

He writes:

'Aerial mustering is a relatively new operation which was introduced to help combat rising labour costs and a growing shortage of experienced stockmen. In normal circumstances, given good weather and an eye for the odd tall tree or hill, it is quite safe. The aircraft is usually flown between 100 and 300 feet above the ground at about 60 knots with between 10 and 20 degrees of flap selected, and communication is effected with ground staff using small 27.240 MHz walkie-talkies. Good communication is essential as it eliminates the extra diving and turning that would otherwise be necessary for signalling, and thereby reduces the risk. When stock are spotted, the ground crew are called in and the aircraft dives to indicate their exact position or to start the stock moving.

'Recognising the new skills required for this type of flying, the Department of Transport has introduced a course of pilot training for what is known colloquially as a "mustering endorsement", but is actually "permission to fly below 500 feet", with proximity limitations to persons and occupied buildings. Any pilot who musters without this added flight instruction is a fool, not only to himself, but to his family and friends as well. For though the modern light aircraft is very stable and safe to fly under normal conditions, it is still possible to push it beyond safe limits when there is insufficient airspace for recovery from unusual attitudes.

'The three recent fatal mustering accidents have much in common. All the aircraft involved were found in virtually identical attitudes; all appeared to have struck the ground in a vertical dive; and in each case it seems the aircraft stalled while manoeuvring at low level. I believe all three accidents were caused by a well-known, but little appreciated, handling characteristic which, though no problem at safe altitudes, can be extremely dangerous at the low heights common to mustering flying.

'The only way I know that a Cessna 150 could get to a nose-down angle of 90 degrees to the ground at low level, is from a stall in a nose-high steep turn with nearly full back stick, and I am sure it is this characteristic, or more particularly the ignorance of it, which has been responsible for the three fatal accidents.

'In the case of each of these three accidents, the aircraft was probably climbing away after a dive at about 80 knots with full, or nearly full, throttle. Before levelling out, a steep turn was probably commenced with the nose still up about 15 degrees. I believe that instead of allowing the nose to drop away, the pilot, who would almost certainly have been looking back at the ground, continued to hold on back elevator until, at about 40 knots and with a steep angle of bank, the aircraft stalled. The upper or outside wing would have stalled first and the aircraft would have flicked out of the turn into a 90 degree bank in the opposite direction. The nose would then have fallen away to the vertical and in this attitude, the aircraft would have struck the ground. From my experience any attempt to effect an early recovery will result in a secondary stall with the opposite wing dropping. Unless correct recovery action is taken, a spin will follow this "outside flick", just as it can develop from a normal stall.

'In a Cessna 150, this vertical nose-down attitude that follows a stall off a steep climbing turn occurs very quickly and recovery to level flight takes about 400 feet. I do not know personally what the effect would be in larger aircraft, but the results could well be far more violent, with the wings rolling past the vertical. I am assured that the war-time Oxford trainer would roll right over on to its back!

'Turning quickly is frequently necessary in mustering but I would stress that the safest way to fly under these exacting conditions is never to pull unnecessary g forces. Flying an aircraft fitted with a g meter I have found that it is not necessary to pull more than 2g in normal mustering operations. It is a very steep dive and recovery indeed that will pull 3g. Pilots engaged in mustering operations need to be very careful in applying back elevator. Many will argue about other factors, but it is the heavyhanded use of back-stick which produces high g forces and the situation which leads to an "outside flick" in a steep climbing turn. Unfortunately there are no pilots who have experienced this particularly deadly manoeuvre under 300 feet and lived to tell about it.

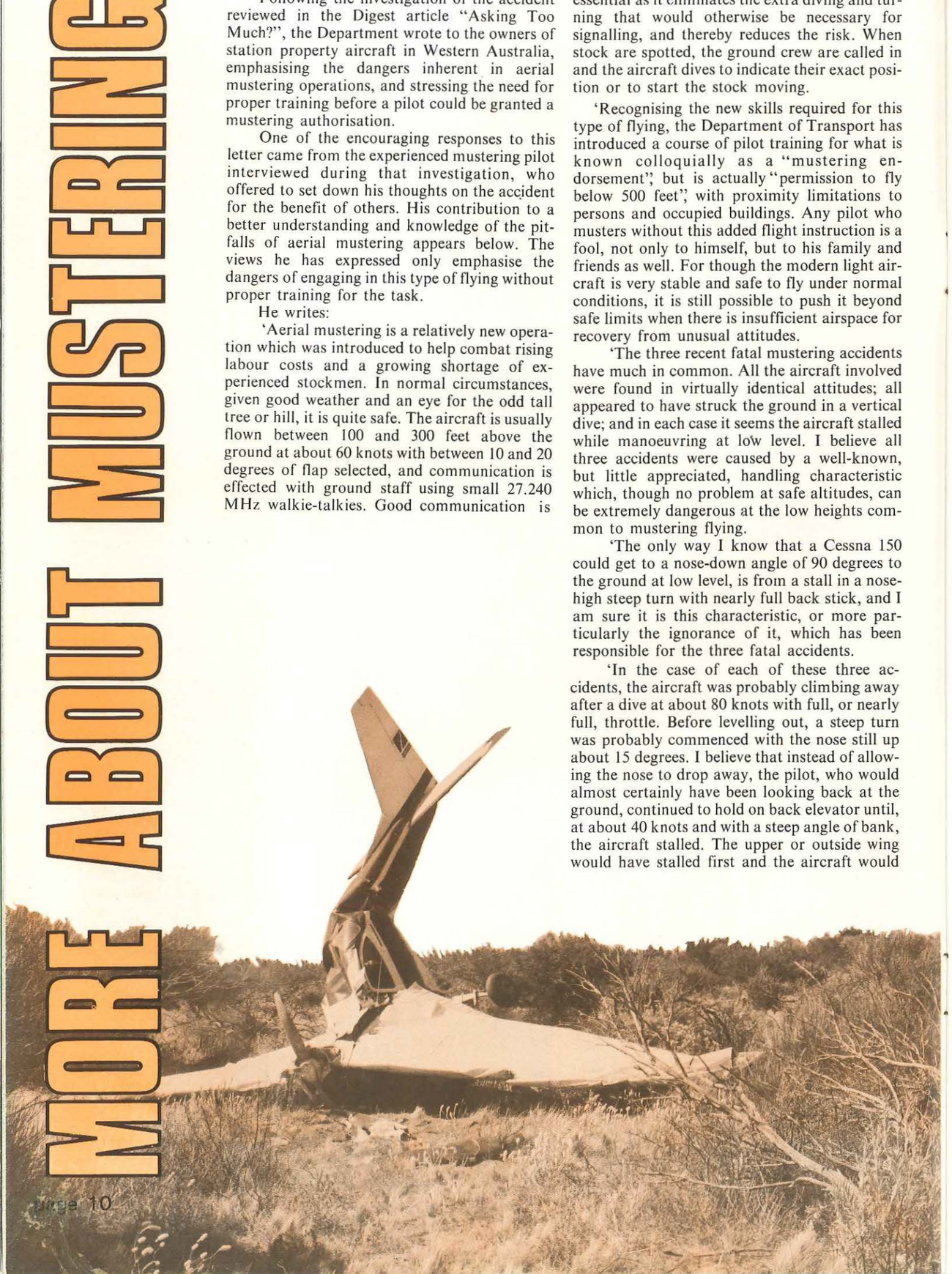
'A look at the accident record for mustering shows that while there have been quite a few relatively minor accidents, mainly attributable to carelessness, the three fatal ones fall into a category entirely on their own. The common factors to all are that there has been no failure of aircraft systems, no obvious terrain hazards, and the aircraft have all struck the ground at relatively low speed and in the same vertically nose down attitude. It seems to me that it is the "unknown" characteristic which is claiming all these lives.'

