Department of Transport - Australia Number 101 1978

Aviation Safety Digest

Bristol Freighter

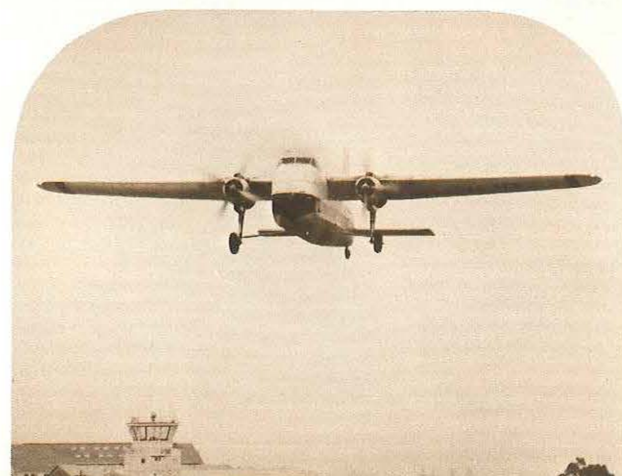
For almost 30 years, the unmistakable profile of the Bristol Freighter has been a familiar sight in Australian skies. Now, with retirement for the last remaining examples just around the corner, the Digest pays tribute on the covers of this issue to one of the true workhorses of aviation.

Though by today's standards slow and relatively unsophisticated, when it went into production in 1946 the Freighter was ahead of its time as a short haul, high capacity cargo transport. With large clamshell doors providing nose loading capability, it has a carrying capacity unmatched even today by some aircraft of similar size.

The Freighter was produced in several versions. The aircraft featured in our cover pictures is a Mk. 21, unique in that it is believed to be the only Freighter of this model still flying anywhere in the world. Now owned by the Essendon-based cargo airline Air Express Ltd., the aircraft first flew in March 1949. After a brief two weeks with the RAF, the aircraft was acquired by the RAAF, who operated it until August, 1969. Released then by the RAAF, the aircraft began civil operations, first with a newly formed charter company and finally with Air Express, who bought the aircraft in April 1971.

With the introduction of newer aircraft types and more specialised cargo handling techniques, the Freighter is becoming outclassed in the highly competitive world of air cargo transportation. Two Freighters however, the Mk. 21 and a later Mk. 31, have been retained in the fleet of Air Express to operate shorter flights such as the services across Bass Strait to King Island and Tasmania, and also to cope with any unusual items of load that cannot conveniently be carried in other types.

Operating mainly at night, the Freighter continues to perform an unglamorous but vital task for which its basic advantages as a cargo aircraft, though to some extent superseded by other types, are still uniquely suited.



Aviation Safety Digest

Number 101 1978

CONTENTS

Disastrous Indecision 2
You — and Low Level Jet Routes 5
What Can Go Wrong — Will! 7
Cherokees Collide Head-on 8
Ooops! 10
Eyesight is Precious 11
A Nasty Situation 12
'What! You Threw Away the Ripcord?' 14
It's Good Advice For Us, Too! 17
The Wrong Side of the Power Curve 18
A Close Call! 19
Dust Devils and Aviation 20
Ask For Help — While You Still Can! 22
The Breath of Life 23
Counting Sheep? 24
Incredible! 25
Recognising and Handling Dangerous Goods 26
Your Role in Search and Rescue 28

Aviation Safety Digest is prepared in the Air Safety Investigation Branch and published for the Department of Transport through the Australian Government Publishing Service, in pursuance of Regulation 283 of the Air Navigation Regulations. It is distributed free of charge to Australian licence holders (except student pilots), registered aircraft owners, and certain other persons and organisations having a vested operational interest in Australian civil aviation.

Aviation Safety Digest is also available on subscription from the Australian Government Publishing Service. Enquiries should be addressed to the Assistant Director (Sales and Distribution), Australian Government Publishing Service, P.O. Box 84, Canberra, A.C.T. 2600.

Change of address: Readers on the Department's free distribution list should notify their nearest Regional Office. Subscribers should notify the Australian Government Publishing Service.

Printed by Ruskin Press, 39 Leveson Street, North Melbourne, Victoria.
RM76/30216(1) Cat. No. 78 9098 5.

Note: Metric units are used except for airspeed and wind speed which are given in knots; and for elevation, height, and altitude where measurements are given in feet.

While landing at St. Thomas, Virgin Islands, after a flight from Rhode Island, U.S.A., a Boeing 727-100 over-ran the end of the runway and crashed. The aircraft caught fire and was destroyed. The flight crew survived but 37 of the 88 occupants were killed. Thirty-nine others, including one person on the ground, were injured.

Although visual meteorological conditions prevailed, the crew elected to fly the ILS to assist in vertical guidance during the approach. Witness observations, crew statements, and information derived from the flight data and cockpit voice recorders all indicate that the aircraft approached the 1420 metre 09 runway in a normal profile which would result in a touchdown 300 metres or slightly more beyond the threshold. Instead of touching down as expected, however, the aircraft floated five to ten feet above the runway and touched down about 850 metres beyond the threshold, leaving some 570 metres of runway and 155 metres of over-run in which to stop.

The captain, concerned that he would not be able to stop in this remaining distance, decided to go-around. It then seemed to him that the engines were not accelerating quickly enough, so he again closed the power levers and attempted to bring the aircraft to a stop. The aircraft over-ran the end of the runway and the 155 metre over-run, tore its way through the perimeter fence, crossed a road, destroying several cars as it did so, and finally came to rest in a service station where it burned to destruction.

Subsequent investigation established that had the captain continued with the landing, the aircraft could have been brought to a stop in about 540 metres, but the runway length remaining was insufficient to achieve a safe go-around.

DISASTROUS INDECISION

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

* * *

Guidelines issued to pilots flying the company's Caribbean routes lay down the company policy concerning flap usage, aiming point, touchdown point and go-around, and point out the possibility of encountering downdraughts on the approach. They emphasize the necessity of being in the 'slot', the importance of the 300 metre aiming point, and the possibility of wind shear which could produce a float if the aircraft is landed beyond the 300 metre point. They also point out the necessity of executing a go-around if the approach is not in the slot, if the landing is going to be appreciably beyond the 300 metre point, or if a bounce occurs on touchdown. The use of 40° of flap is standard practice; however, the use of either 30° or 40° flap 'with strong, gusty winds' is optional. The use of 30° flap is recommended with a wind component of 20 knots or more. In this case the crew had been told that the surface winds at St. Thomas were from 120° at 12 to 14 knots. No gusts had been reported.

The captain said, however, that he knew that any south-east wind at St. Thomas would be gusty and therefore decided to use 30° of flap. He said that with 30° of flap the aircraft is more controllable, is easier to manage, and that, 'you have a greater margin for what is ahead'. But having made the decision to use the non-standard flap setting there was no evidence that the crew had checked their landing analysis chart to see if the landing was permissible. Had they done so they might have been reminded that a 20 knot headwind component was required for a 30° flap landing.

The decision to use 30° rather than 40° flaps exposed the aircraft to a performance penalty, increasing the required landing distance by 76 metres. More importantly, the reduced drag made the aircraft more vulnerable to the effects of increased airspeed, and any wind shear or gusts would be more apt to produce a float. In the actual approach, the captain aimed for a 10 knot margin above the reference speed, and as the aircraft passed over the threshold the margin was 11 knots. The Board believes that, when the captain attempted to flare the aircraft, this excess speed above reference was a factor in overflying the aiming point.

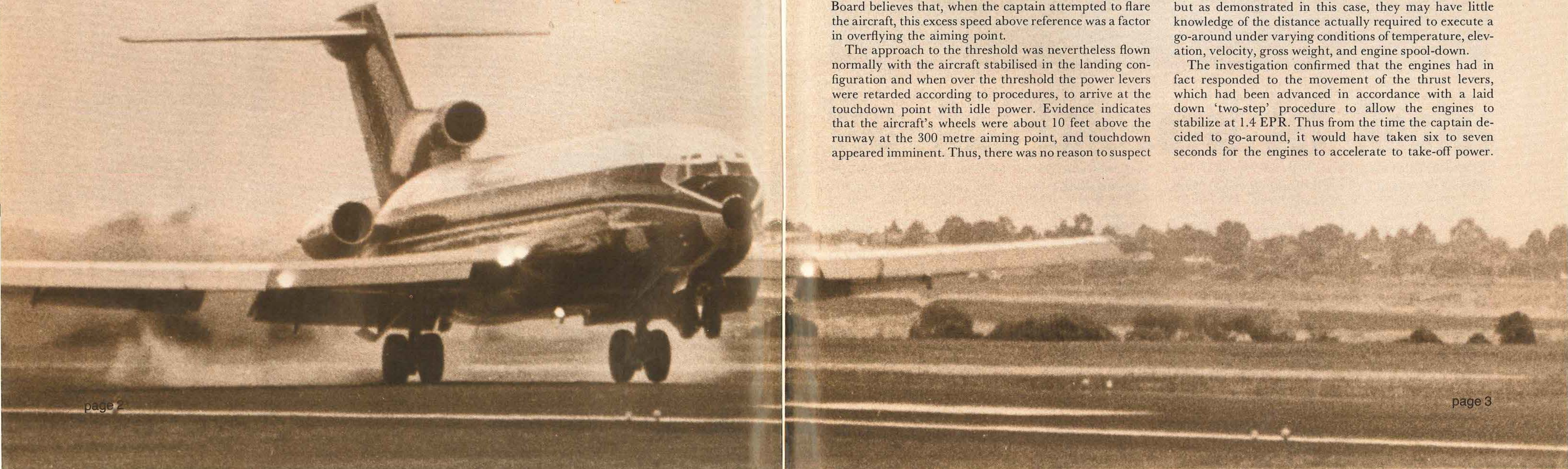
The approach to the threshold was nevertheless flown normally with the aircraft stabilised in the landing configuration and when over the threshold the power levers were retarded according to procedures, to arrive at the touchdown point with idle power. Evidence indicates that the aircraft's wheels were about 10 feet above the runway at the 300 metre aiming point, and touchdown appeared imminent. Thus, there was no reason to suspect that a go-around might be necessary and the captain's thought processes were probably orientated to control of the aircraft on the the ground.

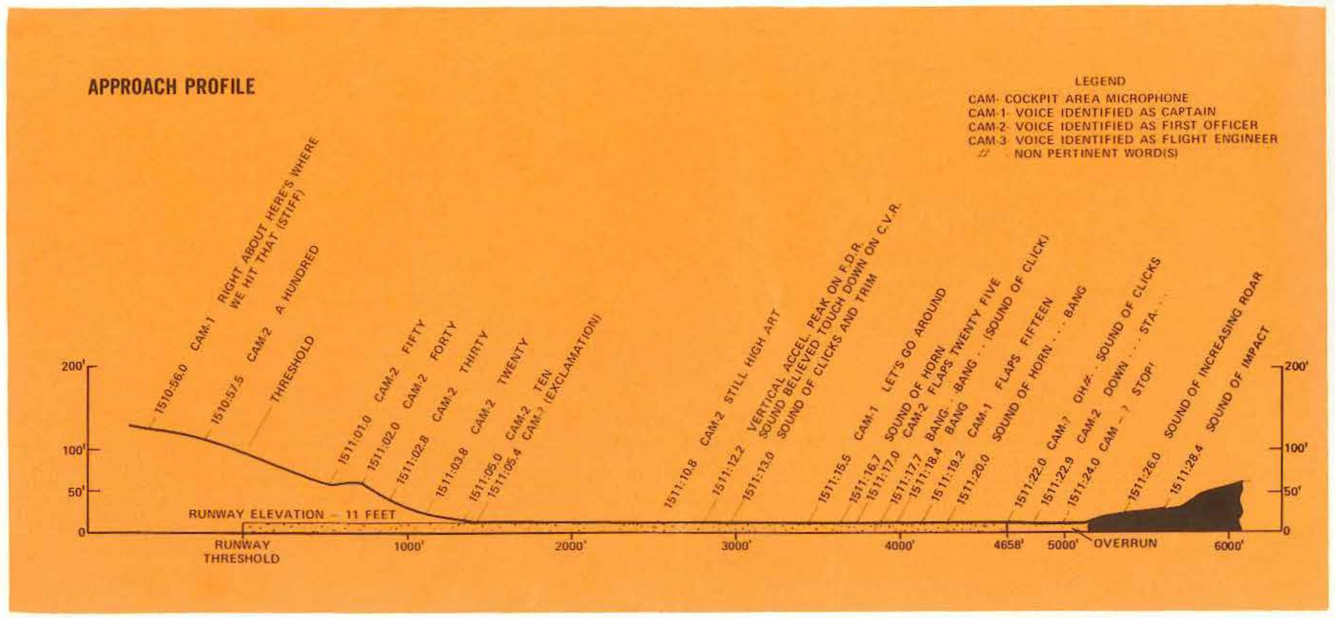
The flight data recorder showed two airspeed aberrations had occurred when the aircraft was slightly beyond the 300 metre marker, which were probably the result of a gust. This caused a lateral upset of the aircraft sufficient to cause an exclamation of surprise which was audible on the cockpit voice recorder. The airspeed increased about five knots, the aircraft rolled to the right and as a result the captain was unable to land before correcting the upset. More critically, the aircraft was still ten feet above the runway and well beyond the normal touchdown point. The Board believes the gust encounter added to the lift already produced by the rotation of the aircraft in the flare, and caused a prolonged float. The captain was thus faced with an immediate decision to land or to initiate a go-around and at that stage he forced the aircraft on to the runway. But though he knew he was past the normal touchdown point, the extent of the aircraft's progress down the runway became evident to him only after touchdown when his visual appraisal of the runway made him change his mind and initiate a go-around.

The captain had extensive operating experience into St. Thomas. In this case the aircraft was about 150 metres short of the point at which it would normally be rotated for take-off and the airspeed was at or within three or four knots of rotation speed. Thus, the captain's experience led him to believe that a go-around was a viable course of action. The aircraft was, however, in a diminishing speed regime and the engines were spooled-down.

