AVIATION SAFETY DIGEST

Number 92 1975

AUSTRALIAN DEPARTMENT OF TRANSPORT

FLYING FOR FUN

One aspect of general aviation that is easily overlooked in today's glamourous world of executive jets, high performance twins and sophisticated radio navigation aids! Not so however in the fraternity of the amateur-built movement, where the sheer enjoyment of flying and all that goes with it becomes the motivating factor.

Now 20 years young, the movement had its Australian beginnings in October, 1955, when a group of 12 enthusiasts met in Melbourne to found the Ultra-light Aircraft Association. From this modest start, the movement quickly spread to other States and before long several diminutive aeroplanes were under construction or being assembled in various parts of the country. Honours for the first to fly went to a type, assuredly more functional than beautiful, which rejoiced in the name "Stits Flut-R-Bug"!

Today the amateur-built scene is a very different one. Not only has the movement a membership of nearly 1000, with 65 aircraft flying and another 300 under construction; the aircraft themselves have "grown up", and the high performance Pitts Specials, Thorpe T18s, and Cassut Racers now flying are far removed in concept from the sedate Luton Minors, Turbulents, and other low-powered types of yesteryear. So much so that the appellation "ultra-light" is no longer an appropriate one, and the movement is about to adopt the more fitting and all-embracing title of "Sport Aircraft Association of Australia".

Our cover story montage captures something of the spirit of the movement, as well as depicting some of the diverse range of types built and flown by members over the years.

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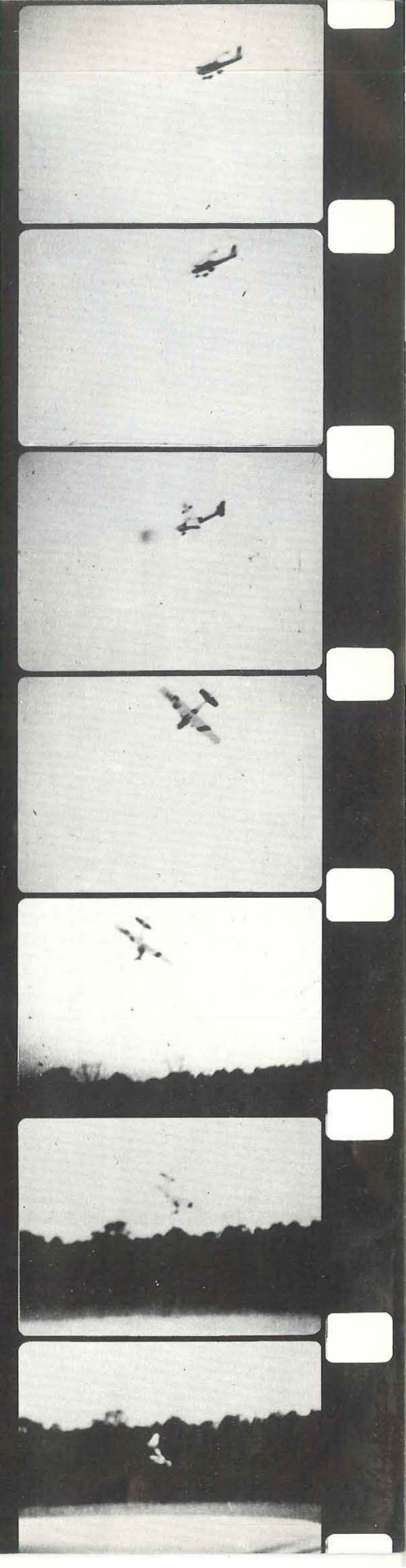
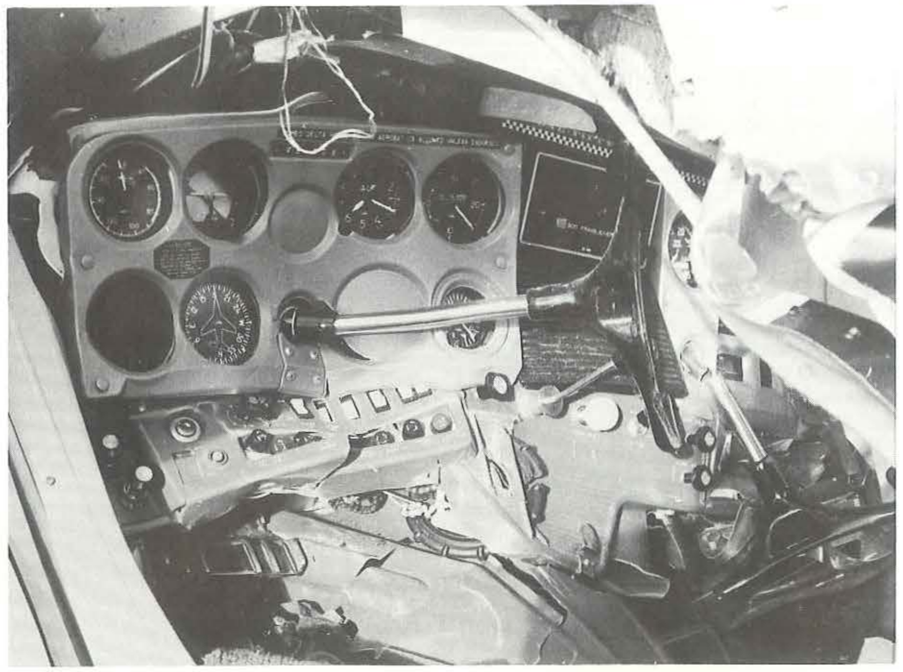
STALL AT LOW LEVEL



At an airstrip a few kilometres southwest of Bankstown Airport, N.S.W., a group of pilots from a flying school at Bankstown were holding a picnic day, in conjunction with flying competitions. Two aircraft, a standard model Cessna 150 and a Cessna A150 Aerobat, were flown to the strip from Bankstown about mid-morning and the flying commenced shortly afterwards. The day's flying activities were under the supervision of an instructor from the flying school, who was responsible for their safe conduct. He had been briefed that there was to be no flying other than the planned events, which consisted of simulated forced landings and power assisted spot landings. These competitions took place through the remainder of the morning and the early afternoon without incident and about mid-afternoon the programme concluded. The day's flying was then reviewed, trophies were presented to the winners, and the competitors and spectators began to leave for home.

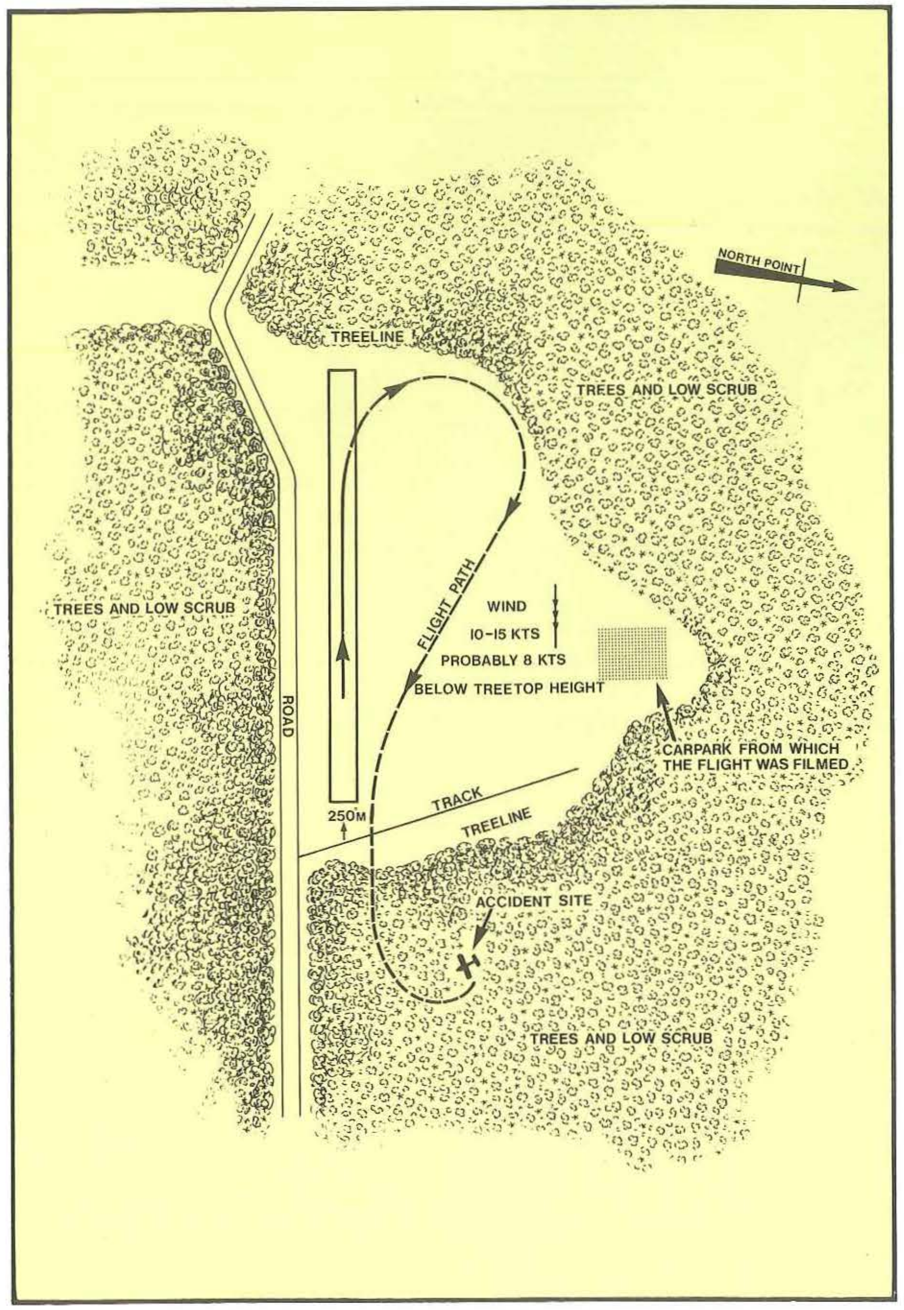
After most had gone, and the aircraft were about to be returned to Bankstown, the instructor, talking with a small group of people still gathered in the picnic area, announced he was 'going to demonstrate the Aerobat'. He did not indicate what form this would take, but said there would definitely be no aerobatics and that he would 'come back over the field'. Dipping the fuel tanks, he remarked to a bystander that they contained 'ten gallons' (45 litres), then boarded the aircraft and fastened his lap belt. He did not use the shoulder straps. The engine started normally and, when the pilot had taxied almost to the threshold of the strip, he turned around and began a take-off into a steady breeze of about eight knots.



Left: Damaged cockpit of the Cessna Aerobat showing closed throttle and elevator control shaft bent in almost full up position.

Below Left: Diagram showing relationship of airstrip, final flight path and accident site.

Opposite Page: Aerial view of airstrip and accident site. The wreckage can be seen in the foreground close to the bottom of the picture. This photograph was taken looking in the direction of take-off.

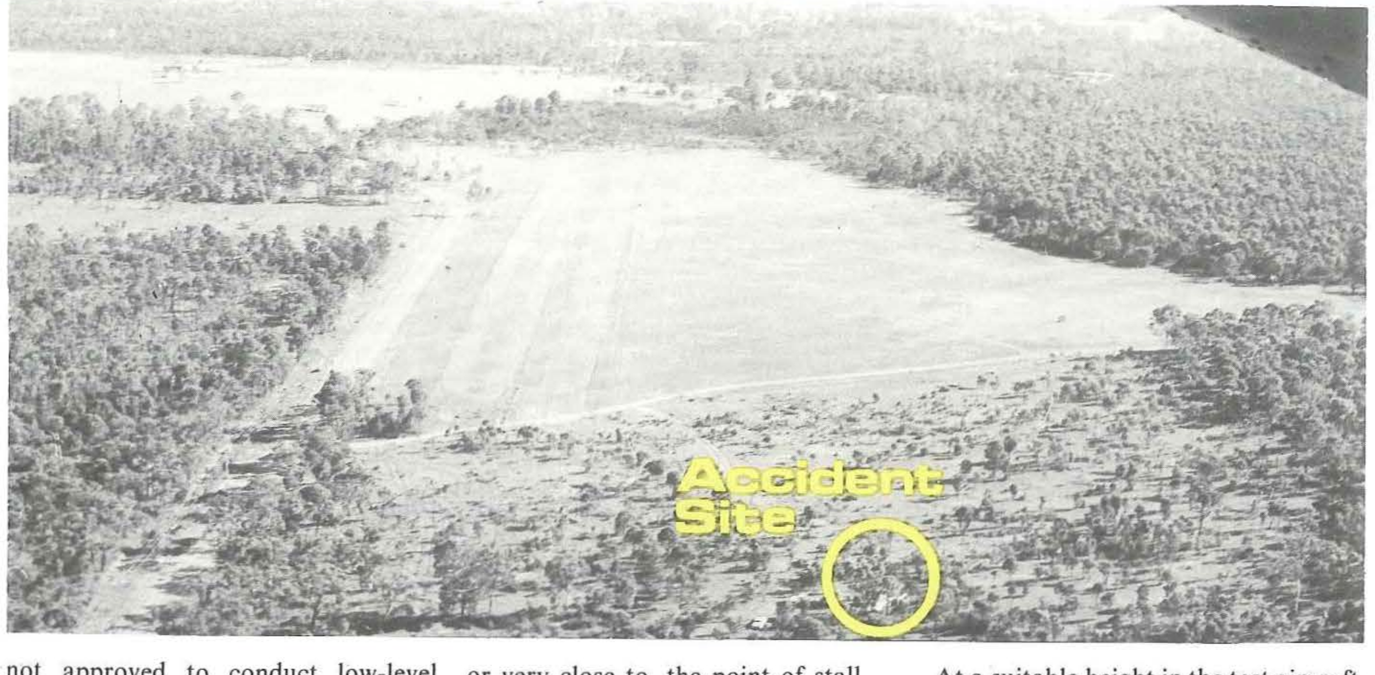


After only a short run, the aircraft became airborne at a slow speed in a marked tail-down attitude and those watching from the ground saw that considerable flap was extended. The aircraft climbed steeply to about 200 feet where the nose lowered and the aircraft, with the flaps now retracted, briefly assumed a more normal climbing attitude before banking steeply into a tight turn to the right. This turn continued until the aircraft was heading back towards the strip. Descending then to a very low height, the aircraft levelled off and flew downwind along the strip at high speed.