* * * *

COMMENT:

There can be no doubt whatever that low level mustering operations demand a very high standard of flying skill. The pilot must manoeuvre his aircraft at a low height while concentrating on a moving target, with the added distraction of maintaining radio communication with the ground party. Where a pilot is properly trained, aerial stock mustering can be safe and effective but obviously, an untrained pilot can very quickly place his aircraft in an attitude from which recovery is impossible in the height available. Turning steeply at an extremely low level should not be necessary in normal mustering flying and pilots who make a practice of this would appear to be doing so for no other reason than to make the operation more spectacular. If in fact, an aircraft has to be flown this way to achieve the desired result, it is obviously time to call in the ground party to assist.

Although this investigation was concerned with the stalling behaviour of the Cessna Aerobat, similar characteristics could well be expected of many other aircraft types. The stall behaviour will of course, vary to some extent between types, but in every case height will be needed to recover. And a gentle, straight-ahead stall at a safe height as practised in the course of a normal training exercise where recovery is anticipated, is clearly a vastly different matter to loss of control in a nose-high, steep climbing turn at full power near the ground. In this situation, which can easily be approached during mustering operations, even the most docile aircraft can 'bite' . Above 3000 feet, the height loss necessary for recovery may seem insignificant. But at low level, the outcome of such a loss of control is virtually a foregone conclusion.



The photographs on these pages depict the other fatal mustering accidents referred to by our contributor.

One JUMP Ahead

Under the command of the holder of a Commercial Pilot Licence, the embarrassed looking Tiger Moth depicted on these pages had set out to fly from Fogarty's Field, Victoria, to attend a fly-in at Wodonga, with an intermediate stop at Benalla for fuel if necessary. On board in addition to the pilot, was one passenger.

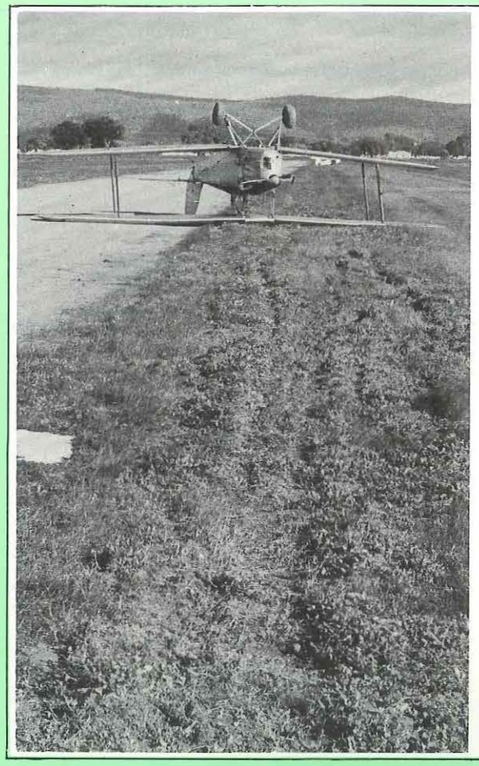
All went well for the first half hour of the flight but, after passing abeam Mangalore, the aircraft encountered several large areas of cloud and a number of diversions to the west of track became necessary. In the course of these diversions, the pilot became unsure of his position and, on regaining track over the Hume Highway, misidentified a small town as Euroa. Subsequently on arriving over Euroa, the pilot believed he was at Benalla and circled the town looking for the aerodrome which is well known as a base of gliding operations. After a brief search had proved fruitless, the pilot decided to conserve his remaining fuel and continue towards Wodonga.

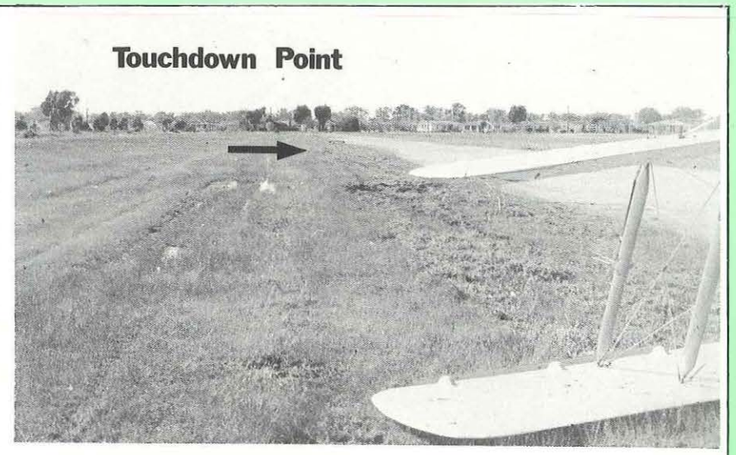
As the flight progressed, the pilot's initial error was compounded and misconception added to misconception. Benalla was passed off as Wangaratta, and by the time he was approaching Wangaratta, the pilot believed he had reached Wodonga. Wangaratta's airstrip lies approximately one kilometre south-east of the city, in a somewhat similar relationship to that of the strip at his intended destination. The pilot also mistook an area of water north of the town for what he believed to be the Murray River. These coincidences quickly led the pilot to locate the Wangaratta airstrip and he entered the circuit, convinced that he had arrived at his destination.

The pilot was not familiar with this landing area, so he took the precaution of completing a circuit while he inspected its layout.

The pilot noticed during his inspection there were no other aircraft on the ground and thought this strange considering the number that were expected to be present at the fly-in. This gave him some second thoughts about his position but he decided that it would do no harm to land, thereby gaining an opportunity to both refuel and to positively check where he was. He noted the windsock indication and assessed the wind as south-westerly at twelve to fifteen knots. This favoured an approach into the west on the single east-west strip and, satisfied that it was suitable, he prepared to land.

Having established the aircraft on final approach, the pilot initially tracked for a landing on the gravel centre section of the strip but his allowance for the crosswind was insufficient and the aircraft drifted to the right. The pilot saw this but made no correction as he considered the grass areas on either side of the gravel quite suitable for landing. Passing over the threshold he straightened the aircraft, flared and closed the throttle, touching down about two metres to the right of the gravel strip. The wheels sank into the ground and rapidly slowed the aircraft. The pilot applied full back stick in an attempt to keep the tail down but to no avail and the Tiger gently nosed forward and somersaulted on to its back. In the course of the landing roll, the aircraft's wheels had sunk about four inches into the soft ground.





Both occupants were restrained in their seats by their safety harness and managed to release their buckles and lower themselves to the ground. Fortunately neither of them was injured. As can be seen from the photographs the aircraft itself had sustained only relatively slight damage.

* * * *

Though it could be argued that the accident would have been avoided if the pilot had not mistaken Wangaratta for his intended destination, the navigational blunders, serious though they were, did not actually cause the accident.