The limited training for touch-and-go landings which most airline captains receive during their type-conversion is conducted under ideal conditions. Both airspeed and engine RPM are maintained to the maximum extent possible and the training is usually conducted on runways of such length that maximum performance is not a consideration. Pilots are taught that accidents which result from misjudged approaches can be averted by going around, but as demonstrated in this case, they may have little knowledge of the distance actually required to execute a go-around under varying conditions of temperature, elevation, velocity, gross weight, and engine spool-down.

The investigation confirmed that the engines had in fact responded to the movement of the thrust levers, which had been advanced in accordance with a laid down 'two-step' procedure to allow the engines to stabilize at 1.4 EPR. Thus from the time the captain decided to go-around, it would have taken six to seven seconds for the engines to accelerate to take-off power.





During at least part of this time the aircraft would have continued to decelerate. Analysis of Boeing 727-100 performance data shows that from the initiation of full power during a touch-and-go, more than 580 metres of runway is required to lift-off, while another 240 metres is needed to reach an obstacle-clearance height of 35 feet. In addition, the 'two-step' advance of the power levers can lengthen the take-off roll by as much as 150 metres. These figures compare with a stopping distance of about 520 metres using maximum wheel braking and other available braking devices.

The Board therefore concluded that a successful go-around could not have been executed when the captain attempted to do so, but that using maximum braking and spoilers, he should have been able to stop the aircraft on the runway and certainly within the confines of the runway over-run.

The final events in the accident sequence thus occurred when the captain realised that the rate of engine acceleration would not allow the aircraft to become safely airborne in the remaining runway length and he closed the power levers and applied full wheel braking. Tyre marks, indicative of braking, were visible about 210 metres before the end of the runway. However, for a time, at least until the aircraft left the over-run, the captain did nothing more than this to bring the aircraft to a stop. He did not lower the nose wheel to the ground, did not extend the spoilers, and did not use reverse thrust. As a result, the aircraft failed to decelerate to its full capability. Not lowering the nose probably had a significant effect on the deceleration, as the lift being developed affected the retarding force transmitted from the tyres to the runway surface. Though reverse thrust was apparently selected, it was not applied until just before final impact.

The captain said that he did not know why he did not use all the available means of deceleration. Research into human behavioural patterns indicates, however, that when danger appears imminent, man may undergo certain behavioural changes intended to extract him rapidly and impulsively from such a situation. This so-called 'emergency mechanism' may be detrimental in situations where deliberate responses are necessary because it cancels the reasoning function.

In this case, the 'emergency mechanism' was triggered when the captain realised that a go-around was impossible and an accident inevitable. The captain probably reacted impulsively and instinctively by applying full wheel brakes, but did not remember the more deliberate actions of lowering the aircraft nose, deploying the spoilers, and applying maximum reverse engine thrust. Had he used these means of deceleration when he commenced braking, the aircraft might have been brought to a stop within the confines of the airport perimeter. At the very least, a much lower-velocity impact would have occurred.

The Board believes that intensive training is the most effective means to combat such reactions. Had the captain been exposed during training to critical go-around situations and to the maximum performance stopping capabilities of the aircraft by means of flight simulation and lectures, he may have reacted appropriately.

In summary, it is evident that the captain had two opportunities to avoid this accident. His first was during the turbulence encounter just after passing the 300 metre touchdown area; he should have followed company procedures and initiated a go-around as soon as he regained control.

His second opportunity came after he had landed the aircraft. He should then have applied maximum-performance stopping procedures to bring the aircraft to a stop within the remaining runway length. Subsequently, when an accident became inevitable, the captain could have lessened the impact by using all available means of deceleration.

The Board concluded that although the captain realised the remaining runway length was critical with regard to stopping the aircraft, he did not know that the remaining runway was even more critical with regard to the execution of a go-around. With adequate training as to the aircraft's performance capability and with training environment exposure to similar situations, the captain may have reacted immediately to stop the aircraft instead of attempting to go-around.

You – And Low Level Jet Routes

The pilot was a careful man — one who did not like surprises when he was flying — especially when he had his family on board. This time, before flying his wife and two young sons to visit her parents' farm in a Cessna 172, he had checked the weather carefully. But as the trip was less than fifty miles over countryside he knew like the back of his hand, he did not lodge a flight plan. Even so, he had taken the trouble to make certain his charts and other documents were current and as usual he had meticulously pre-flighted the aeroplane. Certain that all was in order on this mild, sunny, winter's day, they flew leisurely out to the farm.

But despite all his care, the pilot was in for the fright of his life. As he gently banked the Cessna over the farm's grass strip in preparation for his approach to land, he caught just a glimpse of a military jet, sinister with armament and camouflage, as it flashed very close beneath his upraised wing at what seemed impossible speed. His children shrieked, his wife gasped, horrified, and for several bad moments he found his hands full coping with the ensuing turbulence. At least it gave him time to parry the barrage of questions — 'What was that?' 'What's that jet doing over our farm?' 'Why was he so low over our strip?' For the moment the pilot just didn't know. Then he remembered a loose-leafed folder in his flight bag that he had hardly ever looked at. Issued by the Department, it was entitled 'Military Low Jet Routes'.

Leafing through this folder after he had landed safely and his family had recovered from their fright, the pilot saw to his dismay that the farm strip lay directly beneath the flight path of an officially designated Low Jet Route. He also realised that the high speed military aircraft which had missed them by so little was probably a Mirage jet fighter being flown on a ground-hugging exercise at near the speed of sound!

How was he supposed to avoid such dangerous and unexpected traffic? The more the pilot thought about it, the more concerned he became. He just did not know the answer and remained in troubled ignorance for the next several days until he got back to his base and called in to talk to the Flight Service Officer on duty. There he learned that, had he availed himself of the unit's pre-flight briefing and in-flight services, he would have been provided with information that would have enabled him to keep clear of the low level military traffic.

* * *

In central Queensland the captain of a Fokker Friendship preparing for a flight from Rockhampton to Taroom, was advised that Low Jet Route 321 would be active at approximately the time he was due to arrive at Taroom. From a study of the LJR folder the captain knew that military aircraft would avoid aerodromes published in AIP AGA by at least five miles laterally or 4000 feet above aerodrome level vertically and that Taroom was one such aerodrome. Furthermore, an examination of the flight profile for LJR 321 indicated that the F111C aircraft flying the route would remain above 4000 AGL until it had passed Taroom.

Later, en route to Taroom, the Friendship was advised by Flight Service that the F111 had departed for LJR 321 and was estimating the commencement point of the LJR at the same time as the Friendship was estimating Taroom. This same information was being broadcast on appropriate area frequencies for use by other aircraft. From their pre-flight study of LJR 321, together with the updated information on the progress of the military aircraft, the Friendship crew now saw that there was a possibility of a confliction with the F111 in the vicinity of their destination. Accordingly, their descent and entry into the circuit area was planned, using all available information, so that the flight path of the Fokker remained clear of the F111 at all times.

* * *

These two fictional examples illustrate, at opposite ends of the scale, the outcome of different pilot attitudes to the problem of military low level jet operations. The same information was readily available to each aircraft. What made the difference was an awareness of that service and the use of the information provided to ensure the safe conduct of the flight concerned.

The question of how a pilot is supposed to know about, let alone see and avoid, such traffic, is one which should concern everyone who flies outside controlled airspace whether for business or pleasure. There are no less than 200 promulgated low altitude military training routes, any of which may be active at any given time. Military aircraft flying these routes usually follow the terrain between 500 and 1500 feet above ground level at speeds of up to 540 knots. The aircraft normally operate singly, with an interval of approximately 15 minutes between succeeding aircraft on the same route. Most of the aircraft operating the low level routes are camouflaged and at such high speeds are extremely difficult to sight against the terrain.

The military aircraft are all equipped with UHF but none have VHF. F111C aircraft are also equipped with HF; but their crews do not normally use these frequencies on terrain-following operations. Mirage and Skyhawk aircraft, which are equipped with UHF only, are out of communication with ground stations for a large part of the time and are incapable of direct communication with civil aircraft, except when within range of UHF re-transmit facilities at Coffs Harbour, Dubbo and Wagga.

Civil aircraft flying below 10 000 and 5 000 feet are restricted to maximum airspeeds of 250 and 210 knots respectively, to allow their pilots time to identify possible traffic conflictions and avoid them. But if the potential hazard is a military aircraft approaching head-on at near-sonic speed, the rate of closure is such that a pilot may have less than five seconds for each mile of separation to recognise the danger, decide what evasive action to take, and carry it out. Even for an experienced pilot this is very little time.

Locations of military routes are set out in the Low Jet Route loose-leaf folder issued to all AIP and VFG holders. Notification of the times during which these routes are to be active are advised by Class One Notam at least twelve hours in advance of their intended use. This information is readily available at Airways Operations Units to enable pilots to ascertain whether any active routes are likely to affect their intended flight. Additionally, an in-flight traffic information service provides updated information to aircraft operating in the vicinity of the low jet routes. Whenever practicable, a broadcast of military low level jet activity is also made on appropriate Flight Service frequencies before the jet transits the area.

It is in the interests of pilots engaged in low level aerial work operations, such as aerial agricultural operations, pipe line patrols, and fishery surveys, to familiarise themselves with the locations of any such routes in their vicinity, and to check their nearest Airways Operations Unit for advice of LJR activity.

The fact that these routes exist and are used should not be any cause for alarm. Rather, forewarned is forearmed, and it is simply a matter of being prepared for what can be encountered. Some pilots are inclined to feel that there is little need for concern because the possibility of conflict with military training flights is remote. The truth is that a considerable amount of military low level air training is conducted constantly, year in and year out, throughout Australia. An accident of this sort actually occurred in England some months ago when an RAF Phantom on a low level exercise collided with a Piper Pawnee engaged in super spreading. Needless to say, the crew of the Phantom, as well as the pilot of the Pawnee, were killed. For these reasons, safety in flight demands an understanding of how, where and when such flights are made.

What Can Go Wrong - Will!

Carrying a load of newspapers, a Cessna 206 being flown by a commercial pilot arrived over its first port of call on a daily delivery flight to several towns in northern New South Wales.

The weather was fine and clear, and the pilot assessed the wind as a light easterly of about five knots. Positioning the aircraft in the circuit, he made an approach to land on the sealed runway 11. The touchdown was smooth and apparently normal, but after running for about 60 metres the aircraft began to veer to the right. Applying left rudder, the pilot tried to straighten up but, though the turn was only gradual at first, his efforts were ineffective. Realising that if he delayed any further, the aircraft would run off the runway, the pilot opened the throttle to go around.

Immediately, the aircraft swung sharply to the left and, with all three wheels skidding on the bitumen, headed towards the opposite edge of the runway. The nose leg collapsed and the aircraft slid sideways a short distance before stopping on the gravel verge of the runway, resting on the lower engine cowl, and the right main wheel and wing tip as shown in the picture.

* * *

At first sight, this accident would appear to be just one more instance of a pilot losing directional control after touchdown. But further investigation showed there was more to it than that.

With the seats removed, the Cessna 206 is a very useful small freighter, and the operator of this particular aircraft used it to carry newspapers on a daily service. Part of the freight space was provided by removing the right front seat and placing the right rudder pedals in the forward or stowed position. At the time of the accident however, neither the pilot nor the operator knew that, even though the rudder pedals were in the stowed position, it was still possible to obtain braking action by exerting pressure on them.

Stowable right rudder pedals are an optional fitting on both the Cessna 206 and 207, and are installed in many of these aircraft in Australia. They are also an option in the Cessna 185 and 210. Owner's manuals for aircraft of these models manufactured before 1974 make no mention of the fact that the brakes can still be operated with the rudder pedals stowed. The aircraft involved in this accident was an early model and the operator found out about the brakes only as a result of the accident.

As the bundles of newspapers carried in the aircraft were not restrained against movement in any way, it is likely that, during flight, a bundle of newspapers slipped forward until it was resting against the stowed right rudder pedal. In this way, pressure was applied to the right brake, causing the aircraft to veer to the right after touchdown. This in turn led directly to the need for the pilot to take corrective action, and the subsequent loss of control when he applied full power.

Both the Cessna 206 and 207 are widely used to carry cargo, some of which is often loaded into the space made available by removing the right-hand front seat. This accident shows the potential hazard of placing freight near the stowed rudder pedals — it also emphasises again the importance of properly restraining such freight.

Cherokees Collide Head-on

(Condensed from report issued by National Transportation Safety Board, U.S.A.)

While each was in cruising flight in Missouri, USA, a Cherokee Arrow and Cherokee Archer II collided head-on at an altitude of 6000 feet. Both aircraft disintegrated and all five occupants — two in the Archer and three in the Arrow were killed.

The Cherokee Archer had been hired by its pilot from Urbana, Illinois, and was engaged on a private IFR flight to Emporia, Kansas. The Arrow was operating a VFR charter flight from Salisbury, Missouri, to several airports in the Chicago area. The weather was fine and clear, with a visibility of at least 15 miles.

Kansas City Control had radio and radar contact with the Archer, but no contact had been established with the Arrow during its climb from Salisbury to the collision point.

While the Archer was under the control of the Kansas City Centre, the controller twice advised the pilot of conflicting traffic, based upon transponder returns. The first advisory was given when the Archer was about 25 miles east of the Macon VOR, and the second when it was about 10 miles east of Macon. The pilot acknowledged both. No further advisories were issued to the Archer after it had passed the Macon VOR and assumed a south-westerly heading.

At the time of the accident the pilot of a twin Cessna, which was at an altitude of 7600 feet, sighted black smoke at his 10:30 position and called Kansas City Control, '. . . I was glancing that way, the sky was clear and all of a sudden there was just a black puff. It's right now at about my ten thirty position — just like a flak explosion from World War II'.

The collision was also seen from the ground. A witness, who was working in a field said, 'I had heard the noise of a plane. I thought it was loud for one, so I looked up — what seemed to be practically straight up when I was facing north. I saw two planes, one going east and the other one going west. I said, "Oh . . . they are going to cross," and by the time I had said it, they collided. There was a ball of fire, the bang of an explosion, and a big puff of black smoke. Then the planes started falling. One plane — that there was the most left of — spiralled and came down in slow motion close to the point of impact. The other one was blown into thousands of pieces and drifted west and south'. The witness did not see either aircraft take evasive action.