Abruptly, at the end of this low run, the aircraft again nosed-up into a steep climb. The speed decayed rapidly and, and when it had reached about 300 feet, the nose suddenly pitched down, the port wing dropped sharply and the aircraft began to turn to the left. Witnesses on the ground heard the engine noise cease and, with the aircraft still turning, the nose continued to fall away until the aircraft was diving steeply towards the ground. Although its speed increased, the aircraft showed no signs of recovering and it continued to rotate in a manner consistent with a developing spin until it disappeared from sight behind trees a short distance from the end of the airstrip. Moments later, those on the ground heard the unmistakeable sound of a crash and when they reached the accident site, they found the aircraft had been demolished by impact forces. The pilot had been killed instantly.

* * * *

The pilot was 23-years-old and held a commercial licence with a B grade instructor's rating. His total flight time amounted to over 1400 hours, of which nearly 670 had been flown in the Cessna 150 and 172 types. In addition to his pilot qualifications, he was also studying for an aircraft maintenance engineer's licence and had obtained passes in airworthiness examinations. He had been approved by the flying school where he was employed, to give instruction in aerobatics but his experience in this type of flying was limited to a total of 17 hours. He was



not approved to conduct low-level aerobatics, nor did his flying background include any operations which would have given him particular experience in low level manoeuvring. Most of his flying had been instructional, and some of his aerobatic experience had also been instructional. There was no evidence that the pilot had ever previously engaged in a low level demonstration of this kind.

A detailed technical examination of the aircraft, its engine and control systems did not disclose any evidence of malfunction or pre-existing defect. At the accident site, the throttle was found in the closed position and impact damage to the rudder was consistent with the application of spin recovery action. Damage to the elevator control shaft where it passed through the instrument panel indicated the elevators were almost in a full-up position at the moment of impact, but this would be expected as an involuntary action by the pilot with the aircraft in such a steep nose-down attitude so close to the ground. Taken altogether, the control positions on impact suggested that the pilot was not incapacitated and that an effort was being made to recover from an incipient spin situation.

Examination of the wreckage confirmed that the aircraft had struck the ground at a high angle of attack while rotating to the left. While the aircraft had impacted in a 40 degree nose-down attitude, the actual angle of descent measured from strike damage to the surrounding trees, was 55 degrees below the horizontal. This would have produced an angle of attack in the vicinity of 15 degrees, which would certainly have placed the aircraft on, or very close to, the point of stall.

As the aircraft was taking off, one of the witnesses on the ground who had a movie camera began to film the manoeuvres and later, when the film was developed, it was found that the entire flight up until the moment the aircraft disappeared behind the trees, had been recorded. The film proved invaluable in reconstructing the aircraft's final flight path and, by examining it frame by frame, it was possible to determine the aircraft's speed relative to the ground and its height, at various times during the flight. At the point where the nose and port wing dropped uncontrollably, the film showed without doubt that the airspeed was at or slightly below the stalling speed in the power-off, zero flap configuration and for the angle of bank and all-up weight at which the aircraft was operating at the time.

In the course of the investigation, another Cessna Aerobat of precisely the same model was flown at a safe height to simulate as closely as possible the flight path filmed from the ground. The purpose of the flight was to determine whether the combination of manoeuvres flown could result in an interruption of fuel flow likely to cause an engine hesitation, and what degree of control would have been available to the pilot at the speeds and attitudes at which the aircraft was operating during the last few seconds of flight.

The bulk of the witness evidence indicated that the engine sound ceased at the top of the climb after the aircraft pulled up steeply near the end of the airstrip and the possibility was considered that the pilot might have taken-off with the fuel selector inadvertently set in the 'off' position. At a suitable height in the test aircraft, a take-off was simulated with the fuel cock turned 'off'. The fuel was turned off just before power was applied and the engine continued to operate for a further 17 seconds at full throttle before losing power. It was concluded therefore, that had the aircraft taken off with the fuel selector 'off', the engine would have failed from lack of fuel quite early in the flight, probably during the turn immediately after the aircraft left the ground. But instead, the engine continued to function normally during the subsequent low pass and throughout the rest of the flight up till the final manoeuvre. As the aircraft's total airborne time was a little over 36 seconds, there could have been no doubt that the selector was in the 'on' position for the flight. The possibility was also considered that the manoeuvres the pilot performed, in particular the 'push over' at the end of the steep pull-up just before the engine sound ceased, might have resulted in an interruption to the fuel flow. But when the flight path shown on the film was flown again at a safe height, there was no hesitation from the engine at any time.

This same series of flight tests revealed that, from the point where the nose fell away at the top of the steep climb, a height of about 400 feet would have been necessary to recover level flight.

* * * *

Although the pilot did not give any indication before take-off as to precisely what form the flight would take, it is apparent that he intended to demonstrate the aircraft's or his own capabilities. Although the majority of the witnesses gained the impression that the pilot had used a ' short field ' take-off technique, it was established from the film analysis that the ' considerable flap ' reported by the witnesses was nearly 30 degrees. The owner's manual for the aircraft type recommends that normal and obstacle clearance take-offs be performed with flaps up and recommends against the use of flap deflections of 30 degrees or more for take-off at any time. It is thus clear that, if it was the pilot's intention to commence the flight by demonstrating a maximum performance take-off, he did not use flap in the recommended manner. In fact if anything, his use of flap was detrimental to the aircraft's take-off performance.

If the take-off technique adopted by the pilot was indicative of his knowledge of the aircraft's limitations and its response near the lower limit of the operating speed range, then this same lack of appreciation of the aircraft's capabilities could well have contributed to the pilot's final loss of control. Flying downwind close to the ground, he would have been concentrating outside the aircraft and might well have gained the impression that the airspeed was higher than was actually the case. This effect would have been heightened as the aircraft cleared the tree line and climbed into an area of increasing wind speed and, of course, an even stronger downwind component. But possibly of even greater significance was the fact that the extreme nose-up attitude of the aircraft would have caused the airspeed to decay very quickly, with the inevitable result that the aircraft was in a stalled condition when it reached the top of the climb.

Although the manoeuvre the pilot intended to perform at the end of the low run cannot be known, up to that stage of the flight, he had remained in close proximity to the airstrip and the assembled spectators. It would have been consistent with the demonstration, as it had been flown to that point, for the pilot to have attempted to turn back towards the strip in an effort to keep the aircraft within the immediate area.

But at this point, the aircraft was already stalled and with the pilot probably attempting to hold the nose up with back elevator control, the aircraft fell away into an incipient spin. As the nose dropped, it is unlikely the pilot would have immediately relaxed the elevator back pressure, particularly as the aircraft was so close to the ground, and opposite rudder alone at this stage would have been insufficient to arrest the rotation. Even though the aircraft, as it descended, would have begun to slowly respond to the application of corrective rudder despite the back elevator control, there can be no doubt that, from the moment the aircraft began to spin, it was far too low for there to have been any hope of the pilot regaining control, no matter what recovery technique he used, before it struck the ground.

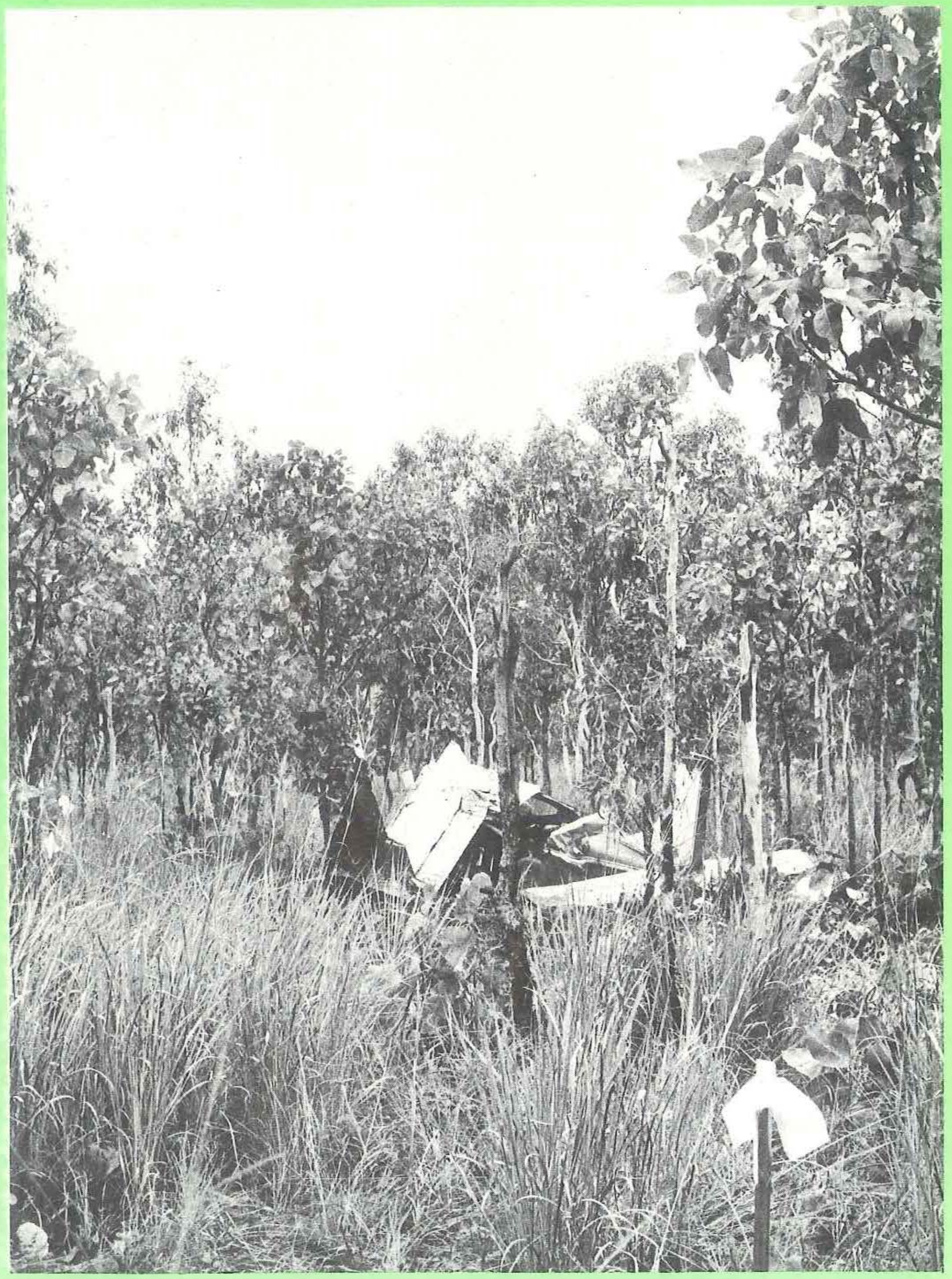
* * * *

The pilot was considered by his associates to be most reliable, with a keenly responsible attitude towards the supervision of his students and indeed, all aspects of his flying. It is thus all the more difficult to understand how he could have even contemplated such a display, especially when he had no approval to conduct any flying on the day other than that involved in the competitions.

But probably the most unfortunate aspect of all was the utter futility of the whole exercise. The gallery of pilots watching were well aware of the aircraft's performance and manoeuvring capabilities — indeed, several had flown it in the competitions earlier in the day — and the intended demonstration flight was not likely to have added anything to their aeronautical knowledge. But this point does not seem to have been appreciated by the pilot and, on the basis of what was in all probability an isolated, spontaneous decision by an otherwise stable and dependable person, he went ahead with his demonstration which was to have such tragic results.

The wreckage as it came to rest. The steep nose-down attitude on impact is clearly evident.

INVITING DISASTER



INVITATION ACCEPTED

'The controlled forced landing straight ahead is likely to result in far less damage and injury than an uncontrolled arrival while attempting to turn back. In other words, if you must drop in without warning, do it gently!' So said the concluding words of the article 'Inviting Disaster' In Aviation Safety Digest No. 89. In that accident, a Piper Cherokee 235 crashed when the engine failed just after taking off from Bankstown and the pilot attempted to turn back to the aerodrome. Both occupants were seriously injured.

Accepting that a pilot confronted with a forced landing on unfavourable terrain just after taking off, can find the temptation to try and turn back almost overwhelming, the article emphasised that though there have been instances where this manoeuvre has been successful, there have been far more which have ended in tragedy. Yet a further accident of this sort now gives weight to these words all too well.

Three aspects of the Cessna 182 wreckage as it came to rest in the dense scrub which surrounds the airstrip.

Below: The disintegration of the aircraft structure is evident from this photograph of the wreckage in the midst of the almost undisturbed scrub.

Opposite Page:—
Above: The initial impact crater and the very short distance which the wreckage slid is indicative of the steep angle at which the aircraft struck the ground.

Below: Damage to the aircraft's instrument panel provides a further impression of the force of impact.