Nevertheless, from all that came to light during the investigation, it was quite clear that the pilot's ability and judgement left a great deal to be desired. He held a Commercial Pilot's Licence and had been associated with aviation for over twenty years, but for the previous ten years he had done very little flying and had not flown outside the Melbourne area at all for more than four years. Just how 'rusty' his navigational ability had become was apparent from the flight plan he had prepared for the trip. The headings, ground speeds, and time intervals appeared to be based on a wind that bore little relationship to those in the relevant area forecasts, and for this flight of six legs, (Fogarty's Field — Romsey — Seymour — Euroa — Benalla — Wangaratta — Wodonga), only five sets of time intervals had been calculated. The details for the Seymour-Euroa leg had been omitted altogether and as a result the details applicable to the following legs had been transposed one position higher in the time interval column. It was on this 'missing leg' that the pilot first became uncertain of his position.

But despite this error, it is hard to imagine how the pilot subsequently maintained his misconceptions in the face of so much contradictory evidence. The orientation and arrangement of roads, railways and rivers around Euroa, Benalla and Wangaratta are all quite different as is quite clear from the WAC series chart for this area. As well as this, the pilot actually sighted a glider in flight in the vicinity of what he thought was Wangaratta and diverted around it, but still the penny didn't drop! Ironically, the passenger in the front seat though he had virtually no flying experience, had correctly identified Benalla from the gliders on the ground and in the air. But not realising the pilot was lost, he had said nothing, complying with the pilot's earlier request not to talk to him during the trip because he would be too busy navigating to indulge in conversation!

The accident itself resulted from the pilot's attempt to land the aircraft on an area that was unsuitable. Though he had made a circuit before landing he had overlooked several warning signs. Firstly there was a large white plaster-board cross on the grass, adjacent to the windsock. The cross had been put out some time before by members of the local aero club when extensive rain had rendered most of the landing area unusable. Secondly, numerous pools of water lying on the grassed areas of the strip were clearly in evidence. Only the gravelled 12 metre wide, centre section of the strip remained relatively firm and dry, while the surrounding grassed area was completely waterlogged. The worst affected were the edges of the marked strip, adjacent to the gravelled section, where the aircraft landed. These had recently been graded and were particularly soft.

SUFFERING FROM A SPLIT PERSONALITY?

'Walter Mitty' fantasies have no place in today's operations!

They had a reason for it —
YOU DON'T!

VITAL ACTIONS Mean Just That

Less than a minute after taking off from Goroka, P.N.G., the engine of a Cessna 207 lost power and the pilot turned back towards the runway. During the descent, the engine ran intermittently but delivered little power and the aircraft struck an embankment 400 metres short of the aerodrome boundary. The pilot and three passengers were killed and the remaining four passengers were seriously injured.

The aircraft was engaged on a private flight from Wabag to Lae via Baiyer River, but because the aircraft's generator was not charging properly, and the condition of the battery was low, the pilot decided to call at Goroka to have the electrical system serviced.

En route to Goroka, while flying through the Daulo Pass, 16 kilometres west of the airport, the 207's engine suddenly cut. The pilot immediately moved the fuel selector from the starboard tank, on which the engine had been running, to the port tank, turned on the electric auxiliary fuel pump, and the engine regained power.

On arrival at Goroka a few minutes later, an engineer met the aircraft and the pilot referred him to both the electrical system problem, and the fact that fuel starvation had occurred during the flight.

While the engineer was checking the electrical system and fitting a new battery to the aircraft, the pilot went to the control tower to prepare his flight plan for continuing the flight to Lae. He mentioned to the briefing officer that he had experienced a partial engine failure in the Daulo Pass as well as how he had overcome the problem. The pilot seemed rather agitated by the delay to his flight and commented that 'things seemed to be going wrong'.

His agitation was still evident when the pilot returned to the aircraft and attempted to hurry the engineer to complete the work. The pilot explained he wanted to get home to Lae early, as he had some other work to do, as well as having another flight planned for Rabaul early the following morning.

Having completed the rectification of the aircraft's electrical system, the engineer climbed into the pilot's seat to start the engine in order to check the battery charging rate, as well as to check the fuel system for any interruption to flow that could have been responsible for the fuel starvation the pilot had experienced a few minutes before reaching Goroka. The fuel selector was already set to the port tank so he started the engine with the selector in that position. After the engine was running properly, he selected the 'OFF' position, and the engine cut out normally. Immediately he selected the starboard tank, the engine picked up again, without the use of the electric auxiliary fuel pump. Again he selected the 'OFF' position and the engine cut. He then re-selected the starboard tank, and completed a five minute engine run with the fuel selector in this position. As the charging rate was satisfactory, and no fuel flow problem was apparent during the engine run, he shut down the engine by pulling the mixture control to the idle cut off position, leaving the fuel selector in the starboard tank position.

When the pilot returned from the control tower, he and the engineer resumed their discussion of the fuel flow problem and the engineer checked the venting of the starboard tank by blowing into the underwing vent. The vent was quite clear and he then asked the pilot what fuel there was in the starboard tank. The pilot then dipped the tank to check its contents and found there was only enough fuel to wet the very base of the dipstick. Both engineer and pilot then concluded that the fuel starvation problem could be attributed to the fact that there had been so little fuel in the tank. This satisfied the pilot and he set about replacing the freight which had been removed from the forward luggage locker to gain access to the aircraft's battery. He told the engineer he would not replenish the tank, as he had sufficient fuel in the port tank for the flight to Lae. The pilot and passengers then reboarded the aircraft.

The pilot experienced some difficulty in starting the engine, as it was still hot, but after accepting some advice from the engineer who was standing by the pilot's door, he succeeded in doing so and immediately began to taxi away.

Meanwhile in the control tower, the air traffic controller on duty had cleared the aircraft to taxi to runway 17R. The pilot acknowledged and almost immediately called for his airways clearance. This was passed to the aircraft and, while still taxi-ing, the pilot requested his take-off clearance. This was also passed, and without pausing at the holding point, the aircraft appeared to taxi directly on to the runway and commence its take-off from a rolling start. Only a minute had passed since the aircraft had first begun to taxi.

The take-off appeared to be quite normal, the aircraft lifting off about half way down the main runway, where it began a normal shallow climb. At a height of about 400 feet, the aircraft began a gentle turn to the left to take up its heading for Lae but, instead of straightening up on that heading, the turn was continued back towards the direction of the runway. Almost simultaneously the pilot called again, requesting a straight-in approach and transmitting 'Mayday'. Superimposed on the pilot's transmission, the aircraft's stall warning could

Above: The wreckage being hoisted from the accident site during the investigation.

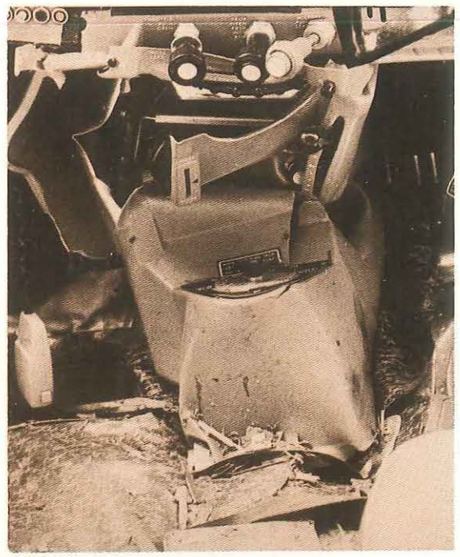
be heard sounding in the background. The controller immediately instructed a Fokker Friendship, which had just been cleared for take-off, to hold position, and cleared the Cessna for a straight-in approach. Asked the nature of his difficulty, the pilot replied 'fuel blockage' and again the sound of the stall warning could be heard during the pilot's transmission.