The flight path of the Arrow is believed to have been a straight line northeast toward the Macon VOR, with the aircraft in a climbing attitude to the collision point. When the two aircraft collided, the Arrow's heading was 042°. The Archer would have been flying at an assigned altitude of 6000 feet on an approximate heading of 241°.

Examination of the recovered wreckage indicated that both aircraft were on a near head-on course at the moment of collision, the Archer striking the right side of the cockpit and cabin of the Arrow. As they collided, one blade of each propeller impacted the engine of the other aircraft. The propeller and engine of the Archer then penetrated the forward right side of the Arrow, completely destroying its cockpit and cabin structure. At the same time, the Archer's fixed nose leg and left main undercarriage penetrated the leading edge of the Arrow's right wing in the area of the fuel tank. Tyre scrapes were found on the crushed wing leading edge structure.

The collision geometry indicated that the Arrow would have been about 11° to the left of the eye reference point of the Archer and would have had a flight path angle of about +4° in its climb. At the same time the Archer would have been about 8° to the right of the Arrow's eye reference point. Neither aircraft would have been 'masked' by passengers, structure, or interior furnishings.

In an effort to determine why each pilot apparently did not see and avoid the other aircraft, the Safety Board considered the following factors:

- The near head-on angle at which both aircraft were converging (about 161°) would have caused the apparent size of each aircraft to have been reduced considerably. In this situation, the target's wing and tail surfaces are not discernible as only the head-on view of the aircraft is presented to the viewer.
- The targets of each aircraft would not have been masked by aircraft structure and each target would have remained essentially in the same location for at least the final 60 seconds. Both targets would have been very small when viewed from either pilot's position and would have appeared in their peripheral vision with respect to the eye reference point. The low rate of closure would have permitted both pilots to see the other aircraft for at least 30 seconds before the collision if each pilot was looking directly at the target. According to the ground witness, however, neither pilot took evasive action.
- A pilot's ability to re-acquire a target after it is first sighted must also be considered. Typically when a target is sighted, a pilot will make an initial judgement as to whether or not it is a threat; if the target is judged not to be a threat, the pilot will continue scanning other portions of the sky. Generally, the areas that are scanned routinely are to the front, less frequently the sides, and above and below. When a target is small, it is often difficult to re-acquire it in foveal vision during subsequent scans, unless it is conspicious. Though both aircraft were white, they would not have been conspicuous until they were relatively close to each other — in this case about 30 seconds before impact. The Archer would have appeared as a black dot against the sky and the Arrow as a black dot against the terrain or slightly above the horizon. Only when the two aircraft got close to each other would the almost head-on relationship have become apparent.

If the pilot of the Archer did see the Arrow, he might not have recognised it was on a collision course. He had received some training on the 'fixity of target' principle which states that, when an airborne target remains in a fixed position in the windscreen, a collision course is indicated. To prevent the collision, the course or altitude of one of the aircraft must be adjusted. Implied in this principle, however, is the pilot's ability to discern a zero rate of change in the other aircraft's heading or speed, or both. The size of the target, depending upon the rate of closure, may change drastically in the last few seconds before the collision. In this case the pilot had limited flight time (310 hours in the last six and a half years and only 60 hours in the last three), and his inexperience in IFR operations, as well as the two previous traffic advisories, could have led him to believe he would be provided with further advisories before other aircraft might be expected to become visible.

The pilot of the Archer had only one passenger, who was located in the other front seat, but as she was not a pilot, she would not be expected to maintain a level of vigilance comparable to that of the pilot. Operating as he was on an IFR clearance, the pilot might have relaxed his vigilance and might not have maintained an adequate outside scan. Any distractions such as referring to maps, explaining the operation of the aircraft to his passenger, or sightseeing, would have further compromised his vigilance.

The pilot of the Arrow had departed Salisbury en route to a number of locations in Missouri and Illinois. From the available information, his flight planning was minimal before take-off. Based on the pilot's experience and his familiarity with the area, the Safety Board assumed that he would have climbed to the Macon VOR and, from there, set a course to his first destination.

The Safety Board believes that, more than any other factor, inadequate vigilance on the part of both pilots appears to have been the predominant cause of this collision. The relatively low closure rates, the location of each target in each aircraft windscreen, and the six or more miles visibility should have allowed each pilot ample opportunity to see the other aircraft in time to prevent the collision

The accident is an example of the limitations of the see-and-avoid concept. It serves as a reminder to all pilots to maintain constant vigilance while flying in visual flight conditions — regardless of the type of flight plan under which they are operating — to request traffic advisories, and to ensure that their transponder is on and functioning.

OOOPS!

During flight, the crew of a Fokker Friendship noticed a difference in the readings of the captain's and the first officer's rate of climb indicators. Suspecting the fault lay in the instrument on the left hand instrument panel, the captain entered the unserviceability in the aircraft's trip record.

After the aircraft had landed, arrangements were made for an LAME to change the suspect instrument during the 'turn around' inspection. To replace this instrument, it is first necessary to lower the main instrument panel by removing the knob from the undercarriage control handle, releasing four screws at the top of the panel and swinging the panel, which is hinged at the bottom, rearwards.

The undercarriage control handle in the Friendship is mounted on the front pressure bulkhead and extends into the cockpit through a slot in the main instrument panel. The handle consists of upper and lower halves connected by the control handle knob, and the combined handle normally functions as a single unit. The upper half of the handle controls the retraction and extension of the undercarriage, while the lower half is locked by means of a pawl when the aircraft is on the ground, to prevent inadvertent UP selection. When the aircraft is airborne and the left main undercarriage leg is fully extended, a microswitch on the shock strut completes a circuit to a solenoid which is then energised and the locking pawl is disengaged. The undercarriage handle, complete with the locking lever, can then be raised. In an emergency, the function of the locking lever can be overridden by 'splitting' the undercarriage control handle. This is done by pulling the disengage trigger on the control handle knob and rotating the knob through about 60 degrees. The upper half of the handle can then be moved independently of the locked lower half, and the undercarriage raised.

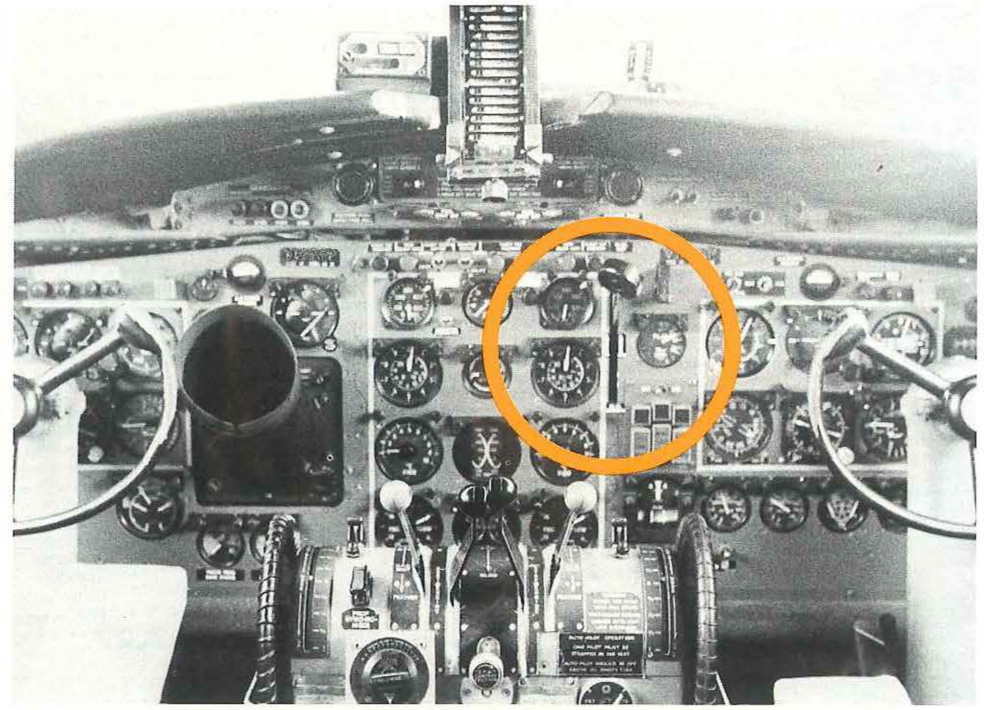
The undercarriage control knob is attached to the lever by a screw underneath the knob. Attempting to release this screw in this case, the LAME found it was particularly tight and that he needed to apply considerable upward force to the screwdriver to ensure it engaged properly in the slotted head of the screw. He had his left hand over the top of the knob to steady it and while pushing firmly on the screwdriver, it is apparent that he inadvertently operated the disengage trigger. With the trigger disengaged, slight misalignment of the screwdriver force was all that was required to rotate the knob to the release position. The handle split, and the operating lever was pushed upwards. The undercarriage retracted and, as the aircraft fell to the ground, the engineer was thrown forward, striking his head on the instrument panel and control pedestal, and injuring his back. The fuselage and left wing of the Friendship were extensively damaged.

* * *

Subsequent investigation revealed that, before attempting to remove the main instrument panel, the engineer had not taken the basic safety precautions specified in the operator's maintenance manual. The first two steps in the removal sequence are to ensure that the aircraft's electrical power is off, and that the pneumatic system is completely discharged.

Ensuring that electrical power is off guards against an inadvertent UP selection of the complete undercarriage control handle, because the locking pawl is engaged with power off. But regardless of whether power is on or off, the undercarriage selector handle can still be split by rotating the knob and the upper half raised, thus permitting the undercarriage to be retracted by pneumatic pressure if the system is not discharged. On this occasion, residual pressure in the main pneumatic system when the aircraft was shut down was 18 600 kPa, sufficient to fully retract both main undercarriage assemblies and partly retract the nose wheel.

Short cuts of any sort in aviation are potentially disastrous. The safety procedures to be adopted when removing the instrument panel were laid down in the company's maintenance manual and it is clear that, if they had been followed in this case, the incident would have been avoided.



Instrument panel of the Friendship, showing the undercarriage selector handle in the raised position. The knob has been rotated 60 degrees to the left, allowing the locking lever which prevents inadvertent retraction to be over-ridden.

EYESIGHT IS PRECIOUS

At a recent safety conference, an eye specialist described a hazard that could affect each of us and our families. That hazard is the catalyst or hardener added to fibreglass resin before the resin is applied. The eye specialist stated that a drop of this catalyst in the eye will progressively destroy the tissue of the eye and result in blindness. This will occur even though an attempt is made to wash the catalyst from the eye. Furthermore, once the chemical has started to destroy the eye, there is no known way of stopping the destruction or repairing the damage.

The specific toxic agent involved is methyl-ethyl-ketone peroxide (MEKP). In laboratory tests, MEKP in solutions of varying concentrations was found to cause eye problems ranging from 'irritation' to 'severe damage'. The maximum concentration producing no appreciable irritation was a solution containing only 0.6% MEKP. Material published on the subject indicates that washing an affected eye within four seconds after contamination prevented injuries in all cases, but no known chemical neutralizer has been discovered. Suggested precautions for catalyst users are eye-protective spectacles and the immediate availability of a source of bland fluid such as water for thorough washing of ocular tissues.

One disastrous experience was described. While fibreglassing a chair at home, a victim had both eyes contaminated by MEKP. Though he made an effort to wash his eyes out, several minutes apparently elapsed before he found water. The sight of one eye was lost immediately, the other was lost gradually over a period of about eight years. Its deterioration was described as resembling that resulting from mustard gas burns during World War I.

This fibreglass resin danger was previously unknown to those attending the conference, though many had used fibreglass resin at work or at home. The hazard may be unknown to readers also — and to wives and children who may use a similar kind of resin and catalyst when working with fibreglass or hardeners used in liquid casting plastic.

So before using any of these catalysts, check their chemical composition and take appropriate precautions. The cost of a pair of safety goggles is a very small price to pay for the protection of eyesight.

— With acknowledgement to American Airlines.

A NASTY SITUATION

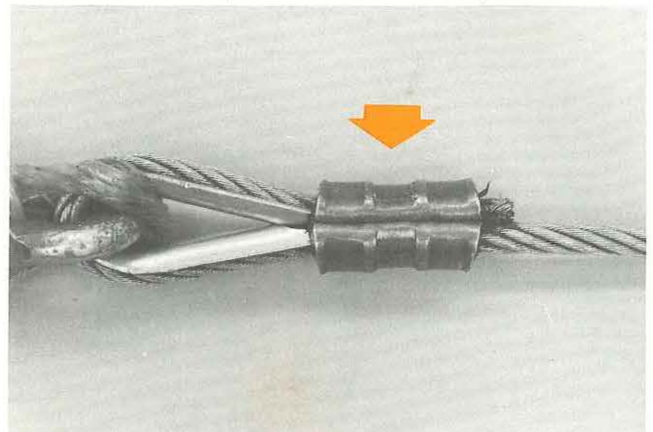
At Darwin, two pilots approved for low-level aerobatics had arranged to conduct some practice sequences. The weather was fine and warm and, about mid-morning, the pilots carried out a daily inspection of the aircraft they would be using, a single-seat Pitts Special. They had obtained a clearance to operate in the 'aerobatic zone', which is over the airport at the south-eastern end of the disused runway 13/31. The upper height limit for the exercise was 3000 feet. One of the pilots, the more experienced of the two, takes up the story:

I had asked the other pilot to fly first, so I could observe his manoeuvres from the ground. This flight lasted 27 minutes and was uneventful. We then changed over and after taking off, I climbed to 3000 feet to practise a four-minute sequence of free-style aerobatics. I began with an inverted, power on, left flat spin. After six turns, I recovered into a vertical dive then, when the airspeed had built-up, pulled up into a vertical climb and carried out an eight-point hesitation roll to the right. This was followed by a stall turn, then in quick succession, an outside 360 degree snap roll to the left on the vertical down line, which I initiated at 80 knots using right rudder, and an inside 360 degree snap roll to the right, again using right rudder, recovering at about 1200 feet.

At this stage I discontinued the sequence and climbed back to 3000 feet to start again. Once more I entered an inverted, power-on flat spin to the left, followed by the same manoeuvres. However, when I applied rapid, firm right rudder, back stick and right aileron to initiate the inside snap on the down line, the aircraft began to rotate cleanly, but suddenly my right leg plunged to its full reach without resistance.