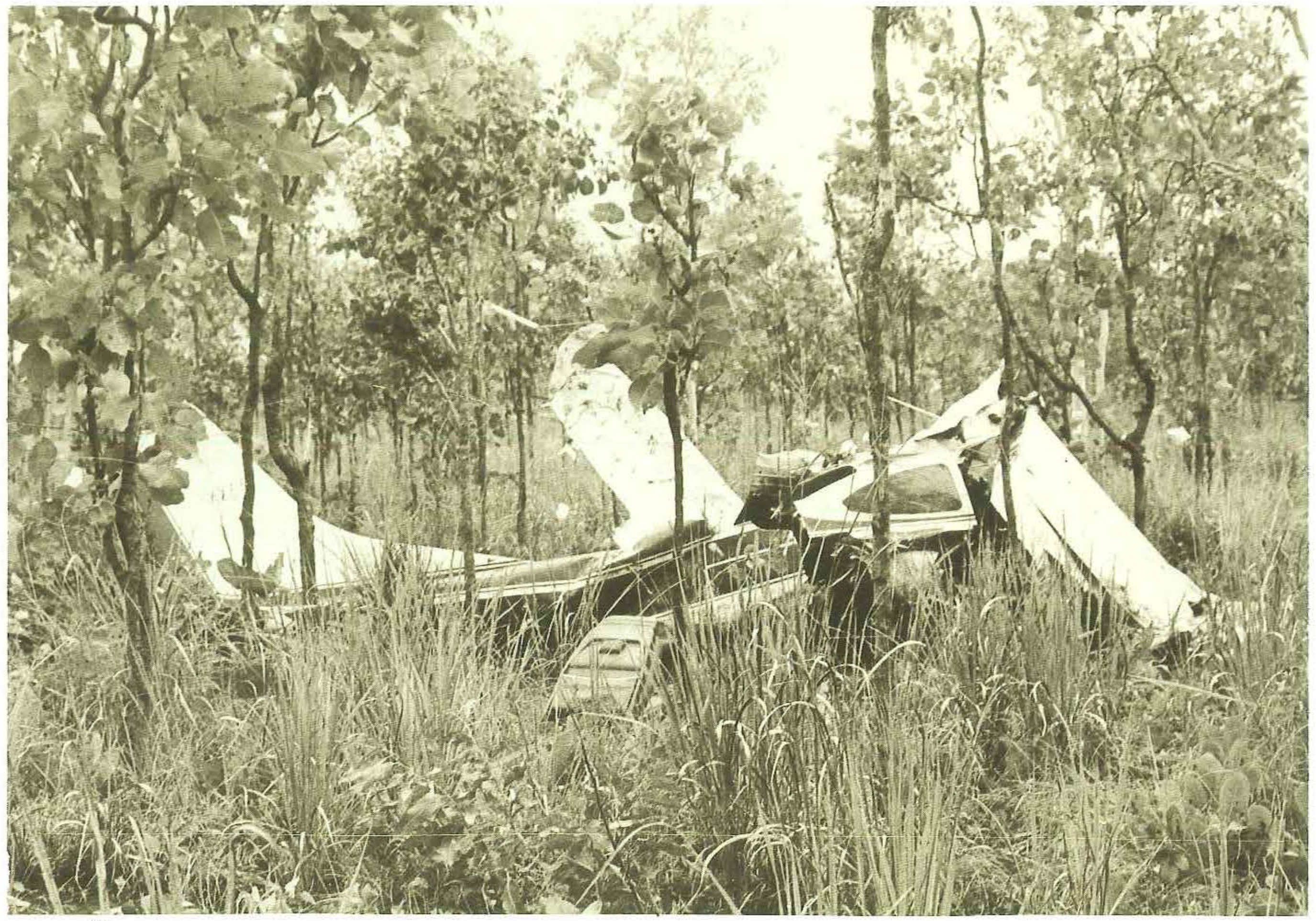
The aircraft concerned was a single-engined Cessna, one of two 182's taking part in a parachute dropping programme at Batchelor Aerodrome, some 64 km south of Darwin. Earlier on the day of the accident, the pilot had experienced difficulty in his radio communications with Darwin and, when the time came for the two aircraft to return to Darwin, he arranged to fly back in company with the other Cessna in case further radio problems were encountered.

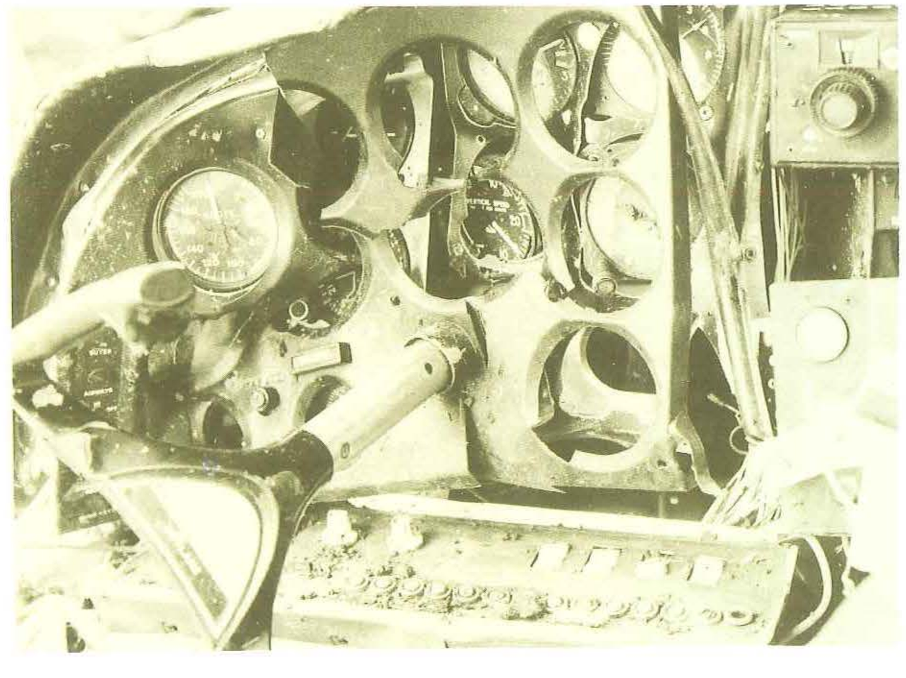
After the parachute dropping exercise had been completed, the two aircraft were made ready to return to Darwin. The pilot of the Cessna 182 subsequently involved in the accident refuelled his aircraft from drums belonging to a Batchelor aircraft maintenance organisation and, at about 1420 hours, after three passengers, (all of whom were associated with the parachuting exercise) had boarded the aircraft to return to Darwin with him, the pilot started the engine and taxied towards the threshold of runway 14 where the other Cessna 182 was already waiting to take off, standing across wind with its engine running.

When the taxi-ing aircraft reached the runway threshold, the pilot of the waiting Cessna saw it pull over to the northern side of the runway and swing round to face him, obviously to let him take off first. Expecting the second 182 to follow him immediately, this pilot therefore taxied on to the runway and took off. After climbing straight ahead to 500 feet and turning left to take up his heading for Darwin, he looked back to see if the second aircraft was following. When he could not see it on the strip, he assumed it had already taken off and was now flying behind him. He therefore called Darwin and reported his departure. The time was now 1430 hours.

Thirteen minutes later, when his aircraft had reached the Darwin River Dam and he had changed frequency to Darwin Approach Control, this pilot called to ask whether anything had been heard from the other Cessna as ' it had left at the same time. ' Neither Approach Control nor Flight Service had received calls from it, and Approach Control then established that the pilot of the first Cessna had not actually seen the other aircraft take off. After calls to the second aircraft by Darwin Flight Service, Darwin Tower, and by other over-flying aircraft had produced no reply, the Senior Operations Controller at Darwin attempted to contact the Batchelor police by telephone, but the call was not answered.

At 1511 hours, a Beech Bonanza which had just departed Darwin for Willeroo, was requested to check the Batchelor strip visually whilst on route. Twenty minutes later, this pilot reported that there was no sign of the aircraft at Batchelor.





Darwin next requested the Bonanza to land at Batchelor to check the hangar there, as well as to seek any local information on the missing aircraft. On landing, the crew of the Bonanza were met by the local aircraft maintenance engineer and, after they had telephoned Darwin to confirm that the missing Cessna was not on the ground at Batchelor, they contacted the local police. At Darwin's request, they then returned to the aircraft and took off to conduct a further local search from the air. At 1627 hours the Bonanza called Darwin to report sighting wreckage lying amongst the trees a short distance beyond the upwind end of runway 14. The Bonanza then landed again and, after leaving a message for the police and ambulance to come as quickly as possible, its crew taxied to the end of the strip where they left their aircraft and hurried through the bush to render assistance. On reaching the wreckage they found that the pilot and one passenger had been killed and the other two passengers were seriously injured.

The aircraft had crashed only 140 metres from the upwind end of the 14 strip in an area thickly covered by young gum trees. Its heading at the time of impact was 040 degrees magnetic, the aircraft having turned to the left through 100 degrees from its take off direction. It had struck the ground initially in a steep nose-down, port wing-down attitude, bounced, and then come to rest only 14 metres from its initial impact point. The damage sustained by the propeller indicated that it was developing no power at the moment of impact.

No witnesses could be located who had seen the aircraft take off, all the parachutists and spectators having left the aerodrome at the conclusion of the parachuting programme before the Cessna 182 departed. There was no clock in the aircraft, but damaged watches belonging to the occupants indicated that the aircraft had crashed between 1427 and 1428½ hours. The fact that the pilot of the other 182 was

INVITING DISASTER
INVITATION ACCEPTED

not able to see the other aircraft on the ground immediately after he had taken off, suggests that the ill-fated aircraft took off close behind and that it had already crashed when the other pilot looked back to check its position.

Witness evidence provided by the two surviving passengers left little doubt that the Cessna's engine had failed very soon after take-off, and their statements were consistent with the impact damage sustained by the aircraft's propeller. Despite the most careful examination of the wreckage and a strip inspection of the engine however, it was not possible to reach any definite conclusion as to the reason for the engine's sudden loss of power.

It is also evident from the statements of the surviving passengers, together with the mode of impact and the position in which the accident occurred, that when the engine failed, the pilot had immediately begun a turn to the left back in the direction of the strip. The evidence of one of the passengers who was a highly experienced parachutist, indicated that the turn was steep. The attitude of the aircraft when it crashed, the type of damage sustained, and the very short distance traversed by the wreckage after the initial impact, all point to the aircraft being in a stalled condition when it struck the ground.

The terrain surrounding the aerodrome at Batchelor is generally level but thickly timbered by small trees and scrub, with virtually no open space in which a forced landing could be accomplished without damaging the aircraft. Thus a loss of power soon after take-off would have placed the pilot in a very difficult situation. In fact, unless it was possible to get the aircraft safely back on to the strip, an accident of some sort was inevitable. For this reason the urge to try and do so was no doubt very compelling. However, in the course of the steep gliding turn necessary to return to the runway, it is apparent that the aircraft stalled, there was no possibility of recovering control in the height available, and it struck the ground in a steep nose-down attitude.

However poor the prospects were for a forced landing in this case, they could only become much worse once a loss of control had occurred. On the other hand, had controlled flight been maintained, even if this meant a landing in the trees, the accident might well have been much less severe. In fact at the same aerodrome only a few months before, another light aeroplane intending to return to Darwin, lost engine power shortly after take-off, and was landed straight ahead into trees at the opposite end of the same runway. Although this aircraft was badly damaged, the pilot, the only occupant, was not injured.

It is of course easy to be wise after the event, and nothing but sympathy can be felt for a pilot who has to make such an instant and irrevocable decision on which so much hangs. But as many readers already understand, the whole reason for reviewing this and other accidents in the Digest is that other pilots may learn from the experience and so improve the safety of their own operations. For this reason, it needs to be emphasised that in an emergency like this, as in the similar one covered in Digest No. 89, a landing straight ahead with only minimum turns to avoid any large obstructions, would have substantially reduced the severity of the impact.

Accident experience accumulated in Australian general aviation operations over the last 20 years, seems to indicate that a ' ditching ' into tree tops, especially one that is controlled and accomplished at the minimum possible airspeed, offers a good chance of avoiding serious injury. Without any doubt it is a far better risk than the uncontrolled, much more violent type of impact that usually follows a stall at low level. This question was discussed, instancing a number of examples, in the article ' After the Fall ' in Digest No. 88. A further quite dramatic example of the survivability of a controlled forced landing into trees is reviewed on page 14 of this issue.

There is one other safety lesson to be drawn from this accident. Again it is one that should be well known, but is clearly in need of further emphasis. Both the passengers who survived were wearing the safety belts provided in the aircraft. The third passenger who died in the impact wore no restraint equipment, and the pilot, though he had fastened his lap strap, was not wearing the sash harness fitted to the aircraft. The investigation indicated it is at least possible that the sash, if worn, could have prevented the fatal injuries the pilot sustained.

The Acid Test

Once upon a time, back in the early days of aviation, engine failure in flight was almost an everyday affair — an occupational hazard, you might say. For this reason, pilots on cross-country flights in that era flew mentally from paddock to paddock, fully prepared for an involuntary descent at any time. And in the slow, low-stalling-speed, high-drag biplanes of the day, forced landings could be successfully accomplished in fields that would be inadequate in many cases now.

These days of course, it is a different story. Though pilots are still trained procedurally to cope with forced landings, sudden complete engine failure is so relatively rare that many pilots do not really expect it ever to happen to them. In fact, some seem to regard it as so unlikely that it can be dealt with by the simple expedient of fervently hoping it will never happen!

But infrequent though they are today, engine failures completely beyond the pilot's control or influence do still occur from time to time. A sudden and complete engine failure of this sort is certainly a most unenviable situation for any pilot, but the fear of it should not be allowed to obscure the need to be constantly prepared for such an eventuality, mentally as well as procedurally. The value of being so prepared is borne out by an accident not long ago to a Bonanza.

The pilot concerned, with one passenger on board, had set out on a private flight from Kerang, Victoria, to Latrobe Valley, to attend an aviation symposium being held there. The flight, which was routed over Moorabbin Airport, proceeded quite normally until the aircraft was only a few kilometres from its destination.

Some five minutes earlier the pilot had changed the fuel selector to the auxiliary tanks and he had just begun to descend from 2000 feet when the engine suddenly began to vibrate and run roughly. Reasonably enough, the pilot at first assumed it was a fuel problem, but then he noticed the fuel

pressure was still satisfactory. However, he also saw the manifold pressure had dropped to 20 inches from the 22 inch setting upon which he had been flying. But before he had time to give the problem any further thought, a loud and obviously expensive metallic noise came from the engine, and it lost power.

The pilot set the aircraft up in a glide, turned off the fuel and magneto switches, and transmitted a Mayday call. Realising he had no hope of reaching the aerodrome, which was still some eight kilometres away, he turned the aircraft to the right on to a southerly heading, away from a nearby built-up area, and began looking for a place to put the aircraft down.

Alongside and immediately to the north of the Princes Highway, the pilot sighted three narrow paddocks aligned end to end. They seemed relatively clear of obstructions and, as they lay east-west, they would enable him to land directly into the easterly wind which was blowing. The pilot therefore turned the aircraft on to an easterly heading, lowered full flap and made an approach towards the nearest of the three paddocks. But as he did so he saw that it was not suitable for a forced landing, as it contained a dam and was crossed by irrigation piping.

By this stage also, the pilot saw that all three paddocks were only of limited length, and decided to land wheels-up. He therefore raised the flaps again to reduce damage to the aircraft during the landing.

Approaching the second of the three paddocks, the pilot realised that it too was unsuitable for a landing because of the heavy tussock grass growing in it. At 75-80 knots, the aircraft still had plenty of airspeed, so the pilot held it in the air a little longer then, passing low over the down-wind fence of the third paddock, he gently forced the aircraft on to the ground. The aircraft bounced slightly several times and slid to a halt, coming to rest only 106 metres from the point of initial touchdown.