At about this time, the attention of a number of people in the area to the south of the aerodrome was aroused by the sound of the aircraft's erratically running engine, and they saw it making an unusually low and shallow approach back towards the aerodrome with the engine cutting in and out. After narrowly missing a small pine plantation a kilometre and a half from the runway threshold, the Cessna turned slightly to by-pass some school buildings at very low level, and continued in the direction of the runway.

At this stage all engine noise ceased and the aircraft descended below the elevation of the aerodrome into a clump of bamboo growing on the southern bank of a deep narrow creek. One of the Cessna's elevators was torn off and, now in a stalled condition, the aircraft crossed the creek and impacted heavily in a nose-up attitude against its opposite bank 760 metres short of the runway.

* * * *

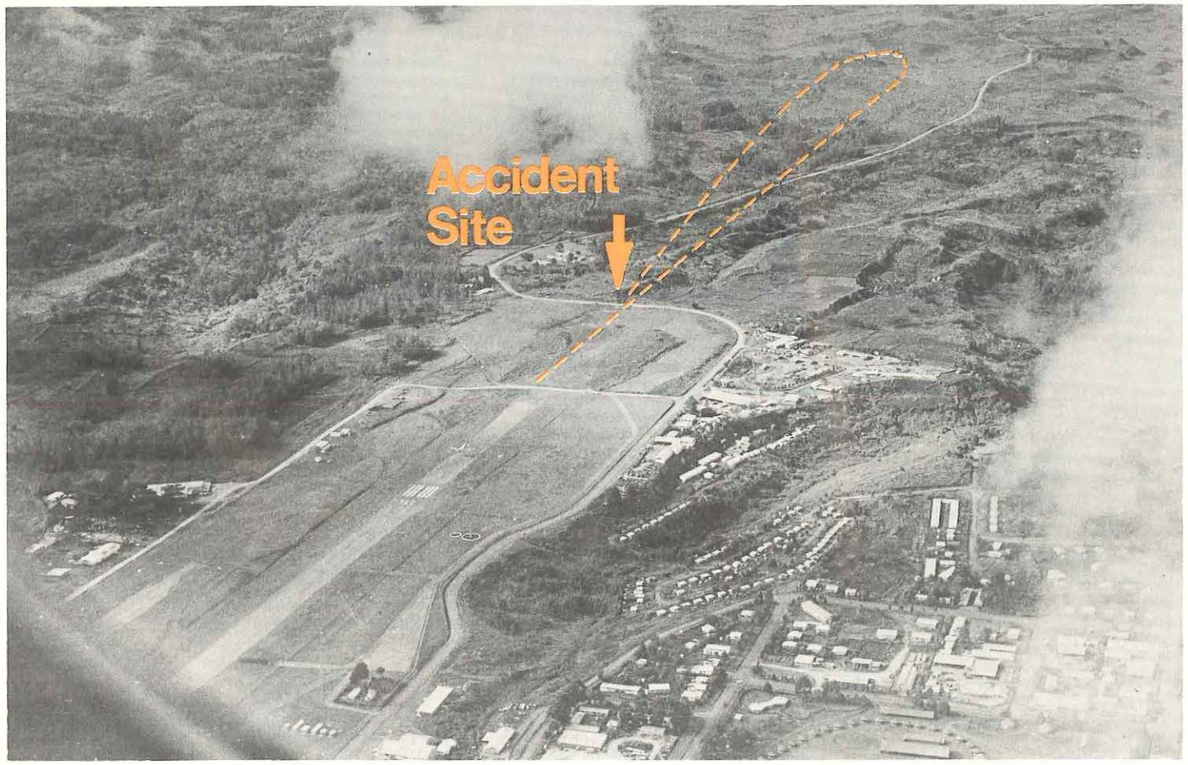
The condition of the wrecked aircraft was consistent with what could be expected in an accident of this type, all sections of the airframe displaying evidence of deformation and collapse in a downward and forward direction.



The fuel selector was found positioned to the starboard tank, which was empty. The port tank was also empty when it was inspected, but it had been damaged in the impact and showed evidence of having contained a considerable amount of fuel at the time of the crash. The fuel system itself was virtually devoid of fuel, but a detailed examination of the aircraft, including a full check of the fuel system and a strip inspection of the engine, failed to reveal any defect which could have contributed to the loss of power. It was concluded that, apart from the fact that the fuel selector was positioned to the empty starboard tank, the aircraft should have been capable of normal operation. It was thus clear that, although the port tank contained an adequate amount of fuel at the time of the crash, the engine had failed from fuel starvation.

Top: View of fuel selector as found, positioned to the empty starboard tank.

Below: View of southern end of Goroka aerodrome showing flight path and position of accident site.



Before departing from Wabag airstrip that morning, the pilot had filled the aircraft's port tank to capacity but because of the load to be uplifted and the elevation of the airstrip, he did not top up the starboard tank. There was nevertheless some fuel in the starboard tank, on which the pilot continued to operate until the engine lost power while flying through the Daulo Pass. The pilot had then selected the port tank and the engine had regained power without difficulty.

While the aircraft was on the ground at Goroka, the engineer had run the engine on the starboard tank for five minutes to check for any interruption to the fuel flow. Finding none, evidently because enough 'unusable fuel' had trickled into the fuel system from the virtually empty starboard tank, he shut the engine down, leaving the fuel selector positioned to this tank.

As soon as the pilot had returned from the control tower and was satisfied that the fuel starvation problem had resulted from nothing more than an empty starboard tank, he hurriedly started the engine and taxied for departure. It seems possible that, because he had positioned the fuel selector to the port tank only a few minutes before landing at Goroka, he assumed it was still in that position. Certainly his very hasty departure would have allowed little time for methodical checks of any kind.

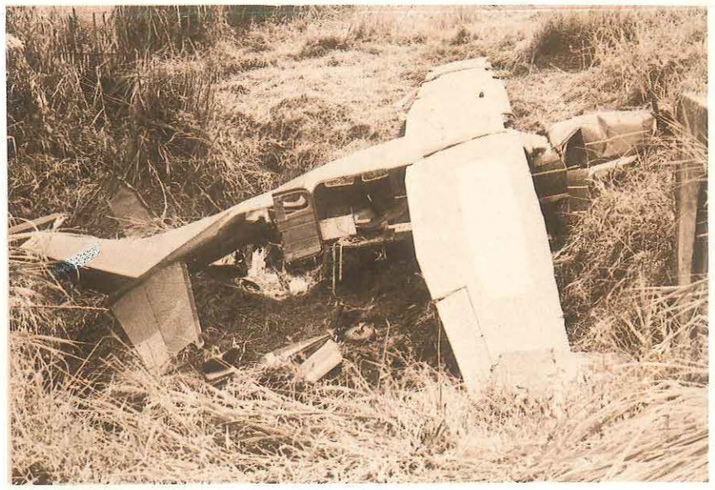
And once again, sufficient fuel had evidently dribbled into the fuel system from the 'empty' starboard tank, while the aircraft was on the ground, to sustain the engine during taxi, take-off, and intial climb. But at this point, the residual fuel in the system had become exhausted. Had the pilot immediately reselected the port tank and turned on the auxiliary fuel pump, the engine should have responded.