Instantly, I realised the rudder cable had given way. Believing at first the cable itself had parted and fearing the right cable would be pulled beyond my reach, I instinctively reached forward and grabbed the loose end before applying left rudder to recover. By this time the aircraft had rotated just over 360 degrees and I pulled out of the dive between 1000 and 1200 feet using elevator and aileron control. I took a moment to settle down, and then called Darwin Tower to tell them of my predicament. They alerted the emergency services and cleared me to land on runway 11. I had taken up a northerly heading across the airport and, while continuing on a wide left circuit, I had wrapped the loose rudder cable around my wrist and hand. By pulling on the cable, I was able to obtain some measure of right rudder control.

The right rudder pedal, with its toe brake, had shot forward with such force when the cable let go that it had dented the firewall and was now beyond my reach. So I knew that on landing, I would have no directional control once the slipstream effect on the rudder had diminished. Because of its tail-wheel undercarriage and very short fuselage, the Pitts requires maximum concentration and constant application of brakes to keep straight after touchdown, irrespective of the wind direction. It was unfortunate that the prevailing weather conditions would compound my problems, as the wind was gusting. I decided to carry out a powered approach at minimum speed.



On final approach, I was able to manipulate sufficient right rudder to maintain a constant heading in a three-point attitude. About five feet over the threshold, I closed the throttle completely and the aircraft settled on to the runway on three points at about 60 knots. The aircraft began to swing to the left, so I corrected by pulling on the right rudder cable. I maintained directional control initially but then the aircraft began to swing to the left again. Though gradual at first, the turn rapidly tightened into a ground loop and, despite full right rudder deflection I was powerless to correct it — obviously slipstream effect had been lost. I could hear the right tyre screeching, then I felt the tail lift and saw the right lower wing scraping the bitumen. As the tail rose higher, the propeller struck the ground and the aircraft skidded to a stop on its nose at about right angles to the runway. I climbed from the aircraft and within seconds, the crash crew was on the scene!

* * *

Inspection of the aircraft disclosed that the right rudder cable had become detached from the rudder pedal. The 3.2 mm (1/8 inch) diameter cable had pulled through a copper Nicopress sleeve used to form an eye where the cable attaches to the rudder pedal (see photograph).

Both rudder cables were removed from the aircraft, which had flown only 65 hours since new, for more detailed examination. The cables have similar eye fittings at each end and these were measured and compared with other sample end splices. It was found that, while the copper sleeves used to form the eyes were the correct type for 3.2 mm (1/8 inch) cable, all four end splices had been formed with a pressing tool appropriate to a cable diameter of 4 mm (5/32 inch). Thus the sleeve had not been properly compressed and the resulting clamping action was insufficient to provide a splice of adequate strength. During a series of laboratory tests, the rear end of the left rudder cable pulled through the sleeve when a load of 280 kg was applied. It appeared from marks on the fittings that the splice which failed in flight would have been significantly less effective than the one which failed on test. A correctly pressed sleeve withstood a load of 1090 kg without any sign of slipping.

As a result of the investigation into this accident, an Airworthiness Directive was issued requiring that all cable splices in Australian-registered Pitts Specials be inspected before further flight. The airworthiness authority in the United States also issued an Airworthiness Directive requiring inspection of the Nicopress sleeves on Pitts' rudder control cables.

* * *

The pilot of the Pitts holds a private licence with approval for low-level aerobatics, and at the time of the accident had flown about 400 hours in the aircraft type. He is to be commended for his handling of the aircraft in a serious emergency. He correctly assessed a nasty situation and by quick improvisation was able to obtain some degree of rudder control. His presence of mind undoubtedly saved a valuable aircraft from more serious damage, if not complete destruction.

Intact end-splice on rudder cable removed from the Pitts after the accident. The copper sleeve has been re-pressed in the centre groove with the correct sized tool, to show the additional compression required for a satisfactory splice.

'WHAT! YOU THREW AWAY THE RIPCORD?'

By David Townsend

(With acknowledgment and thanks to 'Australian Gliding'.)

The morning foretold another scorching day.

It is the first day of the New South Wales Sports Class and Two-seater Gliding Championships at Leeton in the wheat-growing plains of south-eastern Australia and I am to fly my club's new Pilatus B4 15-metre sailplane. I am nervous at the prospect of my first competition: my stomach won't settle down, and the heat is no help.

It will have to be endured, and the met. briefing is that thermals will not start until the ground temperature gets to 40 degrees C. A blanket of high cirrus cloud is moving in from the west; maybe the ground won't get hot enough to produce strong lift. The task-setters consider the pros and cons and announce a 151 kilometre triangle for single-seaters with the distinctive wheat silos at Mirrool and Garoolgan as the turning points.

A couple of hours are spent checking the glider and its equipment, stowing water bottles so necessary in case of an outlanding in some remote area. I decide to remove the seat cushion to give my head a little more clearance from the canopy. I find I can nestle into the cockpit very comfortably in the 'Slimpak' parachute.

At last the thermals begin, weakly, but enough for the ground marshal to call in the tugs. Soon, sweating in the oven-like cockpit and spitting out the gritty red dust blown in by the tug's prop-wash, I am whisked aloft but towards the irrigated farmlands.

Damn! Why does he take me so far downwind over these soggy ricefields? There's no lift around here. I release at 2000 feet and head back for the field but the only lift I can find is within a kilometre of the starting gate where thermalling is prohibited. I land, cursing and calling for a relight.

'Calm down, take it easy', says my wife as she helps me retighten the chute and straps me firmly back in the cockpit. This time the traffic is easier and I am dropped close to a thermal to which it seems every glider in the southern hemisphere is heading. It fizzles out at about 4000 feet and the occupancy rate at the top is very high. I am not happy hanging around in that gaggle even though it would seem to be better to delay starting until conditions strengthen.

I ease carefully out of the crowded thermal and turn for the gate, which is marked by one of the runways. I cross at slightly under 3000 feet, get the radio call, 'Good start Whiskey Quebec Mike', and in the absence of any signs of lift, proceed at a cautious and height-conserving 45 knots on course for Mirrool.

This progress continues in a stately, but downward direction, until with less than 1800 feet, I must decide whether to blunder on hopefully or to scrape back to the airstrip. I creep over some rising ground and the varios tell me we are in zero sink. I make some exploratory turns and gradually work my way into a weak thermal that straggles to 3500 feet.

Gradually things improve and I find strong lift that carries me to 9500 feet. At this height the view is magnificent. I can see the roads leading to Mirrool and the railway line that runs to the second turn point, Garoolgan! I marvel at the yellow of ripe wheat, the bleached stubble and the dark, purple look of the wooded areas.

Exhilarated, I could float here all day; but I remind myself that the race is to the swiftest. I push the stick forward and the B4's nose goes down until the ASI reads 90 knots. I am impressed by the way we travel over the ground, even though I seem to be looking down at it between my feet. I pull the stick back to slow down while passing through rising air, but only bother to circle when the lift is strong. The only other gliders I see are a Blanik and a Ka6.

This is what glider pilots dream about! I laugh and sing with the joy of it. Other pilots are feeling the same by the excited radio chatter and I reflect that the two-seaters are particularly garrulous.

It seems incredible, but I am almost over Mirrool silo still with more than 9000 feet on the clock! I fumble for the Instamatic camera and prepare to make a steep turn.

Over we go — keep the wingtip in the viewfinder — where's that silo? Over further; with this and the unaccustomed left hand on the stick a horrendous sideslip develops. I think I get the silo in the picture but I am practically right over it. Better go back and have another go.

I turn slowly and cautiously away from the silo looking carefully for other gliders. But reckoning on being further out than they would be I turn again to photograph the silo looking back along the direction in which I had come. Can't see anyone. I take two shots and hope they will do — I want to get away from here.

I check my height — still over 9000 feet. Speed? Say 50 knots till I sort out the heading to Garoolgan. There we are — 271° magnetic. Now where's that map?

Reaching for it under my right elbow I take a look outside — heading straight for me is the slim outline of the vee-tailed Salto! It is slightly higher than I am, but obviously close. Instinctively I push the stick forward to go under it. At the same time as my left hand gets to the airbrake lever, the white form blurs overhead.

There is a bump — hollow and metallic. 'It's OK', my brain reports instantly, 'only a glancing blow on top of the tail'.

Perhaps a second of deathly quiet passes — then the B4 flips end over end and I am upside down in a violent, whirling spin. My arms are flung against the sides of the cockpit; I can't get my breath. I struggle to get my hands on the stick; it's jammed hard forward. The earth whirls crazily below.

I know I must jump. Mechanically, my left hand finds the canopy release. The canopy lifts and disappears in an instant with a sound like a rifle shot. Turbulent air blasts noisily at me. It is pleasantly cooler.

Somewhere inside me, as I fumble with the harness release, a calm, textbook sort of voice intones: 'It is advisable to abandon the glider with your hand on the ripcord'. Still whirling, I manage to get my right hand on it, low on my left side. My left hand pulls the harness release. Horror upon horror; I fall straight out of the cockpit!

Face downward I plummet towards the brown earth. I sense that the B4 has righted itself and is above and behind me, well clear. Frantically, I pull the ripcord. It offers no resistance; I continue to hurtle downwards, staring at the ground, breathless with shock.

This ghastly hiatus ends with a violent jerk, I am vertical, dazed, hanging in those wonderful straps. Above me is a smooth white, yellow and black canopy. There is no sound, I am alive and likely to remain so. Suddenly, life is precious.

I hazard a downward glance and my stupor is shattered by the appearance of the Salto hurtling into my field of view, perhaps 1000 feet below, in a spiral dive with the outer section of one wing crumpled.

I know that John Church is in the cockpit. 'John, get out. Let me see you', I scream to the empty air. A second later I see the canopy lift away. John's form steps out as a man might jump into a swimming pool. He pulls the ripcord, the 'Slimpak' opens and his canopy blossoms. I relax.

Then my abandoned glider appears below. It is the right way up in a flat spin. A whirling white object near it puzzles me for a moment. Then I understand. The object is the complete tail section — fin and rudder, horizontal stabiliser and elevator. The whole thing must have been sheared off in the collision.

Now I can see both the B4 and the Salto spinning earthwards, together. John seems to be descending faster than me. I notice that one of my shoes is missing and the other is hanging precariously from my toes. Gingerly, and sickened by the distance between the shoe and the ground, I lean forward in the straps, get it back on my foot and retie the lace.

John is now much lower than me. He is heavier than I am. Maybe I am not descending at all. I look up. A large dark cloud looms around the bright canopy. Maybe I am in some gigantic thermal and I am going to be sucked up into that black cloud.

Frightened again, I tug at the lines, trying to collapse part of the chute. It doesn't seem to make any difference. The thick cords hurt my fingers and I give up. The ground looks just as far away. The few farmhouses are still mere dots.

The fear vanishes and I am filled with a marvellous well-being. I have never felt so peaceful, so happy. The view is magnificent. Time seems to stand still while I am suspended in the huge bowl of sky. It is utterly, utterly quiet.

I watch the Salto, then the B4 thud into a ploughed paddock, not far from each other. They send up brief spurts of reddish dust, then are still. Suddenly I am flooded with wild dismay as I realise two fine aircraft are now wrecks and that one of them was, until a few minutes ago, the newest and proudest possession of my club.

John is near the ground. I watch as he hits. His body seems to crumple; the canopy collapses beside him. Within seconds I see him rolling it into a bundle. Holding it in his arms, he strides vigorously towards a nearby farmhouse. I wonder how I will fare.

I study the ground. At least I can see that it is closer. I am descending, drifting in the light wind away from the paddock where the gliders lie, away from open paddocks and over low, wooded hills. I pull mightily at the right line and drift slowly back towards open ground.

I sink into a bank of hot, dry air. I won't be long now. I am surprised to realise that I am cheerfully resigned to at least a broken leg.

I am going to land in a large fallow paddock. There are three or four trees in it and I am over the largest, an old spreading eucalypt. I pull frantically at the lines, first one side then the other. Nothing seems to happen.

The earth is rushing up at me. I can smell the dry ground. The breeze slides me well clear of the tree. The calm textbook voice is back: 'Remain with your back to the wind, feet together, knees slightly bent and roll as you hit'.

The impact is astonishingly hard. I lie on one side, winded, unable to breath. Gradually air returns to my lungs; I test arms and legs. I sit up and pain shoots along my spine, my chest feels as if it is bound with steel straps.

I roll the chute as best I can and stumble towards the distant farmhouse. Progress is slow and not without discomfort. Every few paces I have to stop and pick thistles from my right foot, protected only by a thin sock.

I become conscious of a car speeding towards me. It slides to a halt in a cloud of dust and the farm owner, his son and John Church step out.

Suddenly John and I are shaking hands and desperately glad to be doing so. While we wait for our wives and crew to drive from Leeton, John and I talk in the friendly farmhouse kitchen. To my surprise, I learn that John was formerly a parachute instructor in the Australian Army. A veteran of about 500 drops, this is his first 'emergency'.

Later, back at the airstrip, I am able to laugh, if wryly, at the number of old hands who, after expressing their pleasure at seeing John and me alive and well, ask to see the ripcord.

'I dropped it, I guess', I say to one, recalling my terror the moment before the canopy filled.

'What, you mean you threw away the ripcord?' he says, shocked. 'You're supposed to keep it for repacking. They cost money you know.'

In Retrospect:

For glider pilots I would sum up advice about parachutes this way:

- Wear one.
- Know how to use it.

I think the only time they are not necessary is in two-seaters on local soaring and training flights. They should always be used in single-seaters. Indeed most cockpits are built so that a parachute forms a handy part of the seating. Except perhaps for some older gliders with upright seating, it seems to me that the 'Slimpak' type is the most adaptable.

The wrecked Pilatus (left) and Salto (right) as they came to rest in open country after the collision. Note the entire tail section of the Pilatus has been torn away.

Pilots converting to their first single-seater are most likely to be about to don a parachute for the first time. They should be thoroughly briefed by an instructor and separately from the briefing on the aircraft. Someone conversant with the particular chute should check that it is donned properly. (Yes, glider pilots *have* been seen climbing into their aircraft, wearing their chutes upside down!)