As soon as it had stopped moving, the pilot and his passenger, both of whom were unhurt, vacated the Bonanza. The crew of another aircraft

Opposite Page:—

Above: The aircraft as it came to rest in the paddock, looking in the landing direction. The touchdown marks are visible in the foreground.

Below: View of accident site looking north. At the time of engine failure the aircraft was on an easterly heading in the vicinity of the water cooling towers in the background.

This Page: As is evident from this photograph, the aircraft sustained only slight structural damage in the forced landing. The fields over which the aircraft approached can be seen in the background.

flying nearby who had heard the pilot's Mayday call, saw that it had forced landed successfully and reported the fact to Melbourne Flight Service.

* * * *

Apart from the internal damage to the engine, which was entirely of a mechanical nature, the aircraft sustained little harm in the forced landing, as is clearly evident in the photographs.

The field in which the aircraft was force landed was 250 metres long in an east-west direction. Of the three paddocks the pilot had considered, this one was the best both from the point of view of condition and location. It had been used for grazing cattle and had a firm, slightly undulating surface.

Under the most favourable circumstances, it might have been possible to land the aircraft wheels-down in this particular field, but to have attempted to do so on this occasion would have incurred a high risk of overrunning the upwind fence and crashing into the trees which lay beyond it. According to the aircraft's landing weight chart, the distance which would have been required to complete a landing from a threshold height of 50 feet, using the recommended approach speed of 66 knots, was 380 metres. Although in this case the aircraft crossed the downwind fence considerably lower than 50 feet, a distance of more than the available length of the field would probably have been required to bring the aircraft to a stop at the actual approach speed.

Discussing the accident afterwards, in particular his decision to land wheels-up, the pilot said he had read of cases where nose-legs have collapsed during forced landings on unsuitable surfaces and the aircraft have overturned as a result. In this case he felt the surface of the field warranted a wheels-up landing and as well he did not believe it would have been possible to brake to a stop in the distance available.

The wisdom of the pilot's decision is vindicated by the fact that the aircraft sustained little damage and that he and his passenger stepped out unhurt. Had he attempted to land wheels-down, it seems quite likely that the aircraft would have been more severely damaged and the two occupants might well have been injured. As it was, both the pilot and passenger remarked how glad they were for the security provided by the full shoulder harnesses they were wearing. They would not care to have been wearing only lap straps at the time, they said.

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In telling this story, the Digest is by no means advocating wheels-up landings in every forced landing situation in retractable-undercarriage aircraft. In this case, the successful outcome of the forced landing was the result of the pilot's decision to land with the undercarriage up and certainly, there are other cases on record where a wheels-up landing would have produced a far happier result than the wheels-down forced landing actually made. But a decision to lower the undercarriage or not, can only be made at the time by the pilot actually faced with the prospect of a forced landing and surely, this is the lesson of this particular accident for other pilots unlucky enough to suffer complete engine failure in aircraft of this category.

The 'text book' arguments against wheels-up forced landings are that there is a tendency to touch down too fast, the fuselage of necessity comes into collision with even small objects in the landing path, and any impact forces are transmitted directly to the aircraft and its occupants. With the undercarriage extended on the other hand, the main impact forces of a forced landing are more likely to be taken by the undercarriage. Furthermore, for as long as the undercarriage remains in position, there is some directional control available on the ground for avoiding major obstacles. Against these objections of course must be set the possibility of secondary impacts and loss of directional control resulting for the dislodgement of one or more undercarriage legs, and the chances of wing fuel cells being punctured or otherwise disrupted in the process.

From a practical point of view, on the basis of the many investigations that have been made into forced landing accidents, it would seem unwise to state categorically that either a wheels-up or a wheels-down landing is generally safer in all circumstances — no one can reasonably predict what those circumstances are likely to be in every situation. For this reason the particular conditions must be, indeed can only be, assessed by the pilot, and the appropriate decision made at that time.

Into the TREES

While carrying out a supply drop in mountainous country 65 km south west of Devonport, Tasmania, a Piper Cherokee 180 lost engine power and the pilot was forced to 'ditch' the aircraft straight ahead into a heavily timbered mountainside. Although the aircraft was completely destroyed by impact forces and fire which followed, the pilot and despatcher escaped with only minor injuries.

The aircraft belonged to a charter and aerial work operator based at Devonport and the purpose of the flight was to drop stores to a boys' camp in a mountain valley on the upper reaches of the Mersey River, eight kilometres west of Lake Rowallen. The floor of the valley in which the dropping zone was located was 2000 feet AMSL and the surrounding mountains rose to 3000 and 4000 feet.

In preparation for the dropping operation, the aircraft's luggage door and rear passenger seat back had been removed, and the stores to be dropped were packed in 19 small hessian bags. The pilot in command held a commercial licence and the person acting as despatcher, a private licence. Departing from Devonport shortly after 1000 hours the aircraft arrived over the dropping zone some 20 minutes later. The weather was fine and mild with a westerly wind and there were two oktas of strato-cumulus cloud at 5000 feet.

Once over the dropping zone, the pilot carried out a normal pre-landing check which included turning on the electric fuel pump. Lowering two stages of flap, he then descended on a northerly heading to a height of about 800 feet above ground level for the first run and the despatcher dropped two of the parcels to check their trajectory. The pilot then applied power again and raised the flap, placed the aircraft in a climb, and began a turn to the left to position it for the second dropping run. But after responding normally for a few seconds the engine began to lose power.

With nothing in the instrument indications to suggest any reason for the loss of power, it quickly became evident to the crew that the aircraft was not going to clear the rising terrain ahead. Calling to the despatcher to brace himself, the pilot lowered two stages of flap again and allowed the aircraft to settle nose-up into the tree tops of the densely timbered slope in front of the aircraft. The aircraft fell to port through the trees, coming to rest upside down on the ground and immediately caught fire. The despatcher escaped from the wreckage through the open luggage doorway and the pilot broke his way outwards through the windscreen.

After the aircraft had burned itself out, the two members of the crew decided they would try and walk back to the boys' camp where they had been carrying out the supply drop. Some five hours after the accident, a searching helicopter located them three kilometres south east of the accident site. It picked them up and flew them to Devonport.

* * * *

In the wild and inaccessible area in which the aircraft had crashed, great difficulty was encountered, firstly in locating the wreckage from the air, and then in reaching it in order to carry out an investigation into the accident. The site was eventually found by using a helicopter to simulate the flight path the aircraft had followed after it had completed its single run over the dropping zone. In this way, what little remained of the aircraft was eventually found on a sloping valley side in dense myrtle forest, nearly four kilometres north of the camp site where the supply drop was to have been made. The relationship of the wreckage to topographical features was noted and the helicopter was then landed in a clearing on a ridge some one and a half kilometres north of the accident site. From here the investigation team then attempted to retrace their way to the accident site on foot. Because of the rugged terrain and dense nature of the undergrowth, however, this plan proved almost impossible and the investigators were forced to return to the helicopter.

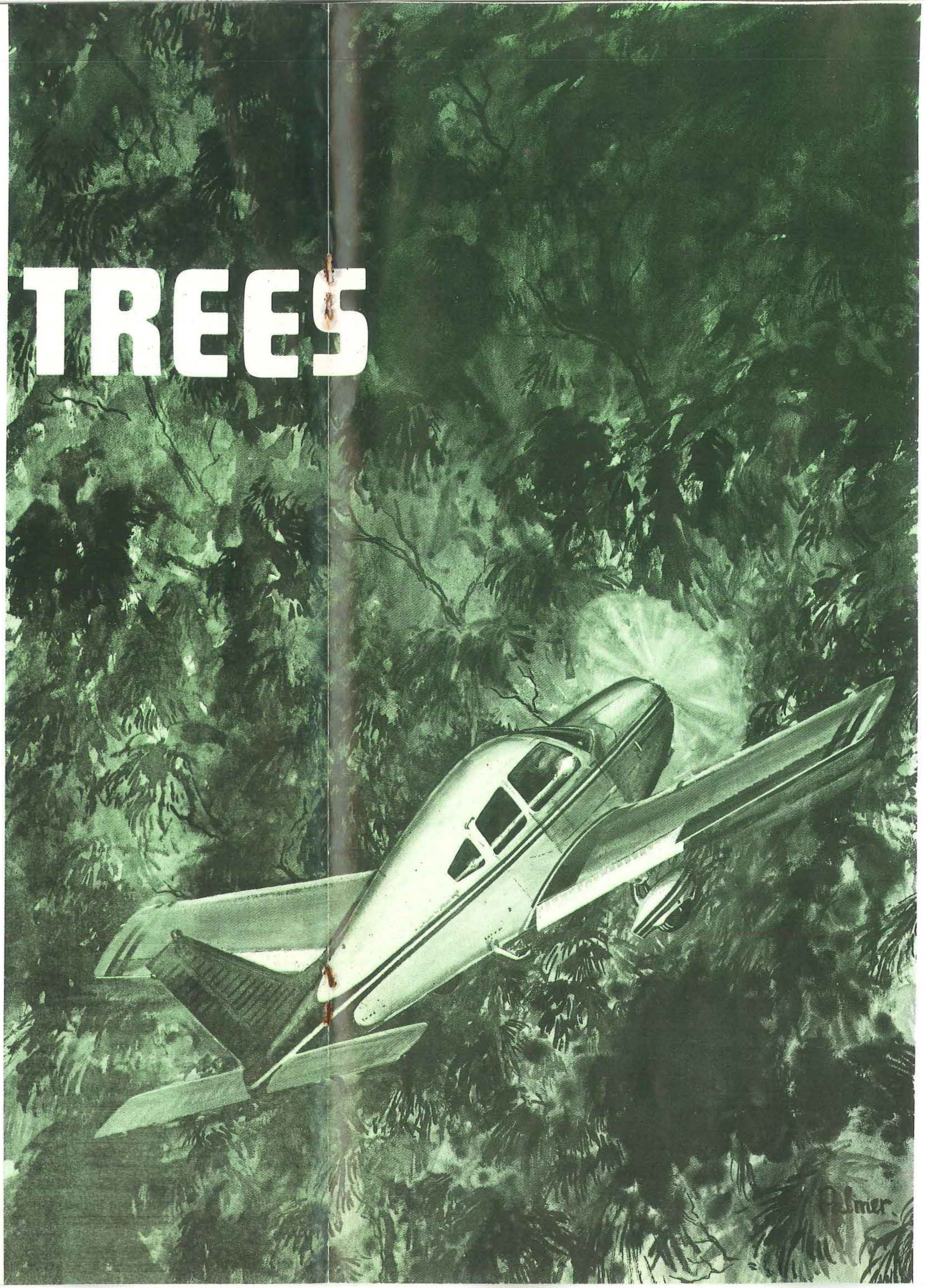
Three days later another attempt to reach the wreckage was made, using four wheel drive vehicles, which were able to get within 12 kilometres of the accident site. From this point, a ground party again set out on foot, but this time violent weather conditions intervened to foil the attempt, and the party had to abandon their efforts and return to the vehicles after walking for nearly nine hours.

Finally, a week later again, by following a different route in finer weather conditions, the ground party was able to reach the wreckage which was found on the forest floor on steeply sloping ground, close to the edge of a deep gully. The average height of the trees into which the aircraft had crashed was 14 metres.

The remains of the fuselage lay inverted on the ground and all but its rear section, together with the tailplane, fin and rudder, had been consumed by fire. Both wings had been torn off in the impact and were lying against the port side of the rear fuselage. The port wing, the closer of the two to the fuselage, had been almost completely destroyed by fire, and the starboard wing, which was severely buckled and torn had been badly burnt at its root.

Two metres of the outer section of the port wing was found 30m down the slope from the main wreckage, and an impact mark on its leading edge showed that it had struck the trunk of a tree at a high angle of attack. A tree with its top snapped off was identified nearby.

Because of the location of the accident site, it was impractical to remove the engine for a detailed strip examination and only an on-site inspection was possible with very limited facilities. Even then the examination

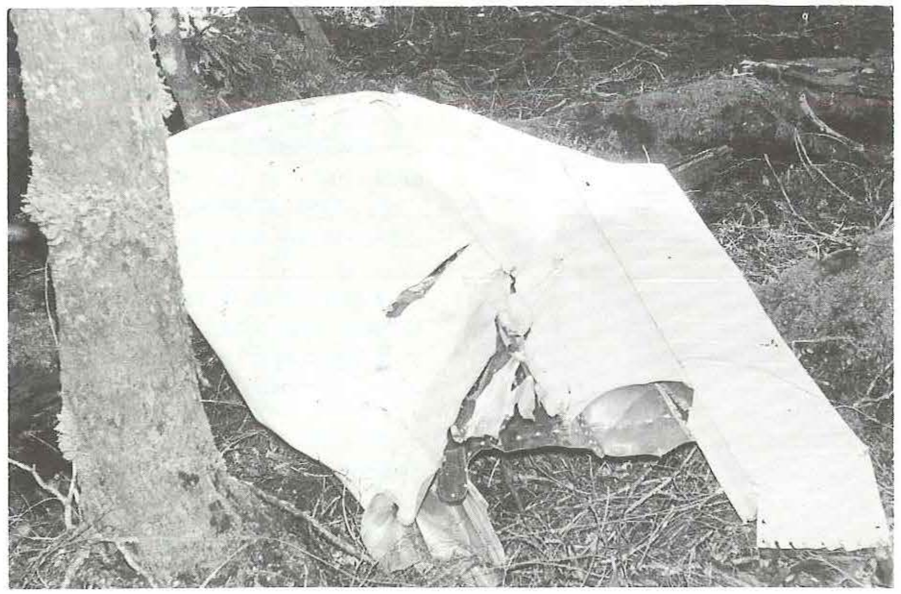


of the engine and its accessories was severely handicapped by the fact that many components had been completely destroyed by fire. Even major components of the engine had suffered extensive heat damage, but what remained indicated that all controls were intact at the time of impact. Although part of one propeller blade had melted, it was evident that little or no power was being delivered by the engine at the time of impact. It was not possible however, to determine the reason for the engine's loss of power.

* * * *

Supply dropping is not unusual in this part of Tasmania and it was evident that the pilot had taken adequate precautions for the safety of the operation. The flight was properly planned in all respects, the aircraft was approved to fly with the luggage door removed, and in the dropping zone the pilot remained at a safe height and carried out a safety check before beginning his first run.