It seems however that he did not do so, and perhaps it did not occur to him that he was operating on other than an almost full tank. Assuming this, the pilot would have seen no point in changing tanks, for he knew the other tank was empty, and his diagnosis of a 'fuel blockage' becomes understandable. Tests conducted during the investigation on a similar type of aircraft, indicated that power would be lost at about this point after take-off in such circumstances.

* * * *

In addition to the fact that this accident provides a costly object lesson on the importance of adequate pre-take-off checks and in-flight emergency drills, there is value in examining the matter of the forced landing itself.

It was evident that, when the Cessna's engine failed, the aircraft had attained a height of about 400 feet, some 2700 metres from the end of the runway, a quite normal performance for a well-loaded Cessna 207 at the elevation of Goroka. Reference to the owner's manual for the aircraft shows that, from this height, the aircraft would have been able to glide only about 1000 metres. Thus, at the time the engine failed, the runway was well beyond the aircraft's gliding range.



Above: The collapsed and distorted airframe as it came to rest against the creek bank.

The terrain along the take-off path to the south of Goroka aerodrome is rough and is crossed in numerous places by steep sided gullies. Even so, there are reasonably flat areas between the gullies, some of which would have been well within the aircraft's gliding range. These areas were by no means ideal, but they would have afforded the opportunity for a relatively safe forced landing. Although the aircraft would almost certainly have been damaged, it is highly probable that such a landing could have been accomplished without injury to the occupants.

The fact that the stall warning could be heard sounding continuously during the two radio transmissions made after the engine failed, indicates that the pilot did not adopt a safe gliding speed, let alone the optimum gliding speed, possibly because he was attempting to 'stretch' the glide back to the runway. Despite this low airspeed however, the point where the aircraft finally crashed was just under 2000 metres from where the engine failed, which suggests that the pilot was able to obtain some assistance from the erratically running engine during his obviously desperate attempt to regain the aerodrome.

Nevertheless, when the engine failed the pilot would have been much better advised to position the aircraft for a forced landing on the best available area within gliding range, aiming to put it down with the least possibility of injury to the occupants. Had he subsequently been able to restore power to the engine before finally being committed to a forced landing, he could have then climbed away and returned to the aerodrome.

It is a well known fact that certain items in an aircraft's pre-take-off and emergency checks lists are often referred to as VITAL ACTIONS. The outcome of this accident makes it clear why this is so.

While making a night approach to land at Pago Pago airport, Samoa, a Boeing 707 descended below the glideslope and crashed 1200 metres short of the runway. The aircraft was destroyed by impact and fire and of its 101 occupants, only four subsequently survived.

BELOW THE GLIDESLOPE

THE FLIGHT

The aircraft was operating a scheduled international passenger flight from Auckland to Los Angeles with intermediate landings at Pago Pago and Honolulu. It had departed Auckland at 2014 hours Samoa time and three hours later reported position 160 nautical miles south of Pago Pago.

The weather, which was showery with broken cloud at about 1700 feet, was passed to the aircraft and at 2317 hours, it commenced its descent from flight level 330. The 707 was subsequently cleared for an ILS-DME approach to runway 05. The wind was from the north-east at 10 to 15 knots.

At 2338:50 hours (one minute 52 seconds before impact), when the aircraft was established on final approach and had just descended through 2000 feet, some eight kilometres from touchdown, the Pago Pago approach controller reported an apparent power failure at the airport. The crew of the 707 replied that they were still receiving the VOR and ILS, and that they had the runway lights in sight. The approach controller commented that it was raining heavily and that he could not see the lights from his position. The aircraft replied that it was now 'five DME' and that the lights still looked bright. The approach controller then passed a wind check.

The aircraft's acknowledgement of this call proved to be its final transmission. One minute afterwards it struck trees 1200 metres short of the runway threshold and plunged to destruction in the jungle. Heavy rain fell at the accident site shortly after the crash.

INVESTIGATION

Runway 05 at Pago Pago International Airport is 30 feet AMSL and is 2750 metres long. It is served by an ILS, and equipped with high intensity runway lights, a medium intensity approach light system, and a VASI. The ILS glideslope is installed at a descent angle of three degrees 15 minutes and is not usable below 138 feet because of the effects of the irregular terrain on signal reliability. The ILS localiser is offset to the right and crosses the extended runway centre-line about 1000 metres from the runway threshold. There is no control tower at the airport and the approach control building is situated 700 metres north-west of the runway.

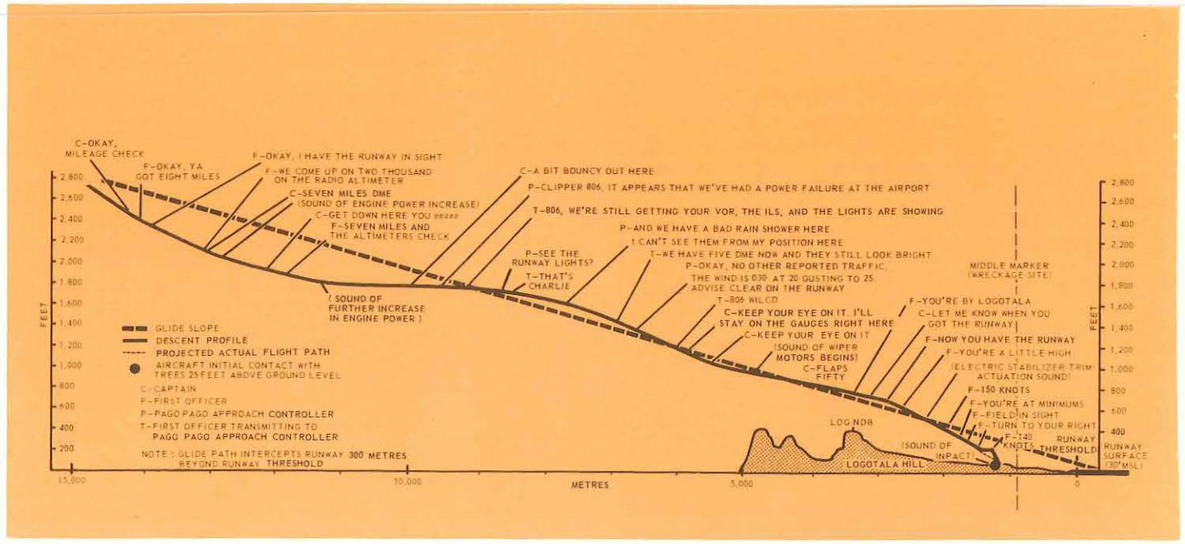
The approach to runway 05 is over the sea to a point 3.25 nautical miles from the threshold. About 1.7 nautical miles, or 3000 metres, from the threshold, the approach path crosses a hill 399 feet AMSL. From the top of this hill, rough, jungle-covered terrain beneath the approach path slopes downwards to the runway.

From its initial impact point on the sloping terrain, the aircraft had cut a swathe downhill through the jungle for nearly 240 metres, finally coming to rest some 960 metres short of the runway threshold. The fuselage remained substantially intact throughout the crash, but was subsequently destroyed by fire with the exception of the tail section aft of the rear pressure bulkhead.

The undercarriage and flaps were extended at the time of the crash, and it was evident that the aircraft and its systems were fully serviceable and functioning normally. Recordings from both the flight data and cockpit voice recorders were recovered intact from the wreckage and the information they contained was read out for use in the investigation.

Nine passengers and the aircraft's third officer, who was occupying the co-pilot's seat, survived the crash, but of these, the third officer and four of the passengers died from their injuries during the following three days. Most of the survivors sustained burns after they escaped from the aircraft.