The harness should be drawn up tight while standing. You should end up slightly crouched and find walking a little awkward. Spend some time in the cockpit ensuring comfort. Get out again if necessary, until the harness is adjusted correctly. A too tight strap loosened in flight could be as disastrous as not wearing a chute at all.

Films are available on the use of parachutes, so why not arrange a showing at your club? There are many experienced parachutists among the skydivers, who would be happy to speak on the subject and demonstrate proper care and handling.

Ensure that everyone who wears a parachute knows how to inspect it. Check the packing slip and make sure it is repacked by the due date.

Carefully open the flap covering the pins. They must be pushed fully into the studs, and the piece of red thread and lead seal tied around one pin and stud must be intact. The ripcord should be tucked fully into its pocket.

Keep the chute clean and dry. Never put it on the ground. Keep it in a zippered carrying bag. This way you can use it as a temporary wing-tip weight.

Thinking back, I don't believe the remote voice inside me offered the best advice. I discussed the jump with fellow club member Jack Stevens, an experienced pilot and a renowned authority on parachutes. (Incidentally, Jack packed the chute I used and for this alone, I hold him forever blessed.)

Jack believes the pilot's hand should not be on the ripcord before bailing out. This is because of the risk of pulling it instead of the seat harness release or of deploying the chute when not clear of the aircraft.

Both John and I suffered cuts and bruises to the shins caused by dragging against the instrument panels. If possible, departing pilots should draw their knees towards their chests before releasing the seat harness. This may be difficult in some gliders. At least make sure there are no dangerous projections such as oxygen plumbing under the panel or attached to the cockpit sides.

Jack says you should try to land facing the wind rather than turning one's back on it — in strong conditions the canopy could drag you along the ground. When face down it may not be possible to collapse the canopy and the slowest ground speed gives the softest landing (the same as a glider).

The pain in my spine disappeared in a day or two. Soreness in my chest and upper back persisted for five or six weeks. This was due not to the hard landing, as I had thought, but to the shock from the canopy opening when I was face down. Bruising on my shoulders and inner thighs testified to that.

Just one final piece of advice: if you do have to bail-out, do *not* hang on to the ripcord after you've pulled it. It could tangle with the canopy and cause a malfunction — so get rid of it!

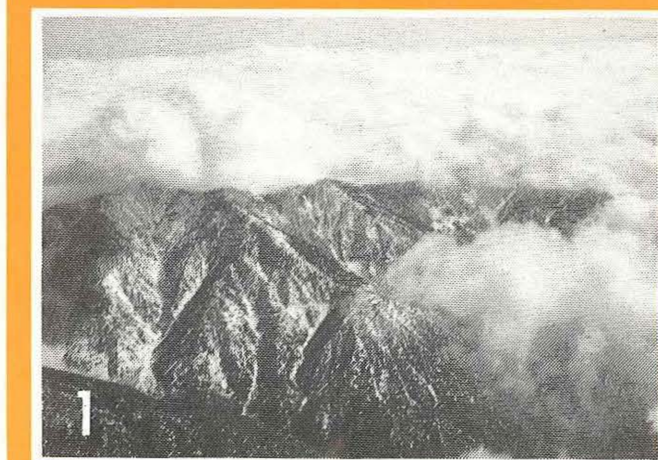
It's Good Advice For Us Too!

The following 'Pilot Contribution' appeared recently in the United States gliding magazine — 'Soaring'. We reproduce it with acknowledgement, believing that Australian pilots — both power and glider — can learn something from their American colleague's experience:

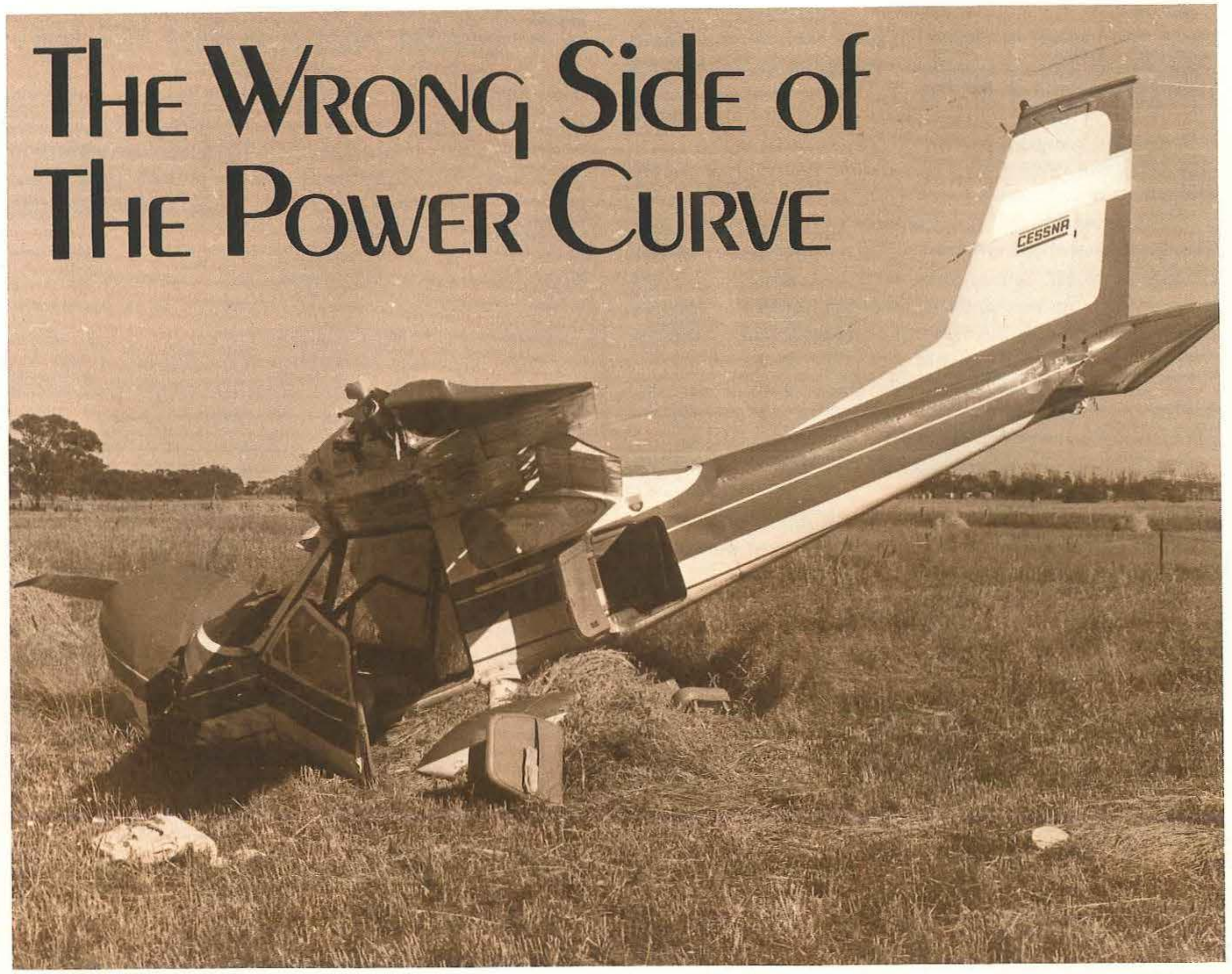
Keep your eye on that hole!

I was making a thermalling ascent on the desert side of the San Gabriel Mountains in California. To my surprise, lift continued past cloudbase (9000 feet AMSL), increasing to 800 fpm on the windward face of a building cumulus. Cloud cover was broken with plenty of safe exit holes and it looked like a rare opportunity. In no time at all I was climbing right up the cloud's face at 14 000 feet AMSL and enjoying the spectacular panorama. In my eagerness to savour this experience and record it on camera, I neglected to check the undercast for 10 to 15 minutes — no more. Picture 1 shows the size of the holes on the way up. About 10 minutes later picture 2 (my last on that day) alerted me, and to my dismay the holes below were closed except for a small one that I just squeaked through.

I sure learned a thing about weather from that and wanted to share this pictorial proof of how fast old Mother Nature can do her thing!



THE WRONG SIDE OF THE POWER CURVE



The pilot of a Cessna 177 was departing from a country airstrip with two passengers on board. He carried out his pre-take-off checks, selected one stage of flap and after lining-up at the threshold, applied full power. The grass strip was approximately 600 metres long with a down-slope of about one degree, the wind conditions light and variable.

Before commencing the take-off, the pilot had noticed several flocks of birds in the vicinity of the strip and half-way through the take-off run, he caught sight of two galahs on the ground in front of the aircraft. The pilot said that he then reduced power by about a quarter-throttle, before veering to the right to avoid the birds. This evasive manoeuvre was successful and he steered the Cessna back on to its take-off path.

Believing that he was now committed, the pilot persevered with the take-off, and the aircraft became airborne just before reaching the far end of the strip, with the stall-warning sounding for a short period. The Cessna climbed slowly, narrowly clearing a house beyond the end of the strip, and the pilot became concerned at the apparent lack of performance. In the hope of improving the rate of climb, he increased the flap setting to about the 'half' position. At this point he also noticed for the first time that he had forgotten to re-open the throttle after veering to avoid the birds. He immediately applied full power.

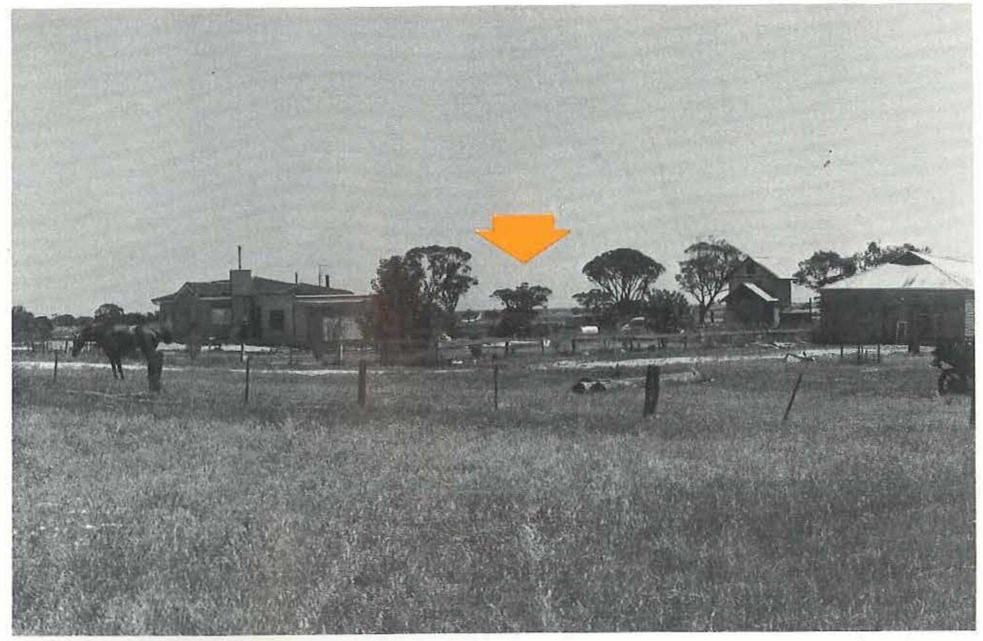
The aircraft held height for a short while but then began to sink and the pilot was unable to prevent the starboard wing hitting the top of a gum-tree. Losing speed rapidly, the aircraft fell to the ground, striking it first on the nose and port wing, and came to rest badly damaged. Though all three occupants suffered injuries, they were able to climb out unaided.

* * *

Subsequent investigation disclosed that there were no defects in the aircraft or its systems that could have contributed to the accident and that the aircraft's gross weight and centre of gravity were within limits. Witnesses said that the aircraft had become airborne at a point consistent with previous operations by this aircraft. It was calculated that in the existing meteorological conditions, the take-off distance available was about 45 metres less than the distance required to reach a height of 50 feet as specified in the take-off weight chart in the approved flight manual for the aircraft.

Although it would appear that the throttle reduction was a major factor in the circumstances which led to this accident, it was probably not the only one. A positive climb angle of only about two degrees was all that was needed for the aircraft to have cleared the tree it finally hit. As the aircraft had become airborne within the length of the strip and had already cleared trees slightly higher than the one it struck, it would seem that the aircraft should have been able to continue climbing away and avoid other obstructions which were lower and more distant from the point of lift-off.

View looking in take-off direction as seen from a position close to where aircraft became airborne. The tree the aircraft struck is indicated. The wreckage is in the centre background of the picture.



The sounding of the stall-warning horn and the aircraft's low height over the buildings beyond the end of the strip had alerted the pilot to the aircraft's subnormal rate of climb. It was at this point that another factor in the accident sequence was introduced: the pilot lowered the flaps to the 'half' position believing that in so doing he would improve the climb performance of the aircraft. In fact, the only result of lowering flap from the normal take-off setting of 10 degrees to the 'half' position would have been to reduce the lift-drag ratio. For an aircraft in this situation, the only way in which an improvement in climb performance could have been achieved would have been to increase speed or, if this were not possible, to use additional power.

The pilot felt the aircraft begin to mush and lose height and at this stage he claims he did increase the engine power. But of course it was too late and any possible advantage was outweighed by the drag associated with the half-flap setting and the low airspeed situation. In other words, the aircraft was well on to 'the back side of the power curve', where the power required to recover exceeded the power available.

A Close Call!

From a recent incident report:

Flying a Piper Cherokee, I departed from Bankstown at 1150 hours on an IFR flight to Canberra. The airways clearance was '29 Marulan departure, cruise 6000' and there was an initial height restriction of 3000 feet.

On reaching 6000 feet I noticed that the cloud base was about 5800 feet on area QNH and that the aircraft was in and out of broken strato-cumulus.

The pilot in the right hand seat happened to be watching for a visual fix when he suddenly saw a glider emerging from cloud only 500 metres ahead and above our aircraft. There was no question of a collision if both aircraft continued on their established paths and within a few seconds, my aircraft passed less than 50 feet beneath the glider.