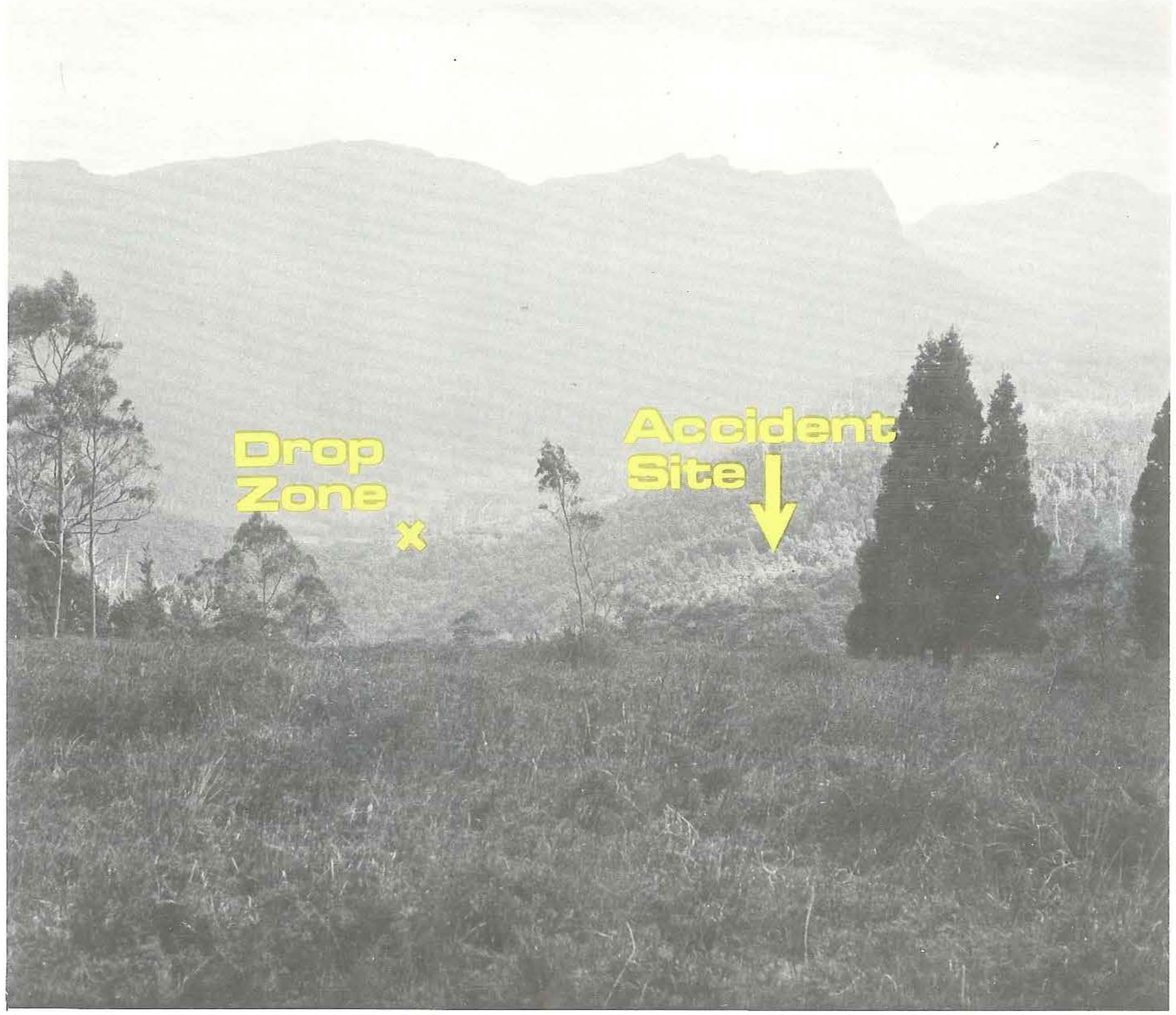
It is apparent that when the engine lost power, the pilot did not have time to complete a full trouble check before he was forced to concentrate his attention on ' ditching ' the aircraft into the tree tops. As it was not possible to determine the reason for the loss of power, it cannot be known whether the trouble check, had it been possible to complete it, could have affected the outcome. In the circumstances there was no possibility of effecting a landing without incurring serious damage. Even if the pilot had been able to turn back and attempt a landing near the camp site, he would still have had to contend with high tussocks as well as logs and rocks, strewn about the valley floor. The pilot obviously made the most of the situation, and as events proved, his technique in allowing the aircraft to settle nose-up into the trees while still under control at low airspeed, was undoubtedly the right one. Except for the outbreak of fire, the outcome of this



Above and Left: The dense forest in which the pilot was forced to land is apparent in these two photographs. More difficult terrain in which to make a forced landing can scarcely be imagined.

Opposite Page: General view of area taken from where the investigation team's helicopter first landed, showing drop zone and accident site.

Below Left: The outer section of the port wing, torn off as the aircraft descended into the trees, was found 30 metres from the main wreckage.



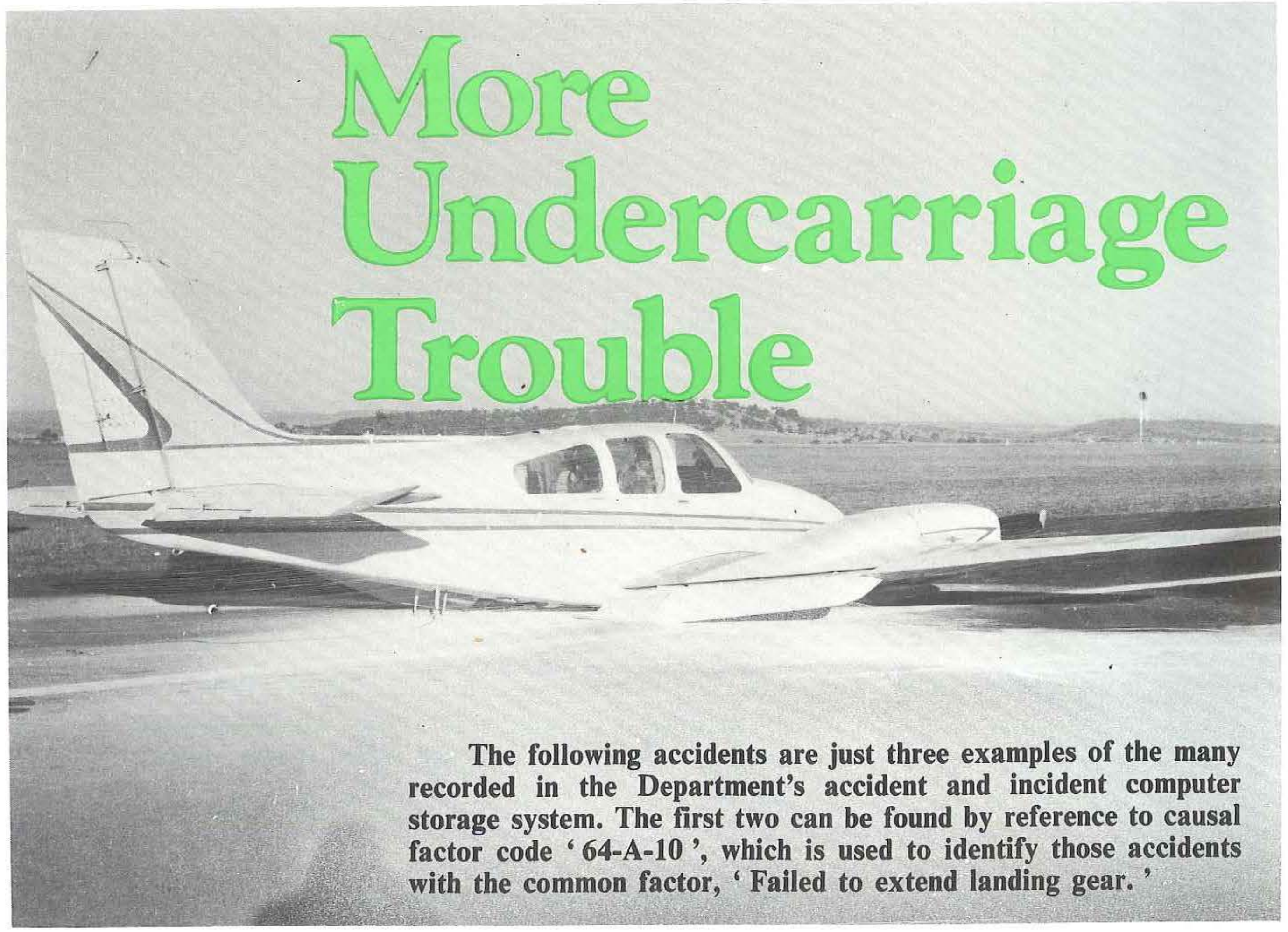
crash landing is remarkably similar to that involving the Cessna 172 in the article ' I Had No Fears About Flying in Cloud ' in Digest No. 75. With others, these accidents show that a properly controlled crash into trees in a light aircraft can offer a very good chance of escape from serious injury.

There is one other important safety aspect to this accident and this is the very serious fact that the aircraft caught fire immediately it crashed. Indeed, had the crew been only slightly stunned in the impact, the outcome of the accident could have been tragically different.

Describing the sequence of events later, the pilot said that he had turned the master switch and fuel off as the aircraft came to rest **after** falling through the trees, but fire broke out immediately. From the limited examination of the wreckage that was possible, it seems that the fire could have been started by the breaking of the fuel filter bowl as the aircraft struck the trees. This would have released fuel under pressure from the electric auxiliary fuel pump which, having been switched on during the cockpit check immediately before the dropping run, would have been still running at the moment of impact. Located immediately above the fuel filter bowl and the electric auxiliary fuel pump on the engine compartment firewall, is the engine starter solenoid and associated electric cables. Had these been damaged by impact at the same time as the fuel bowl, a source of ignition for the fuel fire could have been provided.

This comment is in no way intended to be critical of the pilot, who had very little time for the decision and actions he was forced to take. But for the sake of what can be learnt from this accident, it is necessary to point out that if the fuel and switches had been turned off **before** the aircraft struck the trees, the outbreak of fire might have been averted.

More Undercarriage Trouble



The following accidents are just three examples of the many recorded in the Department's accident and incident computer storage system. The first two can be found by reference to causal factor code ' 64-A-10 ', which is used to identify those accidents with the common factor, ' Failed to extend landing gear. '

On descent to Toowoomba, Queensland, late in the afternoon, the pilot of this Beech 55 became somewhat concerned when he heard traffic using runway 29, as this meant a landing with the sun in his eyes. After observing the wind direction therefore, he decided to use the reciprocal runway 11, even though this would involve landing downwind. But later during the descent he changed his mind and decided to use the into-wind runway after all.

As a result of the pilot's indecision and the fact that he had misjudged the wind strength during his descent, the aircraft entered the circuit area both too high and too fast. On the downwind leg the pilot saw that the airspeed was still too high so he reduced power to 12 inches Hg. and deliberately omitted to lower the flaps and undercarriage, intending to wait until the airspeed had washed off sufficiently.

As he turned on to base leg the pilot saw the airspeed was now low enough to permit the extension of half flap and while still on this leg, he cancelled his Sarwatch. Because the sun was now sufficiently low to make it difficult to see the runway, he again began to doubt its suitability for landing. As a result he overshot his turn on to final approach, and was forced to apply power and execute an S-turn to regain the correct approach path. By this time the continual ' beep beep ' of the undercarriage warning horn, which had been sounding since the descent had begun, had lost some of its urgency. Having regained the approach path, the pilot lowered full flap and placed the propellers into full fine. As he closed the throttles for the roundout, the aircraft seemed to float a little longer than usual, but it was not until the underside of the aircraft hit the ground that the pilot realised that he had forgotten to lower the undercarriage.

The underlying reason for this accident was probably that, at no time during his approach, did the pilot have a definite plan of action. In fact, from the time the pilot left his cruising height, his actions could only be described as untidy and disorganised.

Wherever possible, decisions concerning landing direction and circuit procedures should be made well before entering the circuit to enable essential cockpit checks to be conducted in an orderly manner without interruption. In being so indecisive on this occasion, the pilot left no time for his normal, routine prelanding drills.

* * * *

The pilot of this Beech Bonanza was practising circuits and landings at Archerfield, Queensland. It was his intention to make as many ' touch and go ' landings as possible during the 30 minute period for which he had booked the aircraft.

However, his attempt to achieve the maximum number of circuits was repeatedly frustrated by a series of minor occurrences and delays, necessitating some changes of plan and some effort on his part to adjust separation in the circuit. On one occasion he had to go around when another aircraft taxied the full length of the runway and on several occasions he experienced difficulty adjusting his position in the circuit relative to a larger aircraft which was carrying out a similar exercise.

On the downwind leg of one circuit, as the pilot was assessing the traffic, yet another aircraft taxied on to the runway before being told to vacate it. As a result of his pre-occupation with this possible obstruction, the pilot omitted to lower the undercarriage.

After turning base, the pilot nominated a ' touch and go ' landing

but shortly afterwards amended this to a full stop because of his present unfavourable position in the circuit.

It was the pilot's habit to make a pre-landing check on final approach but, just as he was doing this, the aircraft happened to be buffetted by the slipstream of the preceding aircraft and because he wanted to give his passenger as smooth a ride as possible, he brought his hand back to the control column. Unfortunately also, there was an intermittent fault in the undercarriage warning system which prevented the undercarriage warning horn from sounding when he closed the throttle to land. The outcome was almost inevitable.

Undoubtedly the pilot was frustrated by the circumstances of the flight but it is in just such situations that orderly cockpit checks become more necessary than ever. Unexpected distractions and operating pressures are conducive to forgetfulness and can divert a pilot's attention from the immediate task of flying the aircraft. It is thus imperative that pilots adopt a routine, regular sequence of cockpit checks to ensure that an essential item is not overlooked.

* * * *

Our last undercarriage accident is somewhat unusual in that, in this instance, the pilot failed to ensure that the undercarriage was **retracted** for landing! (code 64-A-11).