The passengers who survived said the deceleration forces were only slightly more severe than those of a normal landing. There was no apparent damage to the interior of the cabin, but large fires could be seen outside on the star-



Descent profile of aircraft to impact point in comparison with the 3.25 degree glideslope of the Pago Pago ILS.

board side. One passenger had opened an overwing escape hatch on this side, but flames came in and he closed it again. Other passengers opened the overwing exits on the port side, and all the survivors except the third officer escaped through these. The injured third officer managed to escape through a hole in the side of the cockpit.

Although those who survived said that some passengers had rushed to the front and rear of the cabin before the aircraft came to rest, it was evident that neither the forward nor the rear doors had been opened to allow them to escape. It could not be determined why this was so, but it is possible that the cabin crew were overcome by smoke. It is also possible that they were prevented from doing so by the press of passengers against the doors.

Those who survived said they had listened to the pre-take-off briefing and read the passenger information pamphlet which had prepared them for the evacuation by stressing the position of the nearest exits. By contrast, the movement of most of the other passengers, including some seated in the overwing area of the cabin, to the front and rear doors, indicates that they either did not absorb the pre-take-off briefing, or that they reacted without thinking. Though it is unlikely that all the cabin occupants could have escaped through the overwing exits on the port side, it is possible that there would have been more survivors if passengers had followed instructions and moved to their nearest emergency exit. Except for the third officer, all the victims of the accident died of smoke inhalation, and massive burns. Toxicological examinations of the bodies revealed significant levels of carbon monoxide and hydrogen cyanide, which are by-products to be expected in such a fire.

All members of the flight crew were properly licensed and qualified, but until only two weeks before the accident, the captain had been off duty for four months because of ill health. After returning to flying duty, he had completed simulator and flight training, which included three take-offs and landings, to re-qualify himself for 707 type aircraft. These had all been made in Visual Meteorological Conditions. Three further take-offs and landings which the captain had made since returning to duty had also been made in VMC. He had flown into Pago Pago seven days before the accident, but it is apparent that the first officer accomplished the landing on that occasion. The instrument approach on which the accident occurred was thus the captain's first in actual Instrument Meteorological Conditions for 132 days. For this reason, it is probable that his instrument flying proficiency was not at its peak. The third officer was performing the duties of co-pilot, while the first officer, who was suffering from laryngitis, occupied the jump seat.

The company's operations manual specifies that, for all approaches and landings, the aircraft is to be established on final approach, with the landing checklist completed, not lower than 1000 feet in IMC, or 500 feet in VMC. At this point, the aircraft is to be stabilised on the glide path at the proper rate of descent and trimmed for zero control forces.

During any approach, the pilot not flying is required to call the sink rate should it exceed 800 feet per minute at any time. During an ILS approach also, he is to make calls at the outer marker, at 500 feet above the aerodrome elevation, at 100 feet above decision height, and at the decision height itself. As well as these calls, the second or third officer and the flight engineer are required to monitor all aspects of the approach procedure. The required altitude awareness call and vertical rate of descent calls were not made in this case.

* * * *

ANALYSIS

The investigation established that the runway lights were in sight when the aircraft was

eight nautical miles out, and that they had remained visible throughout the approach.

There was nothing to suggest that any of the navigational aids, or aircraft instruments were faulty, but it is evident that the captain, who was flying the aircraft, did not intercept the glideslope smoothly. According to the approach chart, the aircraft could have descended to 2500 feet after being cleared for the approach, and then intercepted the glideslope at the seven mile DME gateway at about 2180 feet. Instead, the aircraft had levelled off at 5000 feet for one minute before descending through the glideslope and, at the six mile DME position, was 260 feet below the glideslope. After levelling off again at 1750 feet, the aircraft re-intercepted the glideslope and followed a path about 100 feet above it until the first officer said 'now you have the runway', 23 seconds before the initial impact with the trees.

While the captain was using the glideslope for vertical guidance, the aircraft's rate of descent was about 690 feet per minute. The recommended no-wind rate of descent for this glideslope is 750 feet per minute.

From the time the aircraft descended through 2000 feet, until it was approaching 1400 feet, the airspeed remained fairly constant at 160 knots. But from that time on, large excursions in airspeed, between 160 and 188 knots, were recorded. These continued until 30 seconds before impact. There were also numerous changes in power during the same period. The landing check list was completed 36 seconds before impact, by which time the aircraft had descended to 817 feet. There was no change in the approach profile as the last item, flaps 50 degrees, was accomplished. The evidence of survivors indicated that the aircraft had encountered light rain during the approach. It was also evident that the aircraft's windscreen wipers had been turned on at an altitude of about 900 feet.

Throughout this time, the captain was flying the aircraft on instruments and continued to do so until 23 seconds before impact when, at a height of about 700 feet, he 'went visual' to complete the landing. Three seconds after this, the co-pilot commented, 'you're a little high'. Four seconds later again, a sound like the electric elevator trim could be heard on the cockpit audio recorder. At the same time, there was a major change in the approach profile, the rate of descent increasing from 690 to 1470 feet per minute. This descent was then sustained until impact.

It is probable that, from the time the captain went visual, he did not again refer to the ILS indicator or the flight instruments, which would have shown that the aircraft was below the glideslope and descending too rapidly. Proper monitoring of the VASI lights would also have provided a positive visual indication that the aircraft was descending below the glideslope.

Many factors can produce visual illusions during an approach to land at night, and there are several which could have caused the crew to believe they were higher than normal during this approach. It is difficult to determine just which effects might have been present on this occasion, but the possibility of visual illusions cannot be dismissed. This is especially so in view of the co-pilot's statement after the accident that 'just prior to impact, everything looked normal'.

Rain can affect a pilot's perception of distance from approach and runway lighting by diffusing their intensity, giving the impression that the lights are further away than actually so. At times also, rain can cause the lights to appear larger (though not brighter), leading a pilot to believe they are closer than they really are. In either case, the illusion could prompt a pilot to descend to an altitude compatible with the perceived runway elevation.

The illusion of runway foreshortening could also have been present in this particular case. The area of heavy rain, which was moving slowly down the runway towards the threshold, would have caused an apparent decrease in the runway's length, thereby leading the crew to believe they were higher than they should have been.

Regardless of any illusions which might have been present however, it is impossible to avoid the conclusion that established pilot techniques, cockpit discipline and crew co-ordination procedures designed to safeguard such an approach, were disregarded and that, as a result, the aircraft's departure from an established, normal rate of descent went unnoticed and unchecked.

PROBABLE CAUSE

The National Transportation Safety Board determined that the probable cause of the accident was the failure of the pilot to correct an excessive rate of descent after the aircraft had passed decision height. The flight-crew did not monitor adequately the flight instruments after they had transitioned to the visual portion of an ILS approach. The flight-crew did not detect the increased rate of descent. Lack of crew co-ordination resulted in inadequate altitude callouts, inadequate instrument cross checks by the pilot not flying the aircraft, and inadequate procedural monitoring by other flight-crew members. Visual illusions produced by the environment may have caused the crew to perceive incorrectly their altitude above the ground and their distance to the airport. VASI was available and operating but apparently was not used by the crew to monitor the approach.

Condensed from report published by the National Transportation Safety Board, U.S.A.