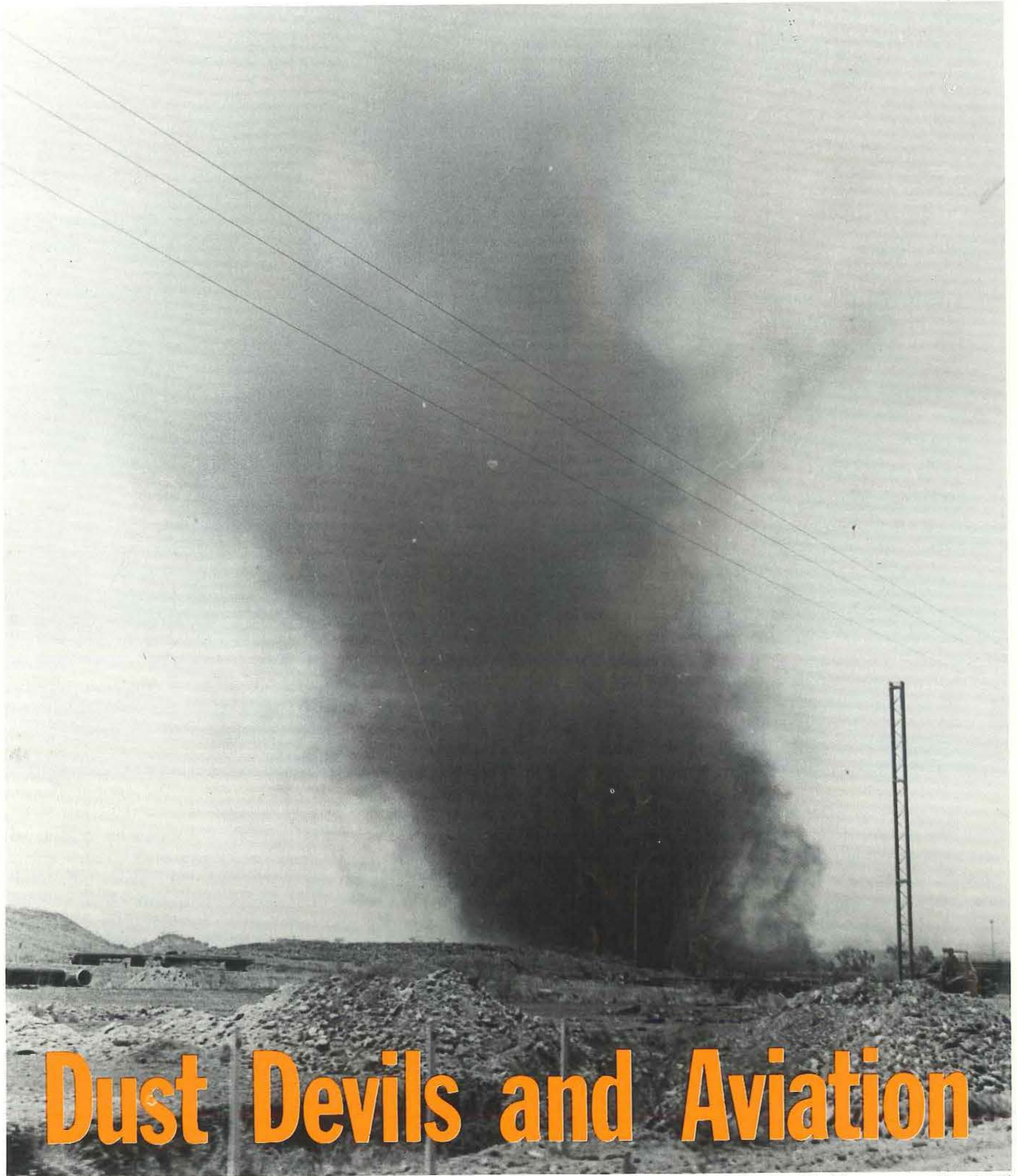
Apart from being a very unnerving and dangerous experience, I am concerned at the irresponsibility of the glider pilot. The incident highlights the following points:

- The glider was non-VMC in controlled airspace.
- Had I been alone on instruments I would not have seen the glider if evasive action had been necessary.
- If evasive action had been necessary, a sudden change of attitude into cloud could have meant loss of control of the aircraft, thus further jeopardising aircraft and crew.

We all need to be reminded of our responsibilities from time to time — both to ourselves and to others — and I think gliding clubs, especially around dense traffic areas like Sydney and Bankstown, need regular reminders. No matter how tempting it is to go up with a thermal to get home, there is almost certainly somebody else in that cloud on top of the thermal!

I hope this experience will alert all pilots to the potential hazards of bending the rules.

Dust Devils and Aviation



(Photograph courtesy of Carpentaria Newspapers Pty. Ltd.)

The paper on which this article is based was originally prepared as a result of questions raised at a general aviation symposium attended by more than 100 pilots at Longreach, Queensland. Though mainly concerned with the problem of dust devils in that State, the comments and observations made have application to inland Australia generally.

In inland Queensland the occurrence of whirlwinds or 'dust devils' as they have come to be known, is so frequent that local residents regard them as part of the summer 'scenery'. Pilots operating in these areas encounter dust devils so often that they do not usually bother to report them, even when their in-flight experience could be classed as 'frightening'. Voluntary weather observers evidently have much the same attitude, for though local people will speak of seeing at least ten dust devils in the course of an hour, or even at one time, this is not borne out by reports from weather stations in western Queensland.

Pilots were asked to recount some of their more hazardous moments while flying in dust devil conditions and the following accounts give some indication of their effect on light aircraft. Though most pilots were adamant that dust devils are not really a dangerous phenomenon, their experience shows the need to develop safe techniques for operating in dust devil conditions — both in-flight and during take-offs and landings:

- A pilot was flying a Cessna 172 in the Cunnamulla area at 10 000 feet in cloudless conditions. The surface temperature was above 38 degrees C and the wind light and variable. No dust devils were visible at the cruising level, but many could be seen below. The aircraft was heavily loaded, with the pilot's wife and three children as passengers. The pilot believes he flew into the invisible top of a cauliflowering dust devil: 'In spite of full corrective control and full power,' he recounts, 'the aircraft rolled inverted and was flown out underneath. I could not climb any higher and was forced to descend to maintain control'.
- At Nanda an aircraft was landing into a gusty wind of 20 to 30 knots. Small numbers of scattered dust devils were visible and the surface temperature was about 38 degrees C. 'At the last moment,' the pilot relates, 'a dust devil several hundred feet high crossed the landing path, slewing the aircraft first one way then the other, and rolling it on to each main landing wheel alternately. The whirlwind was one of a group of three, and was invisible until it moved on to an ungrassed area and picked up dust. At one point the aircraft was lifted clear of the ground at or just below stalling speed — very unpleasant!'
- At Richmond, a Cessna 150 was taking off in almost calm conditions. The temperature was 41 degrees C and the sky was cloudless. At a height of about 100 feet it encountered a whirlwind. (The pilot believes this was in the process of forming at the time — it was not visible as he was taking off, but it later became a very large dust devil.) The pilot's first indication of the encounter was a very sudden gain of about 200 feet of height. But then the upward motion stopped so suddenly that the pilot was flung against the restraint of his seat belt and bumped his head against the cabin roof. At the same time the airspeed indicator needle shot up into the red arc! Though buffetted, the aircraft remained controllable. The pilot considers the only real danger was the effect of the gust on the aircraft's structure as the airspeed indicator showed an increase of some 60 knots. Had the whirlwind been fully developed, he feels that structural overloading could have resulted in airframe failure.
- Another pilot said he had seen the roofs of two houses at Richmond lifted by dust devils and the sheets of galvanised iron carried half a mile. He believes that light aircraft would certainly be lifted if not pegged down. On one occasion a Cherokee Six tied down at Windorah with four 16 mm diameter ropes was tipped on to its back when a whirlwind snapped two of the ropes. Another pilot told of a Piper Colt which had just been wheeled from a hangar in the course of a 100 hourly inspection. Before those pushing it had time to walk back into the hangar, a whirlwind had struck the aircraft, picked it up and dropped it again upside down, damaged almost beyond repair.

The conditions necessary for the formation of dust devils are fairly well known. They occur most frequently in arid country where there is little surface vegetation and much loose surface dust, though the dust need not be thick. In country where scattered trees and sparse vegetation alternates with areas where there are no trees or grass, dust devils are intermittently visible. They are seldom seen over salt marshes, well-watered grasslands, or thick forests.

Meteorologically, dust devil formation requires strong surface heating for some hours with little surface wind. This implies a decidedly super adiabatic lapse rate near the ground with surface temperatures in the region of 60°C to 70°C and cloudless skies or at least well-scattered high level cumulus cloud. These conditions prevail in inland Australia during the warmer months.

Dust devils also occur along the sea breeze front in hot arid or semi-arid regions such as in the Gulf country of Queensland and the north west of Western Australia. 'Invisible dust devils' or whirlwinds can occur after a good season when there is more grass.

In his concluding remarks, the author of the paper points out that dust devils, whether visible or not, are a hazard to light aircraft taking-off or landing. Moreover disturbances have their greatest energy near the ground when the pilot's attention is concentrated on flying the aircraft, rather than watching for evidence of whirlwinds.

At higher levels, where there is more airspace to manoeuvre, the dangers are not so great, but loss of control at any time can be frightening. The risk of loss of control seems to be greater in the upper part of the disturbance where the rising air column changes its structure by spreading and contains areas of subsiding air which find their own density levels after having been carried higher than that level by the dust devil's inertia. Here the aircraft's lift can be affected, resulting in sloppy control responses. This disturbed region of air is seldom visible but extends for about 2000 feet above the visible dust column. It will usually follow the extension of the column of dust; i.e. if the dust column is vertical, then the area is usually directly above it; if the dust column is sinuous, then the area is beyond and in line with the path of the dust column.

The author suggests that pilots who have gained the bulk of their experience in coastal areas may be blissfully unaware of the possible consequences of operating in dust devil conditions. Thus a 'coastal' pilot's first encounter with a dust devil while landing at an inland strip could well result in an accident. For such as these, the following advice is offered:

- In dust devil areas, watch the tall grass movement when landing as this will give an indication of the invisible dust devil.
- It is better to fly at middle levels and put up with the turbulence, than to wallow uncontrollably at the 'cauliflowering' level.
- Confine flying to morning hours whenever possible.
- Avoid dust devils wherever possible, and delay landing until the strip is clear of dust devils.
- Dust devils are not dangerous to experienced pilots but must be treated with respect at take-off and landing.
- On the ground, light aircraft should be securely pegged down if not parked in a substantial hangar.

Ask for Help — While You Still Can!

(Pilot Contribution)

I detect a fairly prevalent feeling among pilots that Departmental officials are regarded with the same kind of suspicion as school teachers or policemen. The attitude is that Flight Service and similar staff are to be given a wide berth — or you could end up with a fistful of 225s. This seems to me to be another factor in the chain of events that can lead to dangerous situations for pilots and passengers.

I would therefore like to describe an incident with the object of highlighting how liaison with Flight Service can make life safer for the pilot. During my flying career I have often sought the guidance of Flight Service. They have usually put their suggestions in a tactful, indirect fashion — presumably because their transmissions are recorded. But from the Departmental point of view, I am sure that helping to keep pilots out of trouble is far more important than castigating them or, worse still, having to pick up the pieces after a crash.

My own story is about a flight from Clermont to Maroochydore where I was to spend Christmas. At the time of the incident I had a private licence, about 400 hours in command, and a new Night VMC rating. Most of my hours had been gained in remote areas of the Gulf country and northern Queensland. The aircraft was a Cessna 172 with VOR, ADF, and long range tanks. On board with me were my wife and infant son. We were tracking direct from Clermont to Maroochydore and had adequate endurance to complete the flight safely.

The flight started in the morning in fine clear weather and the forecast indicated suitable weather for the flight. However, the indications were that deteriorating conditions could be expected towards the coast late in the afternoon with buildups of cumulonimbus clouds, thunderstorms and rain squalls. This forecast was quite accurate and by Eidsvold we were looking carefully at the situation. By Gayndah there was storm activity and occasional squalls. We decided to keep going, bearing in mind that the weather activity was only scattered, with a high cloud base at 5000 feet, and that the coast to the east was still clear as the weather was coming from the south south west, so that Maryborough was CAVOK and a safe haven if needed. Our endurance was adequate to fly to alternative destinations safely, and we had plenty of daylight left.

Abeam Gympie, Brisbane called me up and asked for a report on the weather in my area. By this stage there were very heavy clouds rolling in from the south west, areas of dense thunderstorm activity and heavy rain squalls. We kept going because Maryborough was still fine and because Brisbane advised us that the weather along the remainder of my track was still VMC. Things in the Maroochydore direction certainly did look more pleasant than Gympie.

By Cooroy I decided to give flying away for a while and see how the weather developed. I did not know the area well for one thing, and secondly conditions were now deteriorating too fast for comfort. I told Brisbane of my decision and asked them to advise what strips were in my area. By this time I could still see the strip at Noosa but it was rapidly disappearing in a rain squall. Flight Service advised that there was a nearby private strip close to a set of white cattle yards on the northern end of a lake. At this stage also I could still have safely made Maryborough.

We landed without trouble at this bush strip and waited for a while. After about half an hour the rain stopped and the clouds lifted a little. I rang a friend at Maroochydore for a report on conditions there. I also rang Brisbane Flight Service. On the basis of my local observations and the reports from Brisbane and Maroochydore I decided to continue, overflying Noosa strip for safety. At the time of take-off, conditions were VFR at the destination and apparently along the track. The flight to Maroochydore should have taken about 20 minutes.

However, a few minutes later a heavy rain squall moved along the coast towards us. The clouds had again descended to hilltop level, so our bush strip was now hidden by cloud. We looked in the Maryborough direction to see that blanked out also.

At this stage I was circling above a very grey sea just out from the beach at about 1000 feet. That beach looked very welcoming. Just as I had finally decided that the beach was the place to head for, Brisbane called me to ask if I could maintain VMC. My prompt reply was: 'Negative, and there is a nice stretch of beach down below where I intend to land.'

We did a normal circuit and landed with full flap and minimal airspeed. I judged that the beach would be hardest where the wet sand merged into the dry. All went well and SARWATCH was cancelled from the beach.

I rang Brisbane FS from Tawantin rather expecting a blast for landing on a beach. The reaction was, however: 'Well, you would have been a bloody fool if you had done anything else! Happy Christmas!'