On arrival at West Wallabi Island, Houtman Abrolhos, Western Australia, at the end of a flight from Geraldton, an amphibious Cessna 185 made a wheels-down water landing and, upon touching down, violently pitched forward and decelerated rapidly, coming to rest inverted in about a metre of water. Fortunately the cabin area remained intact and was not immersed, and a boat was quickly on the scene. After some difficulty in releasing the passengers, who were suspended in their seat belts, the aircraft was safely evacuated. The aircraft was substantially damaged by impact forces and sustained further extensive damage as a result of salt water immersion.

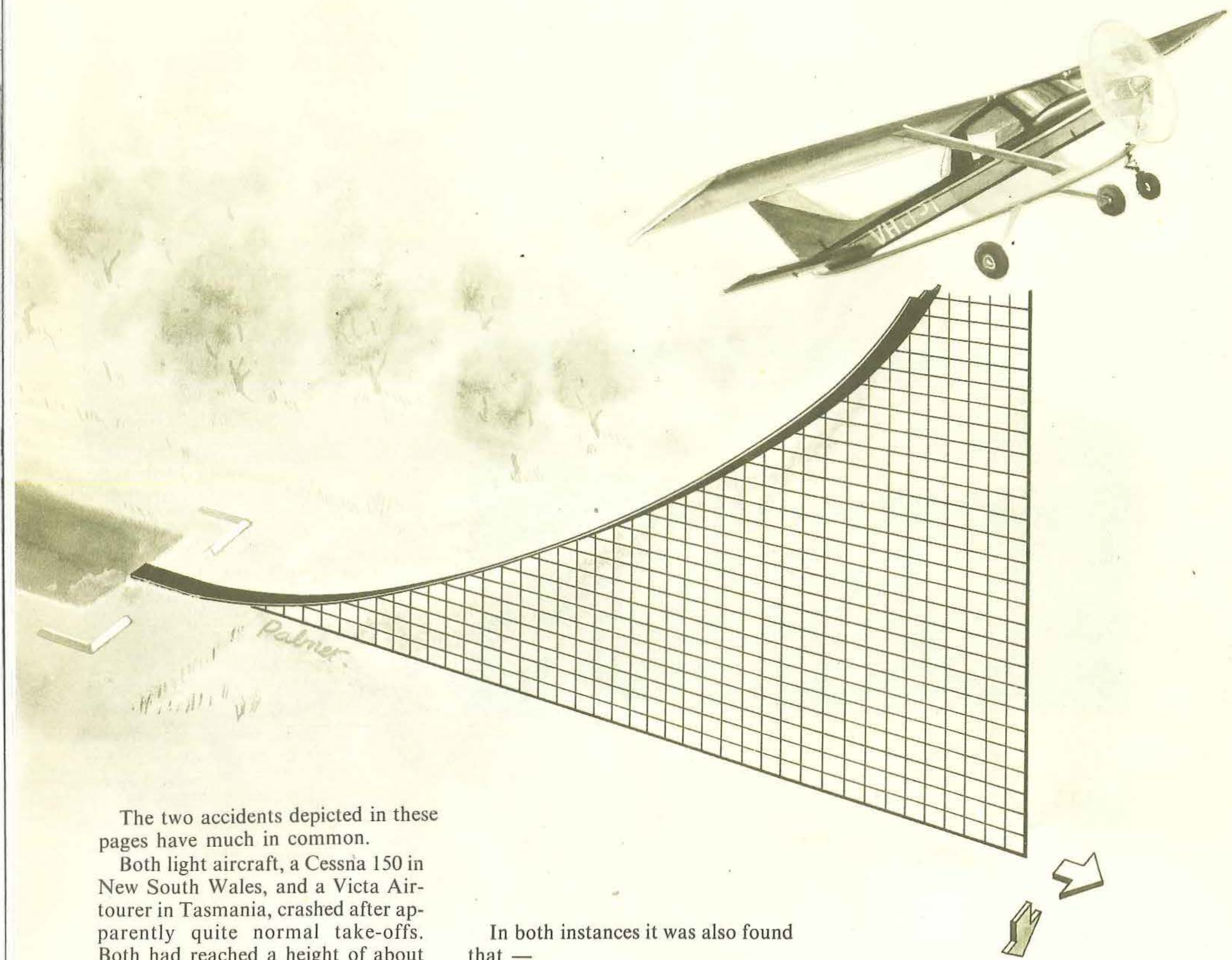
The aircraft had been engaged in amphibious work involving constantly alternating land and water operations, mainly between Geraldton and the Abrolhos Islands. Each of the aircraft's two floats was equipped with a retractable nose and main landing wheel.

It could not be determined if the pilot had failed to retract the undercarriage on departure from Geraldton or if he had inadvertently lowered it without being conscious of the fact, during his pre-alighting check on arrival at West Wallabi Island. It was the pilot's normal practice to check the position of the undercarriage on the downwind leg of the circuit, but he could not definitely recall having done so on this occasion. His flying record and experience reflected sound flying habits including the proper performance of cockpit checks. In this case however, if the pilot did carry out a full pre-alighting check, he could not have been correctly relating it to the aircraft's situation.

Another factor which might have contributed to the accident was the fact that the pilot was probably suffering the effects of fatigue. He had been flying and working long hours during the preceding weeks and the short, repetitive flights, by their very nature, would have developed a monotony which could well have reduced his alertness to the point where he was not conscious of the unsafe undercarriage selection.

But whatever the reason for the pilot's error in the unusual and somewhat different cockpit checks he was obliged to perform, the fact remains that the amphibian's undercarriage was lowered or was down for alighting when it should have been UP. In this condition an accident of some sort was bound to occur on touchdown — yet a further variation on the extensive theme of ' undercarriage trouble ' for the Department's computer ' memory '!

ON THE WRONG SIDE OF THE POWER CURVE



The two accidents depicted in these pages have much in common.

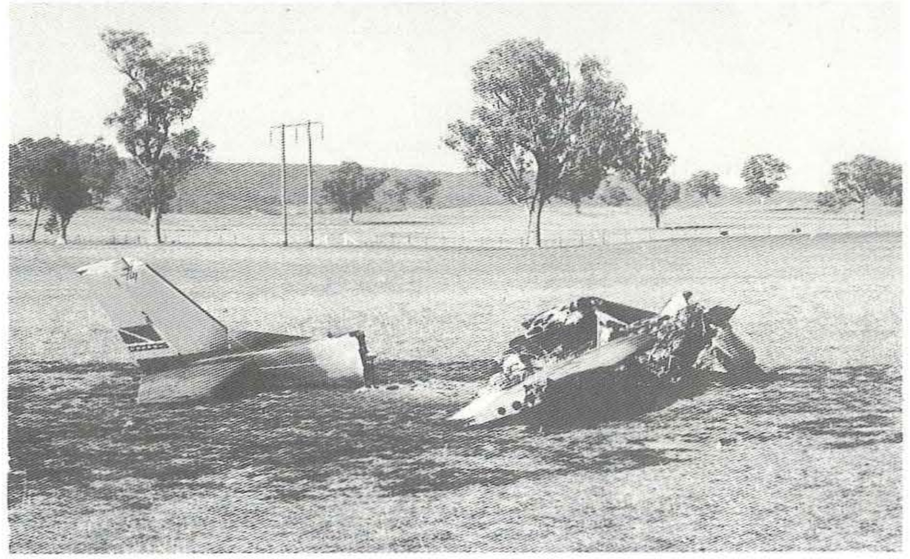
Both light aircraft, a Cessna 150 in New South Wales, and a Victa Airtourer in Tasmania, crashed after apparently quite normal take-offs. Both had reached a height of about 150 feet when the airspeed decayed, the stall warning sounded, and the aircraft began to sink. In both cases also, apparently normal power was still being delivered by the engine.

Investigation established more common ground. In neither case was there —

- Any fault evident in engine or airframe.
- Any possibility of fuel starvation.
- A likelihood of carburettor icing.

In both instances it was also found that —

- The field being used for take-off, though adequate, did not provide a large margin for error.
- The aircraft was operating close to its maximum weight in almost calm conditions.
- The pilot's previous flight, a short while before, had been made comparatively lightly laden, without a passenger.
- The pilot was inexperienced on the aircraft type.
- Rising ground beyond the field in the direction of take-off would have provided a false horizon.
- The pilot, having previously selected take-off flap, increased the setting to **full** flap in the course of the take-off, apparently in an attempt to improve the aircraft's performance.



The gutted wreckage of the Cessna 150. It is possible that the power line and rising terrain in the background affected the pilot's judgement.

What is the key to these two strikingly similar near-tragedies in different aircraft types and in widely differing localities? (Thankfully, in both instances also, the occupants escaped with comparatively minor injuries). Undoubtedly the answer lies in the combination of circumstances common to both situations.

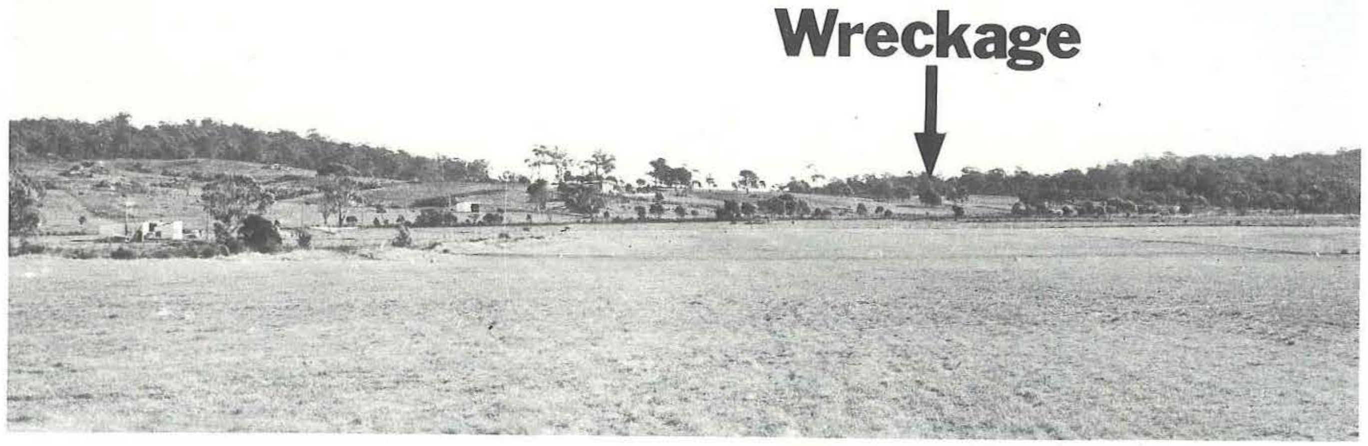
Probably the pilots would have been concerned about the length of the field and the obstructions beyond it, in relation to the load they were carrying. Possibly they were not sufficiently experienced to be fully confident of their aircraft's capacity to cope with the situation. As a result, they could have been pre-occupied with the task of getting airborne and climbing away to the detriment of monitoring their airspeed until too late. Possibly aided and abetted by a false horizon presented by the more distant terrain, the aircraft were placed in an excessively high nose-up attitude during the attempt to climb.

This situation, which was further compounded by the aerodynamic blunder of attempting to use an excessive amount of flap during the climb, would have produced a condition where the aircraft's drag was greater than the thrust being produced by the engine, even at full power. As a result, the speed decreased, the aircraft squashed and lost height. Finally, when the angle of attack had reached the critical point, the aircraft stalled at a height from which recovery was not possible, even though in each case the pilot lowered the nose.

The two accidents stress the importance of monitoring one's airspeed when aircraft performance is critical, as well as when flying amid terrain that is conducive to spatial disorientation. Additionally, they demonstrate how necessary it is to have a proper understanding of the effect of flap on lift-off and climb performance.

Use of Flap for Take-off:

The use of flap increases the lifting capability of an aeroplane's wing, while at the same time reducing its stalling speed. Extending the flaps alters an aeroplane's lift-off and climb performance by permitting the use of lower unstick and climbing speeds, which in turn derive from the reduction in stalling speed that occurs as flap deflection is increased. The advantages gained during operations from soft surfaces, fields of marginal physical dimensions, or marginal distance available to clear obstructions, are obvious.

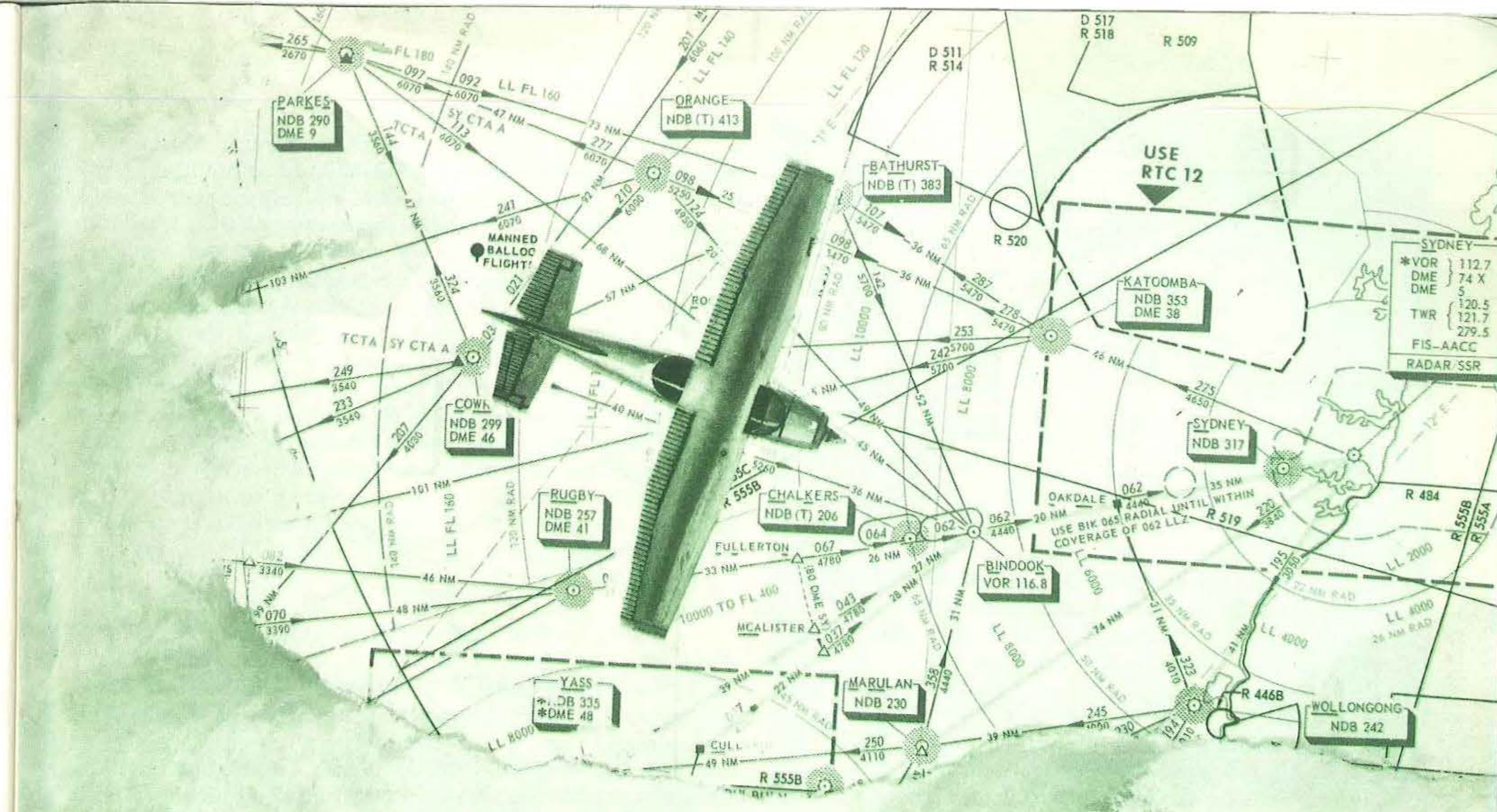


The remains of the Victa Airtourer involved in the other very similar accident.