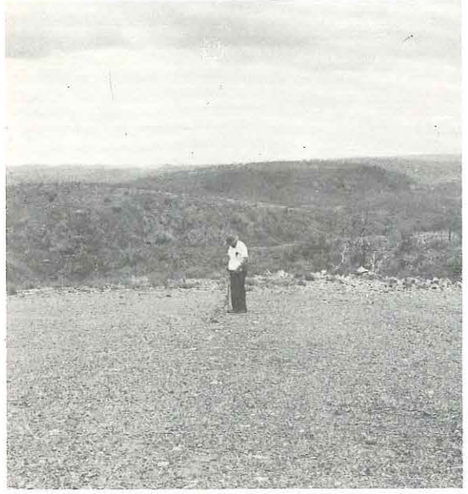
THAT SINKING FEELING!

The sorry looking Cherokee Six depicted here, had been engaged for a charter flight and, with four persons on board, was approaching to land at a mining site airstrip located on a ridge top in hilly country to the north of Mt. Isa, Queensland.

The undulating strip, aligned north-south, is 826 metres in length and, being situated in such an exposed position, is subject to mechanical turbulence in any but light wind conditions.

The pilot was familiar with the characteristics of the strip, having landed there many times during the preceding three months. Arriving in the circuit area, he saw that the wind was blowing from the north-west at about 15 knots, so he positioned the aircraft for a landing into the north. Turning on to final approach, he maintained an airspeed of 80 knots, slightly more than the recommended approach speed of this aeroplane, to allow for fluctuations in wind velocity, as well as for wind gradient effect in the vicinity of the strip threshold. With the engine power set at about 17 inches of manifold pressure, and two stages of flap selected, the pilot was aiming to touch down about 10 metres in from the threshold.

On short final approach, when the Cherokee was only about 20 feet above the ground, the airspeed, which had been fluctuating, suddenly dropped, and the aircraft sank rapidly. The pilot did not increase power, but instead quickly reached for the flap lever and lowered the remaining third stage of flap. In his haste, the flap mechanism apparently failed to positively engage the third stage detent, and when the pilot released his hold on the lever, it sprang back to the second stage position. As best he could the pilot attempted to flare the aircraft for the touchdown, but it struck the ground very heavily 25 metres short of the threshold, dislodging the port landing wheel. Bouncing violently three times, the Cherokee finally settled on to the strip 110 metres in from the threshold, then swung to the left off the prepared surface on to rocky ground. Both the port and nose undercarriage legs collapsed, allowing the



port wing, nose, and propeller to strike the rough ground and sustain severe impact damage.

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It was evident from the subsequent investigation that the pilot did not simply fly the aircraft into the ground short of the strip, but rather experienced an unexpected high rate of sink on short final approach. The pilot did not believe the aircraft had stalled, because the stall warning lamp did not illuminate until just before the aircraft struck the ground. Instead, he believed, the sudden loss of height was the result of a down-draught, or some other type of wind effect produced by the irregular exposed terrain on which the strip is situated.

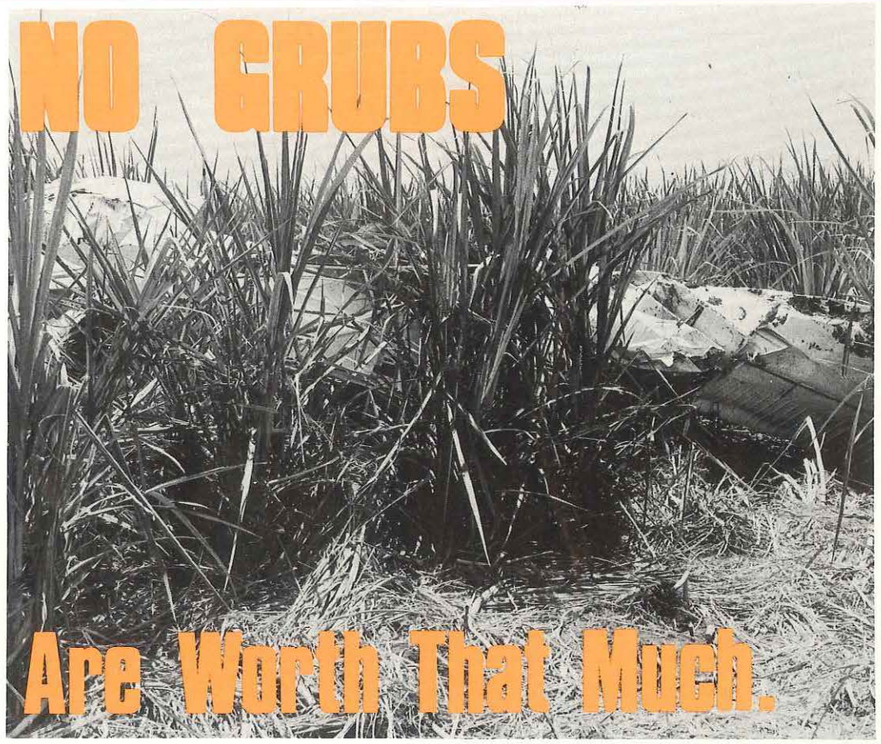
Whatever the reason for the loss of height, there can be no doubt that the pilot's decision to lower the third stage of flap at this point, did nothing to retrieve the situation. On the contrary, his action merely resulted in the aircraft striking the ground all the more heavily. The third stage of flap is virtually all additional drag.

On the other hand, if the pilot had applied full power when the aircraft had begun to sink, he might well have succeeded in arresting the rate of descent or, if this was not entirely successful, at least ensured that the impact was considerably softened at that point.

The pilot was unable to explain why he had extended the additional flap instead of increasing engine power, other than to say that it was a 'natural reaction' in his endeavour to check the rate of sink. He said afterwards however that he knew he would have had a better chance of avoiding the accident if he had used engine power.

It can only be concluded that the sudden loss of height took the pilot by surprise, and because he was not prepared for such an eventuality, he reacted without thinking. The accident therefore underlines the need, not only to be prepared for the unexpected, but to ensure that one's understanding of the fundamentals of flight is sound so that, even in the heat of the moment, the correct decision can be taken surely, positively and without delay.

NO GRUBS Are Worth That Much.



At least that's what one agricultural operator always tells his pilots when the going gets rough. And looking at the depicted remains of what was a perfectly good Agwagon, few readers would disagree with this theory. Yet even with the best of intentions, we can all be caught out and that's just what happened to one pilot we know.

Pressured by Queensland cane farmers to get on and treat their crops before these were devoured by a plague of ravenous grasshoppers, the pilot had begun a round of urgent insecticide spraying jobs early in the morning. At first the calm conditions were almost perfect for the operation but, as the sun rose higher, the wind began to pick up and by mid-morning a gusty south-easterly was blowing at 15 to 20 knots.

Normally in these conditions the pilot would have given up for the day, but because of the farmers' anxiety to protect their investment, regardless of the difficulties, the pilot continued to do his best in the increasingly demanding flying conditions.