So thank you, DoT staff, for your help to me and my family on several occasions. May I say to other raw pilots that if you find yourself in a tight spot, liaise with Flight Service for advice, make up your own mind ultimately on your course of action, but do not leave either the liaison or the decision-making too late.

Comment

We too endorse the pilot's decision to land on the beach, in a situation where there was no reasonable alternative. But, unless you know the particular beach treat it with respect, particularly in nose wheel aircraft. There may be soft patches in what seems to be a firm surface.

The Breath of Life

At first glance the details of the flight might not have seemed particularly unusual — just a Cessna 172 on a private VFR flight from Broken Hill to a country town in South Australia. But it didn't take the Adelaide flight service officer long to notice one thing that *was* out of the ordinary. The pilot had reported to Broken Hill that he was cruising at flight level 140. A Cessna 172? At 14 000 feet? The Adelaide FSO called the aircraft and spoke to the pilot. The pilot's reply seemed slurred and his words were pronounced very slowly. 'Are you equipped with oxygen?' the FSO anxiously enquired. 'Negative,' was the answer!

The FSO immediately suggested that the pilot begin a descent to below 10 000 feet. The pilot followed this advice, although his radio communications continued to suggest a mental state of confusion and drowsiness. However, once the aircraft had descended there were no further problems and the rest of the flight was without incident.

The pilot later explained that he had climbed to flight level 140 to try and avoid the strong head winds he had encountered at 6000 feet, the altitude he had originally planned. Altogether, the aircraft was above 10 000 feet for about 35 minutes. Throughout this time, of course, the pilot should have been using oxygen. Although the flight ended safely, it is quite possible that had it continued at such a high altitude, the progressive onset of hypoxia (oxygen deprivation) could have led to a dangerous situation.

Several years ago, the Digest discussed the need to use oxygen at altitude in the article 'Oxygen, the Life Giver', published in Issue No. 66. The following extract is pertinent to the incident described and worthy of repetition:

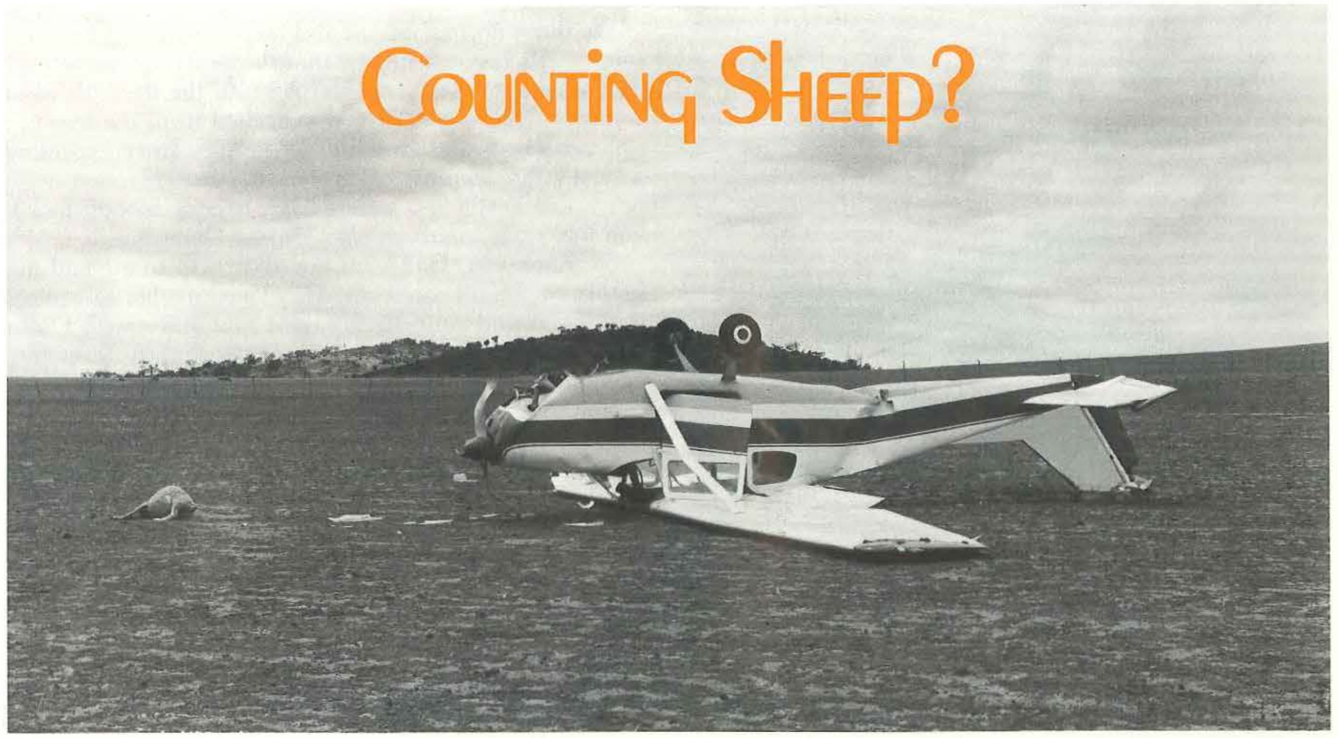
The altitude at which the onset of the effects of hypoxia occur varies with the individual to some degree and with the period of exposure to lack of oxygen. Poor physical condition, for instance, lowers the body's tolerance to altitude. But no matter how fit a person may consider himself to be, the onset of hypoxia is insidious, producing symptoms not likely to be recognised by the subject himself. The lack of oxygen has its effect first on the most highly developed cells of the body: those of the brain. Night vision, the ability to see in 'the dark', is actually affected as low as 4000 feet. Fatigue, consumption of alcohol, sleep-inducing drugs and carbon monoxide all increase the likelihood and effect of hypoxia. The blood of heavy smokers contains 5 to 10 percent carboxy haemoglobin and as this percentage is unusable for carrying oxygen, heavy smokers, as far as physical effects are concerned, have to be regarded as several thousand feet 'above' the actual cabin altitude.

At 10 000 feet, the upper limit to which flight crews may operate in non-pressurised aircraft without supplemental oxygen, a definite degree of hypoxia can take place during a prolonged flight: there is a gradual impairment of the pilot's judgement, co-ordination and ability to assess a flight situation. At 14 000 feet the effects become more pronounced: thought processes and memory are impaired and headache, dizziness, fatigue and slurred speech occur. The nails and lips may become blue.

At 16 000 feet disorientation, belligerence and an over-confident feeling of well-being are common symptoms, effects much like those of alcoholic intoxication, a 'not caring a damn' feeling. Between 18 000 feet and 20 000 feet, unconsciousness, akin to a fainting attack, may occur. The time taken for hypoxia to cause unconsciousness shortens rapidly as the altitude increases.

Lack of oxygen is an insidious hazard. It is all the more dangerous because the pilot affected by it is usually unaware that he has a problem. So, when flying high, remember: oxygen is the breath of life.

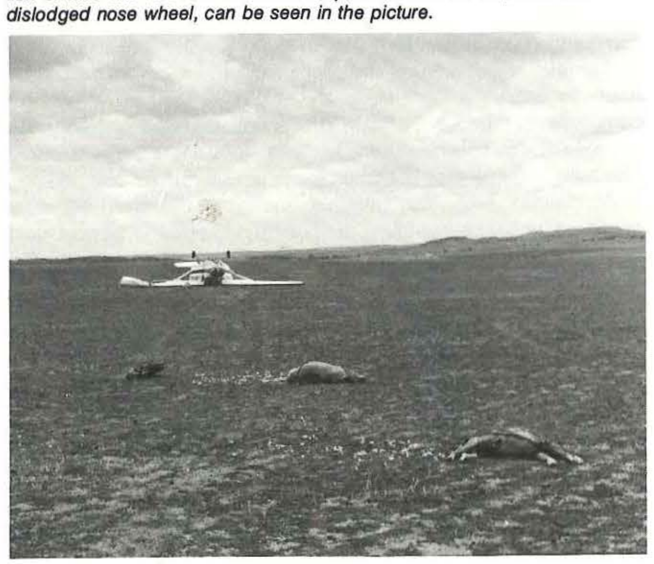
Counting Sheep?



Before landing in a paddock, the young woman pilot of a Cessna 172 made a low run to clear sheep from her intended landing path. She had operated regularly into the paddock and frequently had to clear a path in this way before landing.

The pilot had planned another flight later in the day to take three passengers some 200 kilometres to another property. They had intended to leave about mid-afternoon but, when they eventually arrived at the aircraft, they were already half an hour late. While the passengers loaded their personal baggage on board, the pilot walked along her intended take-off path to the top of a slight rise in the paddock to check the position of the sheep. She saw they were in two groups on either side of the landing area with a gap in between of about 60 to 70 metres. Returning to the aircraft, she carried out a pre-flight inspection but then discovered she had lost the aircraft's ignition key. An exhaustive search failed to find it and the pilot finally decided to drive back into town to pick up another key. The time taken by the search and the drive into town and back delayed the departure by a further 40 minutes. On her way back with the spare key, the pilot saw the sheep in the distance and it seemed they were still in much the same position.

View of paddock from which Cessna was operating, looking in direction of take-off. Three of the four sheep the aircraft struck, and the dislodged nose wheel, can be seen in the picture.



By now, time was growing short for the aircraft to reach its destination before last light, so the passengers quickly reboarded the aircraft and the pilot, after starting the engine and completing her pre-take-off checks, began to take-off without delay.

As the aircraft topped the rise at about 45 knots, the pilot saw a sheep come from her right side and start to cross the take-off path. Characteristically, others immediately began to follow. Seeing that she was on a collision course with the animal, the pilot tried to pull the aircraft into the air. But she was unsuccessful, and the aircraft struck the first sheep with the propeller. There seemed to be no damage, so the pilot decided to continue her attempt to become airborne and avoid other sheep now moving quickly across ahead of her.

The aircraft struck a second sheep with a heavy impact, the nose leg was torn off and the aircraft began to lose speed. Even so, the pilot was apparently undeterred and did not throttle back. The aircraft struck two more sheep and finally the nose dropped, the propeller slashed into the ground and the aircraft somersaulted on to its back.

The pilot and two passengers suffered minor injuries, apparently inflicted by an attache case, an overnight bag and a water bottle which had been stowed unrestrained behind the rear seat on the baggage shelf. The aircraft was extensively damaged.

Comment

To comment on the lessons of this accident would be superfluous — the events speak for themselves!

INCREDIBLE!

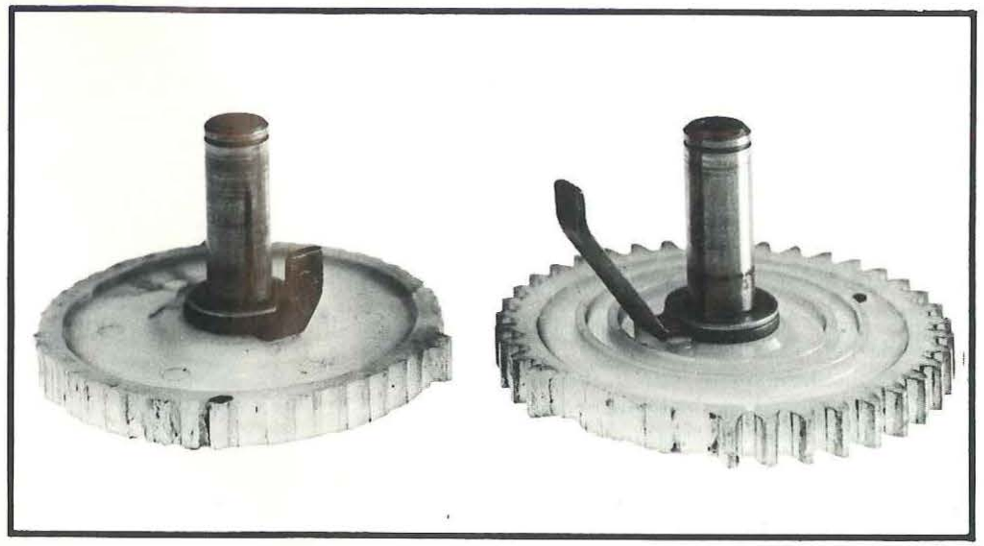
While carrying out mustering operations in Western Australia, the pilot of a Cessna 150 found that the use of the aircraft's warning horns was insufficient to move a group of presumably rather aloof cattle out of thick scrub.

The pilot therefore decided to use his own technique of making the aircraft's engine backfire by switching the magnetos on and off. As he was doing so however, the lock nut which holds the switch in place on the panel came off, and the magneto switch fell out on to the floor — in the off position, with the key out of the lock, and with the aircraft only about 50 feet above ground!

At the moment the engine failed, the pilot had just begun a steep climbing turn at an airspeed of about 60 knots. Immediately he applied nearly full forward pressure on the control column to maintain airspeed, and selected full flap. The aircraft just missed the tops of nearby trees and the pilot managed to put it down in a small clearing surrounded by rough spinifex, ant hills and trees. Miraculously the aircraft suffered no damage and the pilot was uninjured. The report does not reveal what the cattle thought.