It must be emphasised however, that in order to take advantage of any improvement in performance resulting from the use of flap, the aircraft's take-off safety speed must be reduced by the correct amount as flap is extended. Obviously, any benefits in terms of distance or height which may be gained by the use of flap will be lost if the pilot attempts to accelerate the aircraft to the higher ' flaps-up ' take-off safety speed.

A significant loss of performance can also result from the use of flap deflections **in excess** of the recommended maximum. There is no advantage in using more than the recommended take-off flap setting; too much flap can seriously reduce an aircraft's lift-off and climb performance. The reason is that, although extending more flap will always increase lift, any such increase is accompanied, particularly after the first few degrees, by a corresponding increase in drag. If flap is extended further, the **rate of change** in lift **decreases,** while the **rate of change** in drag **increases.** Before long a point is reached where any further extension of flap produces no real benefit in lift, but incurs a considerable penalty in drag. For most practical purposes, this point can generally be regarded as about half the maximum flap extension, though of course it may vary according to the design of the particular aeroplane type. Any attempt to use more than this amount of flap for lift-off and climb can result in a quite substantial reduction in performance because of the increase in drag which the additional flap extension produces.

The adoption of the correct aircraft operating technique is essential if the performance data published in the flight manual is to be realised in practice. The aircraft must be flown with precision and the flap settings and take off safety speeds recommended on the take-off weight chart must be strictly observed. This is especially important in low-powered aircraft where factors such as turbulence and wind shifts can also have a serious effect on performance, or whenever the aircraft's operation is in any way limited by the characteristics of the area from which the take off is to be made.



CLOUD DARKNESS RAIN ICE!

Palmer

The story that follows happened while I was making an IFR flight, very late in the day, from Parkes to Bankstown, N.S.W., in a Cessna 182. On board with me were two passengers and a small amount of luggage.

I had intended to make the flight early so as to arrive at Bankstown before last light, but was forced to postpone our take-off because Bankstown had been closed throughout the day to all but IFR departing aircraft. At 1615 hours however, when I rang Dubbo Flight Service to check on the weather conditions they had improved to the extent that IFR arrivals were now being accepted at Bankstown. Even so, an alternate was required because of the low cloud and strong south-easterly winds. Dubbo suggested that Tamworth would be a suitable alternate and mentioned that three other aircraft were about to depart for Bankstown.

I decided that the flight to Bankstown was possible and I prepared an IFR flight plan, selecting 7500 feet as my cruising height from Parkes to the Bindook VOR. I chose this altitude because I understood (wrongly as it turned out) that the forecast freezing level was 7000 feet. The Lowest Safe Altitude on this route is 6070 feet, so that 7500 feet was the best quadrantal altitude available to me. Although I realised this would place the aircraft slightly above what I thought was the freezing level, I believed that if icing conditions proved to be a problem, I would have room to descend into warmer air and yet still remain above the Lowest Safe Altitude for the route.

After telephoning my flight plan to Dubbo Flight Service we departed Parkes at 1700 hours and as we climbed to cruising altitude, we encountered stratus cloud between 2000 and 3000 feet. Soon afterwards Sydney Flight Service passed us an amended Bankstown terminal forecast to the effect that conditions had improved further and that the cloud base there was now 2500 feet. This helped to reassure me that I had made the right decision in going ahead with the flight.

But as the flight proceeded we seemed to be losing time and I calculated that we were now ten minutes behind schedule. I therefore passed an amended ETA to Sydney, assuming that the winds were stronger than I had allowed for. Even though most of the flight so far had taken place in cloud and rain, there was no sign of carburettor ice but I remember looking at the outside temperature gauge and noticing that the needle was hovering about the 0° Centigrade mark. This indication was soon confirmed by the fact that we could occasionally see small blebs of ice in the droplets of water on the wing struts.

Apart from the fact that our ground speed was lower than planned all seemed to be going well — at least until about ten minutes before our ETA Bindook. Normally by this stage the VOR's identification code can be heard loud and clear, but this time the signals were fainter than they should have been, indicating we were still some distance from the station. To make matters worse, the small blebs of ice that I had been seeing from time to time on the struts now took on a more permanent appearance and started to form on the windscreen. As well our indicated airspeed was steadily decreasing.

To try and fix our position with a better cross bearing, I retuned our ADF to the Chalkers NDB from the Bathurst NDB frequency on which it had been set, and found that we still had 15 to 30 kilometres to go to Bindook. To verify this I asked Sydney if they had any indication of us on radar but at this stage they did not. Shortly afterwards however, Sydney informed us that they now had a radar reflection, presumably from our aircraft, moving at a groundspeed of only 35 knots! This unexpected news alarmed me not a little and I then requested permission to track directly to Sydney instead of proceeding via Bindook. But because the Sydney VOR was unavailable, this was not possible.

Continuously in cloud, with darkness as well at this stage, I was about to inform Sydney that I intended to descend below 7000 feet and request an alternative airways clearance when suddenly we encountered heavy turbulence, freezing rain and hail. A massive amount of icing quickly built up on the airframe and even though I applied full power the aircraft lost height rapidly. I called Sydney and advised them of our predicament.

As the aircraft continued to lose height down towards the Lowest Safe Altitude, with no sign of the descent rate decreasing, it seemed pointless to continue heading south east. As well as taking us across a much wider band of mountainous terrain, this was almost directly into wind. Lower ground lay to the east and west, so I decided to head due east and informed Sydney of my decision.

As we descended further, the increasingly violent turbulence made the aircraft progressively more difficult to control. I lowered one stage of flap and managed to stabilise the aircraft's height at about 5000 feet, but the airspeed was still varying between 40 and 70 knots. By this stage the engine note was sounding rougher than normal, even though I'd had full carburettor heat applied for some time. Fearing that a total loss of power might occur, I turned on the landing lights and requested my passengers to tighten their seat belts and to be prepared for a forced landing at any time. I even considered lowering full flap and heading into wind to reduce the severity of any impact with the ground but decided against this course of action until such time as the aircraft had descended 1000 feet below the Lowest Safe Altitude.

At about this stage, Sydney Flight Service asked me for our remaining fuel endurance but because of my heavy work load I was unable to comply with this request immediately. Soon afterwards I was asked to report our radial from the Bindook VOR, which I did, and we were then requested to proceed to the station. As we took up this heading, the aircraft slowly began climbing back towards 6000 feet. A little later they requested me to tune the Sydney VOR, identify the radial and proceed direct to Sydney. This we did and though we encountered further periods of icing on the way the aircraft did not descend below the Lowest Safe Altitude at any time. On our arrival in the Sydney area, we found the wind velocities at both Bankstown and Sydney airports were such that, in more normal circumstances, I would have had no hesitation in diverting to Tamworth. But fearing this diversion would take us into icing conditions again, I elected to land at Bankstown.

* * * *

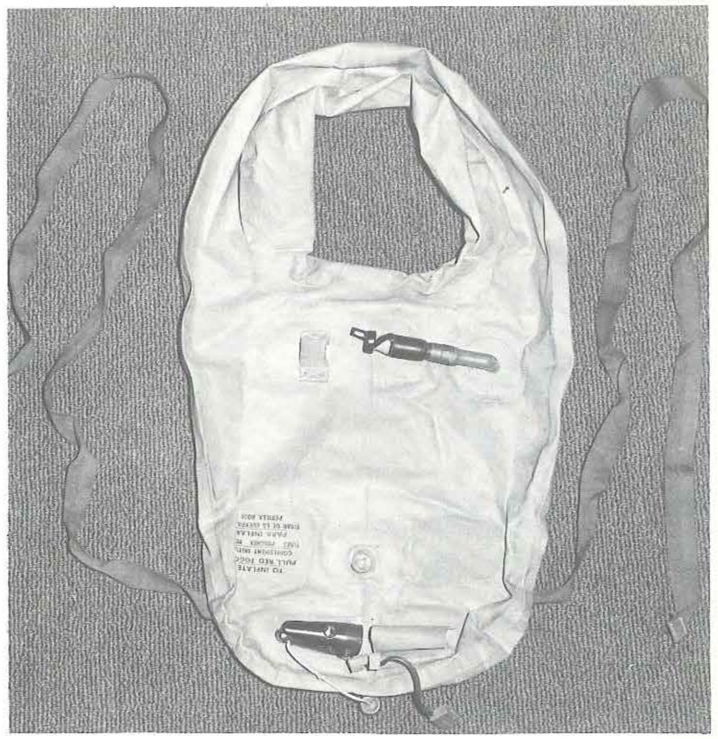
Looking back at these events with the advantage of hindsight, it is apparent that the incident had its beginnings right back in the flight planning stage when I selected 7500 feet as my cruising altitude. Even if the freezing level had been 7000 feet, it seems there would have still been a good probability of encountering icing on route. As it was, the freezing level was forecast for 6000 feet, not 7000 feet, and was probably a good deal lower still over the mountains.

It seems most unlikely that the Flight Service Officer at Dubbo would have given me the wrong figure and I can only assume that I misheard him over the telephone. The clarity of the line left much to be desired and we both had to repeat ourselves several times.

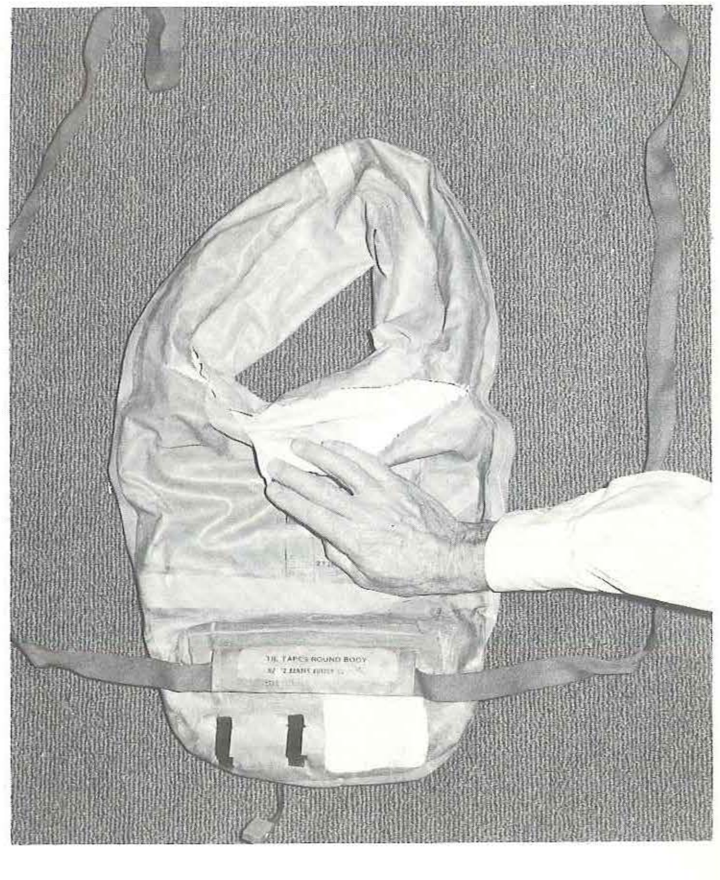
The fact remains however, that despite having obtained the weather forecast from Dubbo, as well as telephoning the domestic forecaster at Sydney earlier in the day, the weather we actually encountered was very much more severe than I had expected. Again with hindsight, I realise now that I should have had a more realistic expectation of the weather conditions, such as the possibility of encountering freezing rain. I also realise that there were many questions that I could have asked during the weather briefing but did not — for example the possibility of icing in cloud or whether snow was falling on the ground. I am sure that this omission will not apply to me in the future.

There can be no doubt that my two passengers and I got off very lightly — things could so easily have gone the other way in the circumstances. Had they done so in those conditions and over that terrain, there would have been no doubt about the result. My hope now is that other pilots, reading this account, will profit from it and so be spared a similar experience.

SINK OR SWIM



Above and Below: The inflatable life jacket used in the laboratory tests. After being inflated by mouth, the jacket's CO² cylinder was discharged and the fabric ruptured as shown.



Articles which have been featured in the Digest from time to time on the subject of post-accident survival, have been concerned mainly with operations in the remote and inhospitable regions of the Australian outback, and have usually centred around the problems of staying alive in a hostile desert environment. But there is another side to the story. Ditching accidents, those in which an aircraft descends into the sea, though comparatively rare in Australia, obviously pose survival problems that are just as critical in other ways.

The minimum survival equipment required to be carried on board aircraft engaged in overwater flights is prescribed in detail in Part 20 of the Air Navigation Orders. However, no amount of legislation on the subject can be effective unless the equipment is used correctly and is, in fact, capable of performing the task for which it is intended. That this is not always the case was brought out during the investigation of two accidents which occurred in widely separated locations in the waters off the coast of the Australian mainland.