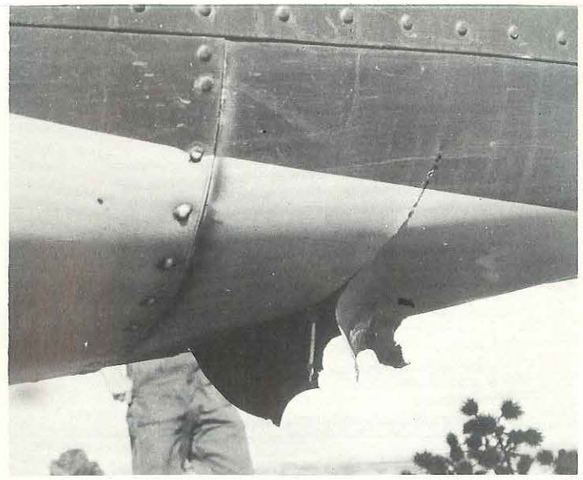
In the strong wind, drift was making it very difficult to position the spray effectively and, to strive for the best coverage, the pilot was flying very close to the top of the crop. During one such run, immediately adjoining another crop of taller cane, mechanical turbulence produced by a break in the crop caused the starboard wing to dip, and the wing-tip entered the top of the tall cane. The aircraft swung off its flight path to the right, losing what little height it had, and flew into the crop of tall cane. Sliding sideways, the aircraft struck the ground and the undercarriage collapsed. The port wing-tip dug in, and the Agwagon flipped over on to its back.

Fortunately the pilot was unhurt and was able to scramble out of the relatively undamaged cockpit unaided. The Agwagon itself was a write-off.

It's easy to be wise after the event of course. But we can be sure that there is now at least someone who would agree there is a limit to how far a pilot should press his luck to please the customer!

'To strive for the best coverage, the pilot was flying very close to the top of the crop!'

MISTAKEN IDENTITY

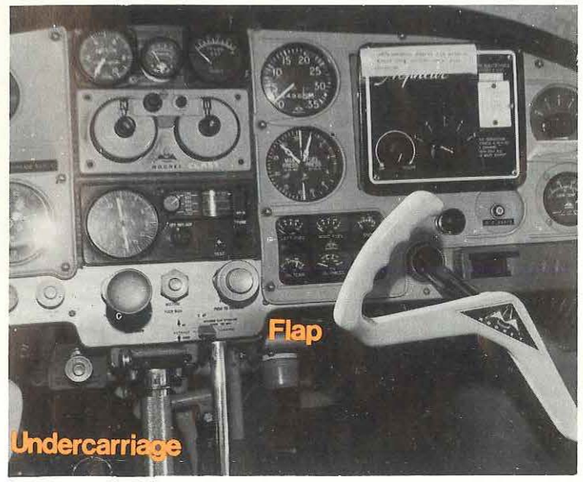


The pilot in command of this Mooney was a flying instructor giving a private pilot endorsement training on the aircraft type.

The pupil had completed two successful circuits; the first to a full stop and the second was to be followed by a touch and go. After landing and then applying power to go around, the pupil selected the carburettor heat OFF, then reached for the flap lever. Instead of selecting the flap lever to the UP position however, he mistakenly unlocked the undercarriage lever just as the aircraft was becoming airborne.

The instructor immediately took over but the aircraft sank slightly and the propeller struck the ground momentarily. The instructor reselected the undercarriage DOWN, and as the aircraft was now vibrating quite seriously and not climbing, he decided to land straight ahead in the adjoining paddock. The ignition, fuel selector and master switch were therefore turned off. The aircraft struck the paddock boundary fence, damaging the underside of the fuselage, then landed wheels down on level but stoney ground without further damage.

Much of the pupil's previous experience had been on single engined Cessna aircraft equipped with manually operated flaps. With the flaps fully extended, the Cessna's flap lever is in a similar position to the Mooney's undercarriage lever with the undercarriage lowered. It is apparent that, intending to raise the flaps after the touch and go landing, the pupil subconsciously operated the undercarriage lever in error.



Right: View of cockpit showing undercarriage lever and flap selector.

Forgotten Basics

In my capacity as a flying instructor, I was involved recently in judging a flying competition in which 11 private pilots were taking part. I flew with each of the contestants, and while taxiing back after landing, I posed two questions to each of the competitors. These were:

1. What conditions constitute visual meteorological conditions below 5000 feet?
2. If an aircraft has a basic stalling speed of 40 knots, what will be its approximate stalling speed in a balanced steep turn with 60 degrees of bank?

To my great consternation, only one pilot answered the first question correctly, and there were no less than six who were unable to answer the second. Only the one pilot answered both questions correctly. The competitor's experience ranged from one pilot who had obtained his restricted private licence only two months before, to several who had held unrestricted licences for more than 10 years. Needless to say the bright boy was the former!

Looking at it on a percentage basis, the overall lack of basic knowledge is horrifying. Admittedly my 'sampling' took place on a very small scale, but I cannot but ponder just to what extent my findings are representative of private pilots generally.

To take the second point first — stalling speed increases during steep turns — it is just not enough to say that forgetting a fact such as this is lamentable; it is potentially fatal! Indeed, as the accident reviews in the Digest have shown time and again, it *has* been fatal all too often. The increase in stalling speed during a turn is of course a function of load factor, and the same situation can be met during aerobatics, recovery from dives and other similar manoeuvres. All students cover the various aspects of stalling, both in theory and in practice during their training, yet this seems to be a point that is quickly forgotten later on.

But even more amazing to me was the pilots' very hazy knowledge of exactly what are Visual Meteorological Conditions. The number of fatal accidents that have resulted from pilots continuing their flight into darkness, poor visibility or cloud, when they were not properly qualified for such conditions, is staggering. The answers that came to light during the competition now make me wonder whether all those unfortunate souls pressed on for the usually accepted reasons — 'have to get home tonight', 'have to be back at work tomorrow', 'I promised I'd be there' — or whether some of them did so simply because they were no longer familiar with the criteria defining conditions that are safe for visual flight.

For example, how many 'visual' pilots are prepared to continue into deteriorating conditions for as long as they can see ahead — even if only spasmodically and regardless of the wisps of cloud sliding past the aircraft with increasing frequency? The subtlety of this situation is that, almost unawares, a point is reached where it is no longer *possible* to see anything!

I am not suggesting that pilots deliberately continue into such conditions out of sheer bravado. Or even out of an inflated impression of their own ability. Rather, I am asking if they do so because the warning signs fail to register, and the well-spelt out definitions, evolved through long experience, are overlooked or forgotten.

The time for a 180 degree turn is not when it finally becomes impossible to continue, but when the visibility falls below three miles, or when the cloud can no longer be avoided by more than 500 feet vertically and 2000 feet horizontally. But if these specifically defined limits are not in the forefront of a pilot's mind, there is every possibility that the mental warning sign will not illuminate until too late!

How these situations as a whole can be remedied is an enormous problem — as is clear from the continuing emphasis given them in the Digest. Perhaps this slightly different 'slant' on these problems may help — at the very least, they provide us all with much food for thought.

a loose end

Just after taking off from a paddock, the pilot and passenger of a Piper Colt noticed that the loose end of the passenger's seat belt had caught in the door and was flapping against the fuselage in the slipstream. Under the pilot's direction the passenger unlatched the door and pulled the belt in.

After climbing for some minutes however, the pilot felt that the aircraft was not trimming out as it should, and as its speed seemed to be down as well, he decided to land at a nearby airstrip and inspect the aircraft. On climbing out of the cockpit, he found that the flapping belt had not only punctured the fabric-covering on the side of the fuselage, but the tear had then progressed both horizontally and vertically. During the 30 minutes that the aircraft was in the air, the whole side of the fuselage had become split and torn all the way back to the tailplane.

'A superior pilot may be defined as one who stays out of trouble by using his superior judgement to avoid situations which might require the use of his superior skill'.

British Airways Air Safety Review