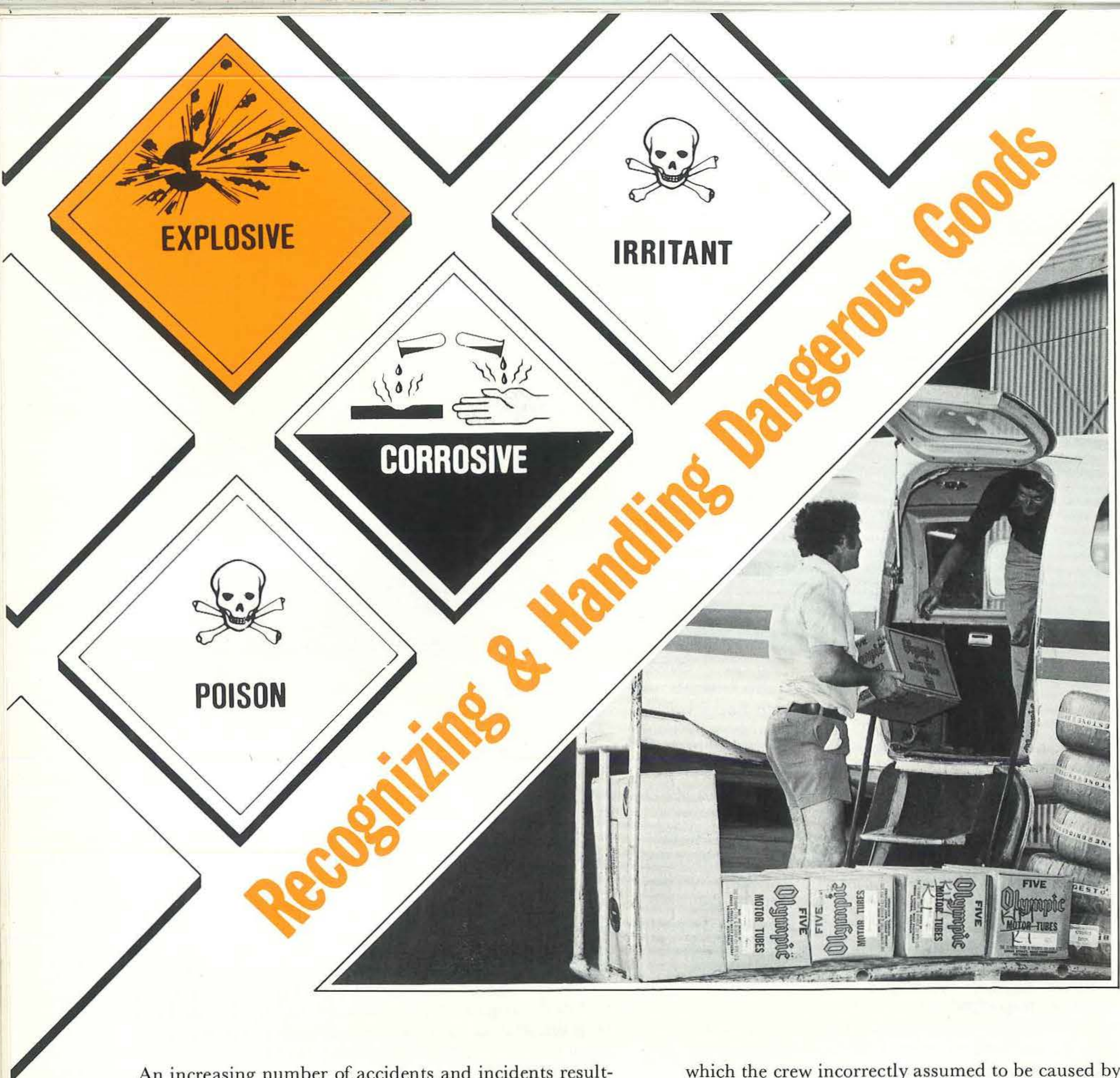
Needless to say, though the pilot claimed his technique is used 'by all mustering pilots', it is not the recommended one! We shudder to think what all those backfires must do to the engine — we wouldn't do it to a car let alone an aeroplane!

The practice of deliberately 'backfiring' an engine by switching the magnetos on and off imposes severe fatigue-inducing loads on the propeller, crankshaft, and gearing within the engine and the exhaust system. It may even strip the teeth of the plastic distributor gear in the magnetos themselves. Higher powered engines are even less tolerant to this type of abuse.



These two examples of failed plastic distributor gears testify to the consequences of deliberately causing an engine to backfire.

Recognizing & Handling Dangerous Goods



An increasing number of accidents and incidents resulting from the carriage of improperly-packaged dangerous goods has alerted the aviation world to the inherent hazards of this problem. There is, however, a widely-held belief in the industry that this is exclusively the concern of the airlines.

General aviation aircraft, whether commuter, charter, aerial work or private, are equally vulnerable. A fire started by loose book matches in a suitcase, or dense smoke resulting from spillage of nitric acid, is of as much concern to the pilot of a Cessna 172 as to the crew of a 747.

The reason for this apparent sense of complacency amongst general aviation pilots understandably arises from the fact that the majority of reported dangerous goods problems come to light in the course of airline and large charter operations. The following cases are typical:

- A cargo aircraft crashed, killing the three crew members, while attempting an emergency landing. It was later determined that control of the aircraft was lost because of dense smoke on the flight deck which the crew incorrectly assumed to be caused by an electrical fire. The smoke, in fact, was the result of leakage of nitric acid which had been improperly packed and improperly loaded, and which the crew did not know was on board.
- After landing, seven out of ten occupants of a passenger aircraft, including the flight crew, were found to be suffering from the effects of toxic-gas inhalation. The poisonous fumes came from a leaking drum of hydrofluoric acid. The relevant regulations did not even permit the transport by air of this substance, which was in any case inadequately packed. The aircraft structure also was damaged by the highly corrosive acid.
- During the unloading of cargo from a jet aircraft, a five gallon drum was found to be leaking. Ten persons were contaminated by the leaking liquid and were treated in hospital for severe burns. It was determined later that the liquid was a corrosive chemical but that the required warning labels had not been affixed to the drum.

No mention of general aviation — but that does not mean that general aviation aircraft are immune. All pilots will accept that they must, at one time or another, and perhaps unwittingly, have carried some article, some package, some baggage or cargo containing paint, thinners, aerosol containers, battery acid, insecticide, weed killers, caustic soda, or some other of the over 2000 different items listed as restricted articles.

Most of these everyday things can be carried in aircraft quite safely, provided they are properly packed or protected according to their particular needs. In most cases it is the form of a substance and the quantity in a particular container that dictates the precautions necessary to transport it by air. It is vital that the crew know exactly what goods they are carrying and where they are stowed — not only to prevent two totally incompatible articles getting together and blowing holes in the fuselage, but to plan for in-flight emergencies that might arise from the particular cargo.

An Air Navigation Order (Part 33) dealing with the carriage of dangerous goods has been in existence for years, but this has not prevented incidents in which crews, passengers and aircraft have been exposed to danger because improperly packed or excessive quantities of poisonous, explosive, flammable or corrosive materials have passed undetected through the loading system and been carried on aircraft. In many cases, the problem begins with the individual because he fails to realise that some substances, whilst relatively harmless in normal circumstances, require special packaging and handling for air transportation by reason of, amongst other things, the pressure and temperature changes involved.

There is a world-wide movement toward more stringent rules for controlling the carriage of hazardous cargo — in all modes of transport — including the training of personnel in the handling and packaging requirements. In Australia, the relevant Air Navigation Order has been reviewed in recognition of the differing needs of the industrialised sectors and of operators serving the remote areas, to reflect the need to train persons in the recognition and handling of dangerous goods, and to provide a feedback by which the efficiency of the system may be assessed.

The International Air Transport Association (IATA) has developed Restricted Articles Regulations to specify the maximum quantities and the packaging, labelling and handling requirements applicable to more than 2000 different types of dangerous goods, many of which are more commonly associated with the urban lifestyle. These regulations have been widely accepted internationally, and compliance with them is required in Australian air operations.

The IATA Regulations make allowances for personal effects carried by passengers for their own use, as indicated in the following extract:

Restricted Articles subject to the requirements of these Regulations shall not be carried in the same compartments occupied by passengers and neither shall such restricted articles be carried in passengers' or crew checked or carry-on baggage. However, these regulations shall not apply to the following:

(a) Medicinal and toilet articles, which are necessary or appropriate during the journey such as hair sprays, perfumes and medicines containing alcohol. These may be carried in hold or cabin baggage when the total net capacity of all packagings used by the passenger for these articles does not exceed 2 kilograms or 2 litres (75 avoirdupois or fluid ounces) and the net capacity of each single package does not exceed

½ kilogram or ½ litre (1 pound or 16 fluid ounces).

(b) Alcoholic beverages carried by passengers or crew as checked hand or hold baggage.

(c) Alcoholic beverages, perfumes and cologne when boarded by the aircraft operator for use or sale on the aircraft.

(d) With approval of the carrier(s) small oxygen cylinders for medical use and small carbon dioxide gas cylinders for use by passengers for the operation of mechanical limbs.

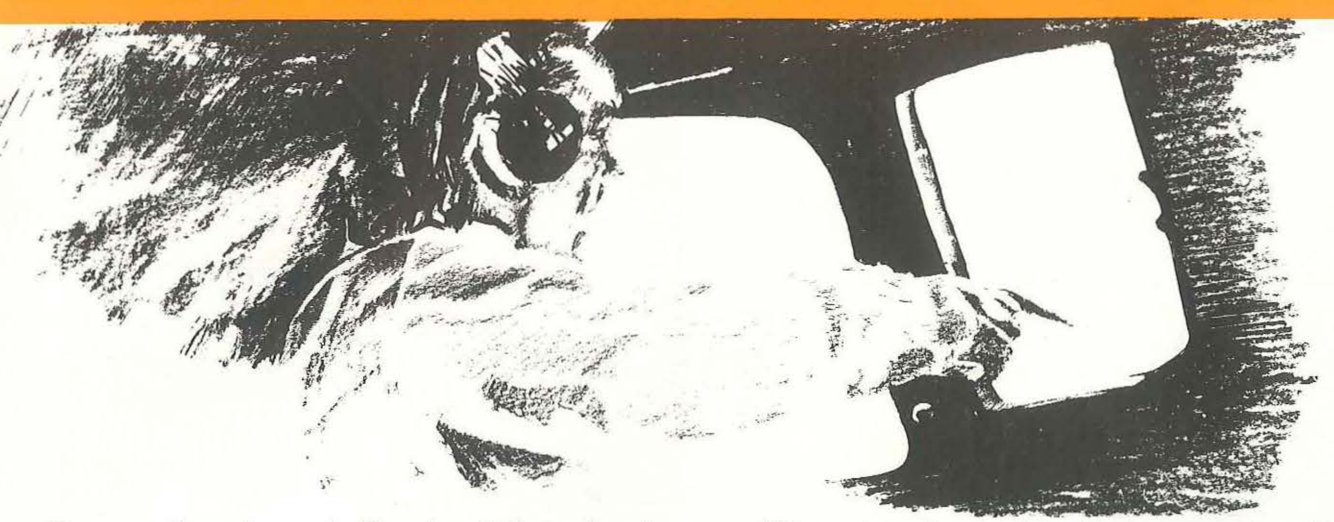
(e) Dry ice in quantities not exceeding 2 kilograms (4 pounds) per passenger, used to pack perishables, as carry-on baggage only.

(f) Installed cardiac pacemakers.

(g) With approval of the carrier(s) as checked baggage only, small arms ammunition (for sporting purposes). In quantities not exceeding 5 kilograms (10 pounds) for personal use, excluding those with explosive or incendiary projectiles.

Private operators are responsible to themselves for achieving the level of safety being sought. Just as you plan your business budget, or your holidays, so too should you plan common sense measures to ensure that some angry item of cargo does not become difficult inside your aeroplane — in-flight.

Your Role in Search and Rescue



To most pilots, the words 'Search and Rescue' conjure up what seems a pretty remote possibility. After all, forced landings or ditchings, with their subsequent rescues are things that happen to someone else! And of course, being called upon to rescue survivors from such misadventures is no less heady!

Yet regardless of the type of flying in which we may be involved, it is possible for some of us to find ourselves part of a search and rescue operation. Whether we fly the oceans of the world in a Boeing 747, or spend our days rounding up cattle in a Cessna 150, we can all be called upon to assist in some way when an emergency arises. The form of assistance each of us is able to render will vary enormously, but it is important for all to understand both the Department's and pilots' roles in the Australian search and rescue organisation.

Through the Department of Transport, Australia discharges obligations, assumed under the International Civil Aviation Organisation and the Air Navigation Act and Regulations, for search and rescue of survivors of civil aircraft involved in crashes, ditchings and forced landings. Also, under the Australian Navigation Act and the Inter-Governmental Maritime Consultative Organisation, Australia has responsibility for the rescue of survivors of shipping disasters at sea. Under various Commonwealth-State agreements too, search and rescue assistance is provided to States when a particular operation is beyond that State's resources. In simple terms, this means that any pilot can be called upon to take part in a SAR action for missing vessels, yachts or boats operating close to the coast, or for lost hikers, bush walkers or children.

Because Australia does not have the resources to maintain a standing search and rescue service such as the United States Coast Guard, it has developed a system under which both civil and military aircraft and crews can be called upon when required. Some people seem to think that the only aircraft suitable for search and rescue operations are Lockheed Orions or similar specialist types, as indeed they are in some circumstances. But in others they are not, and as these service aircraft may well be deployed in their primary role of defence, they may not be available when and where required. Indeed, in some situations, particularly in outback or mountainous areas, the local operator, who is readily available and knows the area and its features intimately, offers a more practical SAR unit.

The conduct of a search and rescue operation calls for considerable expertise on the part of the specialist staff who co-ordinate and control these operations. Departmental personnel are trained in aviation search and rescue activities, and thus have the responsibility for selecting aircraft for each individual task. In doing this, they consider all pertinent factors such as availability, location, endurance, manoeuvrability, and crew experience.

Search and rescue operations require special procedures over and above those normally used by pilots, particularly in regard to navigation and flight patterns. And of course they pose a number of questions such as:

- What am I looking for and how will I recognise it?
- Where do I look and how is the search area calculated?
- What height do I fly at and what determines this?
- Why has my aircraft been selected?
- How will I manage to cover the area asked of me?
- What do I do if I see something?
- Who will be on board to help me?
- Who makes the decisions?
- Who authorises the expense incurred?
- How many times will the area be searched?
- What are the chances of seeing anything?
- How do I drop equipment without previous experience?

Obviously the list is far from exhaustive, for the subject is a broad one. For the same reason, it is not one that can be dealt with adequately in just one or two pages of the Digest. It is therefore intended to publish a series of articles on the various aspects of search and rescue operations and how they affect pilots. These are to appear in successive issues of the Digest under the following broad headings:

- The Departmental SAR organisation, its facilities, staffing and training.
- How search areas are calculated.
- How aircraft are selected and allocated to areas.
- How the target is recognised and the probability of detecting it.
- Supply dropping and rescue operations.

In this way it is hoped that all pilots will gain some understanding of search and rescue operations in Australia and the part they would be expected to play in them should they be called upon to participate in such emergency situations.