In the first of these accidents, a Piper Aztec was forced to ditch in the Gulf of Carpentaria, about 64 km from land. The pilot put the aircraft down on the water in a tail-low attitude, and after skipping slightly, it came to an abrupt stop in calm sea, with the wings just awash. The passengers scrambled out the main cabin door on to the starboard wing, taking with them a four-place dinghy and two inflatable life jackets which had been carried on the floor of the cabin. The last to leave was the pilot, who stepped into the water as the aircraft finally went down. The dinghy could not be deployed before the aircraft sank but, with a little difficulty, it was eventually inflated and those passengers who were non-swimmers were assisted aboard.

When all were safely settled, the pilot and another passenger, who had remained in the water clinging to the raft, went to inflate their life jackets but, when the toggle on the carbon dioxide cylinder of one of the jackets was pulled, the jacket filled and burst. As a precaution, therefore, the second jacket was inflated by mouth. Meanwhile, at Cairns Flight Service Unit, the Distress Phase of Search and Rescue operations had been immediately declared in response to a transmitted "Mayday" call by the pilot. The pilot's call had also been received by prawning vessels in the area and, after the occupants of the aircraft had been in the water for about three hours, they were picked up by a trawler and taken into port.

The burst life jacket was recovered during the rescue and was later subjected to a laboratory examination to determine the cause of its failure. The jacket had burst along a seam at the neck but though the fabric was checked for tensile strength

The type of non-inflatable life jackets worn in the accident to the Cessna 150. Note how the bulkiness of the jackets could hinder movement in a confined aircraft cabin.

and micro-biological attack, no defect could be found. In the absence of any deterioration in the fabric, it could only be concluded that the failure was the result of over-pressurisation of the jacket. How this situation came about has not been positively established but further investigation into various possibilities which can lead to over pressurisation and rupture of the jacket revealed lessons for those who may have to use such equipment.

During this investigation, another serviceable jacket of a similar age and type to the one carried in the ditched aircraft was obtained from the owner of the aircraft and subjected to another series of checks. The jacket was inflated by mouth to an internal pressure of 1.7 kilopascals (¼ psi) above atmospheric pressure, which is the pressure resulting from normal inflation by discharging the CO2 cylinder. With a pressure gauge still connected to the mouth-inflated jacket, the CO2 cylinder was then discharged. When the gauge reading had risen to 62 kPa (nine psi) and the cylinder was almost empty, the jacket ruptured along the reinforcement for the neck cut-out.

A fully inflated life jacket has a certain volume, which will not change significantly with variations in pressure. If the jacket is inflated by mouth to an internal pressure of 1.7 kPa (¼ psi) above atmospheric pressure as in this test, and the bottle then discharged, the jacket will contain twice the amount of gas as normal. This will result in twice the internal pressure, or about 103 kPa (15 psi), which will certainly burst the jacket.

The Department requires that life jackets be inspected and pressure checked annually to detect any serious deterioration in quality or strength in service. A ' proof pressure ' of 15.5 kPa (2.25 psi) above atmospheric pressure, which is well above the normal inflation pressure of 1.7 kPa (¼ psi) above atmospheric pressure, is applied in this check. It must be appreciated, however, that this figure can be achieved if as little as 13 per cent of the normal volume is taken up by oral inflation before the CO2 cylinder is discharged. Thus any jacket which is even only partially inflated by mouth beforehand, runs the risk of bursting when the full contents of the gas cylinder is added to it. The clear lesson is to ensure that this type of life jacket is fully deflated before activating the gas cylinder.

The other case involved a Cessna 150 which was lost during a search for a fisherman missing off the south-east coast of South Australia. The pilot-in-command, who was a flying instructor, and another pilot, who held a private licence and was acting as observer in the left hand seat, were both wearing a popular brand of bulky, non-inflatable plastic covered life jacket. When the accident occurred, the aircraft struck the water a short distance off shore in a nose-down, right wing low attitude. Arriving soon afterwards, a rescue party found the observer had apparently been ejected from the aircraft on impact and, having sustained only minor injuries, had been able to reach the shore unaided. But of the pilot there was no sign and when the wreckage of the aircraft was later recovered from the sea bed, his body was found trapped in the cabin. Amongst other things, it was found that his plastic covered, non-inflatable life jacket had a small tear in the neckline and was completely waterlogged.

Though it might not have been significant to the cause or outcome of this accident, the type of life jacket worn by both pilots in this instance was not approved for use in aircraft. Jackets of this type are made of a tough outer cover, filled with Kapok or a similar material. Buoyancy is thus built into the jackets which are neither collapsible nor inflatable. They consequently tend to be bulky and can be a hindrance to the wearer, especially in the confined cabins of some general aviation aircraft.

Quite apart from the inconvenience of wearing the jackets in flight however, there is the danger, resulting from the inherent buoyancy of the jacket, of the wearer being trapped under water in a sinking aircraft. In such a situation, the jacket's buoyancy could tend to hold him against the uppermost part of the cabin interior and, with the jacket's bulkiness already hampering his movement, could make it impossible for him to escape from the submerged aircraft unless he was first able to remove the jacket.

It is a well known fact that non-approved life jackets are frequently carried in aircraft, presumably in ignorance of the published requirements and the risks involved. It should hardly be necessary to point out that taking short cuts with essential safety equipment could well defeat the very purpose for which it is intended. Design and manufacturing standards are laid down for the protection of users, and life jackets, when required to be carried on overwater flights, must be of an approved type complying in full with the specifications set out in Air Navigation Orders.

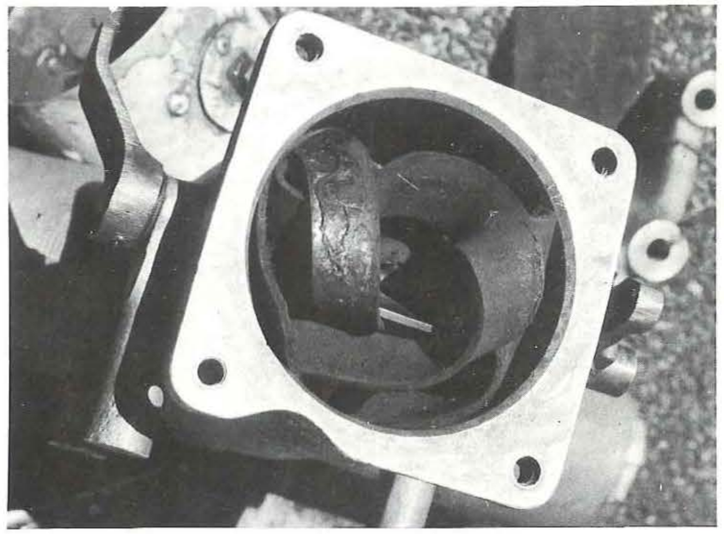
When one stops to consider that the lives of all on board an aircraft could be at stake in an emergency, it is false economy indeed to substitute non-approved life jackets simply on the ground of convenience, or because they are slightly less expensive.

EXPENSIVE OVERSIGHT

Shortly after a Cessna 185 had taken off and turned downwind with a load of superphosphate in the course of a spreading operation, the engine failed without warning at a height of about 100 feet. The pilot immediately dumped the load and seeing that the fuel pressure was dropping, selected the electric fuel pump to the emergency position, but there was no response from the engine.

Faced with an imminent forced landing downwind from low altitude, with no speed in hand, the pilot saw that he had no alternative but to land straight ahead. Lowering full flap, he forced the nose down to maintain flying speed. The aircraft landed heavily on the crest of a rise bounced and floated for 100 metres then, still travelling fast, touched down again on the downslope of the hill. The pilot was reluctant to use heavy braking for fear of somersaulting the aircraft on to its back and, after running for a further 100 metres, it broke through a wire fence, struck a tree with the starboard wing and came to rest in a rocky gully with the port undercarriage sheared off. The pilot extricated himself from the aircraft with only minor bruises and scratches.

Examination of the engine and its accessories revealed that the air box and expander assemblies of the air induction scoop in the lower engine cowling were not bolted together. The two retaining screws were missing, as was the neoprene gasket that fits between the two parts. The gasket was later found in the induction manifold, wrapped around the throttle butterfly as shown in the picture.



It was not possible to determine whether the retaining screws had been omitted or simply just not tightened properly the last time the aircraft was serviced. The original air box fastenings had been replaced with screws and anchor nuts, and in view of the difficulty that would be experienced in tightening the scews while holding the lower engine cowling in position, it seems likely that the screws were inserted but not correctly tightened. This is supported by the fact that the neoprene gasket remained in position for some 30 hours following the servicing. Once the retaining screws fell out however, engine vibration and movement of the cowling would have caused the cement adhesive on the neoprene gasket to break away. This would have allowed the gasket to be drawn into the intake manifold and foul the throttle butterfly, causing the sudden loss of power.

Obstruction In The Works

While on final approach to land the pilot of a Cessna 180 suddenly felt a restriction in the elevator controls.

The approach had been quite normal until the commencement of the flare when, at a height of about 40 feet above the ground, as the pilot began to raise the nose to lessen the rate of descent, he felt a solid impediment to the rearward movement of the control column.

Assuming that something had jammed the elevator controls, he pushed the control column forward then pulled it back hard. The controls suddenly freed and he applied full power, but too late to avoid flying into the ground short of the strip threshold. The aircraft struck the ground very heavily on the port landing wheel and bounced high into the air in a nose-up attitude. Using engine power the pilot brought the aircraft under control again and landed normally on the strip.

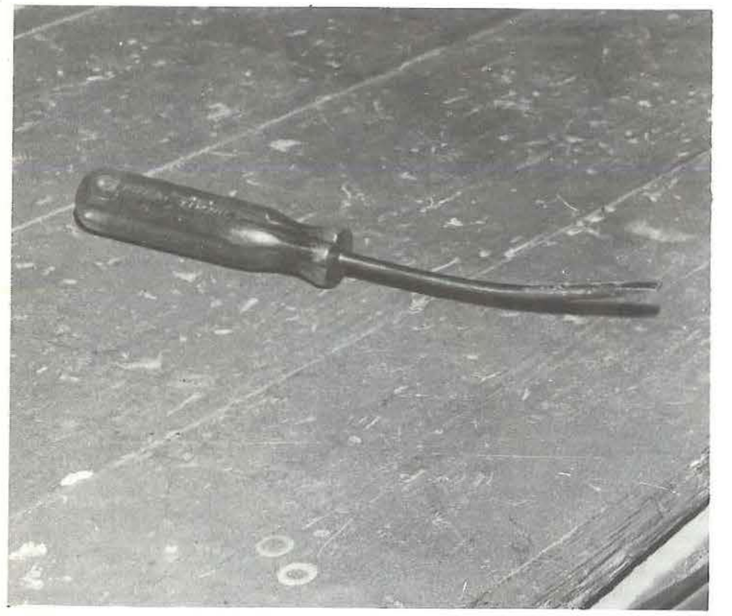
After taxi-ing to the parking area the pilot, who was also an aircraft maintenance engineer, climbed out to inspect the aircraft. The port undercarriage leg, together with the surrounding airframe structure had been substantially damaged in the impact with the ground. He next inspected the tail assembly for signs of control fouling, but finding none, turned his attention to the elevator control system inside the aircraft. Removing some floor panels, he examined the elevator control cable runs. Close to the position of the elevator forward bell crank he felt a foreign object just behind the undercarriage torsion box bulkhead. Removing it, he found it was a screwdriver, the blade of which had been bent. Marks on the blade and on the structure of the underfloor area near the elevator forward bell crank indicated that the screwdriver had been jammed between the bolt securing the rear end of the bell crank, and the structure on which the bell crank is mounted.

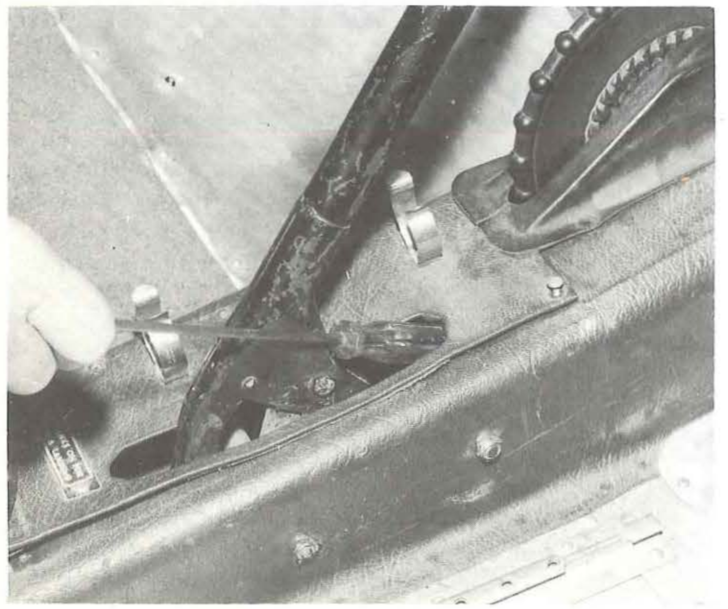
The possibility of the screwdriver having been left in this area during maintenance, and subsequently obstructing the controls, was carefully considered. However, as the aircraft was a tail-wheel type, the place where the screwdriver would have been lying sloped downwards some 15 degrees when the aircraft was on the ground. Since the issue of the last maintenance release, the aircraft had flown 26 hours and it seemed very doubtful if the screwdriver could have remained in this position throughout that time.

It was noticed, however, that when the manually operated flap lever was in any position other than fully up, it left an opening in the control cable tunnel through which the screwdriver could have passed quite readily. Had this occurred, the screwdriver would have been placed just where the elevator forward bell crank is located.

The glove box of the aircraft, above and to the right of this opening for the flap lever, was found to contain several similar screwdrivers. It seems quite possible that if the lid of the glove box had opened while any flap was selected (for example while the aircraft was being taxied) the screwdriver could have fallen out and dropped into the opening unnoticed by the occupants. This possibility would be all the more likely if someone was occupying the right hand seat.

This is not the first time that loose objects in light aircraft have found their way into the control linkage and eventually obstructed the movement of the controls. In fact, on one occasion some years ago, such an obstruction was responsible for a fatal accident to a Chipmunk (see Aviation Safety Digest No. 61). This latest instance emphasises again how unwise it is to leave anything to chance with tools or loose items of any sort being carried in the cockpit of an aircraft.





Above: Screwdriver found in the under-floor area of the Cessna 180. Note the bent blade, marks on which matched similar score marks on the elevator forward bell-crank.

Left: The way in which the screwdriver could have entered the elevator control system with flap selected.