AVIATION SAFETY DIGEST

Number 81 | September 1972

DEPARTMENT OF CIVIL AVIATION AUSTRALIA

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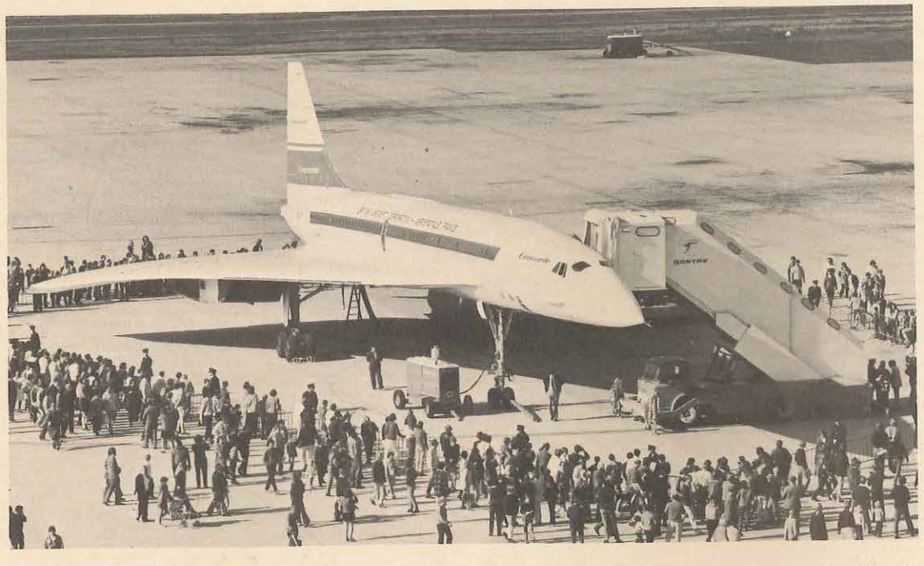

FRONT COVER: *Mach 2 at 50,000 feet! Concorde 002 caught by the Digest's 300 mm telephoto lens as it streaks across the Australian outback during its recent antipodean tour.*

ABOVE: *Almost an embodiment of yesteryear's science-fiction fantasies, the arrival of Concorde 002 at Sydney's Kingsford-Smith Airport foreshadows the shape of things to come in Australian aviation.*

– D.C.A. Photographs by T. Martin

BACK COVER: *The staggering progress of aviation is strikingly conveyed in the contrast provided by this picture of Australia's oldest operational aeroplane, snapped recently over Melbourne's Dandenong Ranges. Designed only four decades earlier than the Concorde, Mr. Arthur Whittaker's beautifully preserved Westland Widgeon seems to belong to another age.*

– S. H. McKenna Photograph

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AVIATION SAFETY DIGEST

Contents

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AUSTRALIA

A MATTER OF TIME!

It had been a long and dreary shift that afternoon in the tower at Parafield. Closed to VFR traffic since 1300 hours, the rain-drenched airport had been almost deserted, with a Cessna 402, departing on an IFR charter flight, the only movement. Apart from a few telephone calls from optimistic pilots enquiring if Parafield was open, there had been little to pass the time for the two controllers on duty.

CERTAINLY it was no day for flying if you didn't have to. The rain and low cloud, driving in from St. Vincent's Gulf across the flats that separate the aerodrome from the bleak coastline, had hardly broken all afternoon. The cloud base, never more than 1,000 feet, was down to 400 feet for much of the time and, in heavier showers, visibility was reducing to less than two miles. Inland from the aerodrome, the slopes of the Mt. Lofty Ranges were invisible in the pervading damp greyness.

Under the sodden sky, the dull afternoon light faded prematurely. Last light at Parafield was not until 1759 hours, but for all practical purposes it was already dark by 1720. In the tower all was quiet and, apart from the misty street lights of the Main North Road, half a mile away on the eastern boundary of the airport, there was little to be seen from the tower windows. No inbound traffic was expected and for the duty controllers it seemed that the remainder of the shift would be no more eventful than the afternoon. But suddenly, half a minute before official last light, there came a call from a Cessna 172:

"– – – *: Outer Harbour Inbound*".

Startled by this totally unexpected arrival in such appalling weather, the tower controller called the aircraft to advise it that the airport was closed to night VMC, and asked the pilot to advise his intentions.

The manner of the aircraft's reply was almost as surprising as the fact of its first call. Seemingly unwilling to accept that it was already dark, the pilot questioned the time remaining to last light. Several exchanges were necessary to assure him that it was indeed last light, and he was again asked to advise his intentions and height. The pilot replied that he was at 1500 feet and not rated for night VMC flight.

The aerodrome controller immediately declared an Alert Phase, while the surface movement controller called Adelaide tower to ask if they could accept the aircraft with their better airport lighting. Conditions at Parafield at the time were anything but suitable for a visual approach, with a cloud base of only 600 feet and poor visibility.

Meanwhile, in response to a query from Parafield tower, the pilot confirmed that he was flying in visual meteorological conditions. Asked if he had Parafield in sight, the pilot replied "Affirmative", and was therefore instructed to track for a left base for runway 33 and report on base leg. But no sooner had Adelaide been informed, than the pilot reported that he was no longer in visual meteorological conditions because of rain! Attempts by the Parafield controllers to gauge the aircraft's position from the tower were in vain. Even from outside on the tower balcony, there was neither sign nor sound of it in the darkness.

General view of accident site looking in direction of impact. The point at which the aircraft struck the hill-side can be seen in the right foreground.

For the next four minutes, during which Parafield questioned the pilot as to his height, headings, endurance and possible position, Adelaide radar endeavoured to identify the aircraft, but without success. At one stage, when the pilot reported he was over the Main North Road, the tower controller warned him to remain clear of the hills to the east of Parafield and instructed him to orbit. Further attempts to see or hear the aircraft from the tower and from a fire tender on the aerodrome also proved fruitless, and at Adelaide's request the aircraft was instructed to turn on to a heading of 270 degrees and to climb to 2,000 feet.

The aircraft did not acknowledge this transmission and when asked "Do you read?", the pilot replied briefly and rapidly, "In a rain storm". Asked a little later to confirm he was heading 270 and climbing to 2,000 feet the pilot, still speaking quickly, replied, "Am still coming round to 270, still climbing. Present height is one four zero —". The message cut off incomplete. Further calls by the controller remained unanswered. From the tower balcony, the controllers again scoured the sky with their binoculars, looking for the lights of the Cessna against the overcast, but there was nothing to be seen. Similarly the fire crew, standing by at the base of the tower, neither heard nor saw the aircraft at any time. The Distress Phase was declared and full scale search and rescue procedures were begun. The time of the aircraft's final transmission was 1746 hours.

A search for the missing aircraft was hampered initially by the bad weather and low cloud, but soon after 0800 hours next morning its wreckage was located from the air in a deep gully six miles north-east of Parafield Airport and less than a mile south-east of the Para Hills electricity sub-station. When a rescue party reached the site a short time later, they found that the aircraft had been virtually destroyed in the crash and that its two occupants had been killed.

It was clear from impact marks and the disposition of the wreckage that the aircraft had struck the ground with great force, apparently while in a steep spiral dive to the right. The engine was under power at the time of impact and the flaps were lowered 25 degrees. It was evident that there was adequate fuel on board when the accident occurred. A damaged watch found in the wreckage had stopped at 1746 hours. A Port Augusta World Aeronautical Chart was also recovered from the wrecked aircraft and on it was a pencil line joining Cowell, on the western side of Spencer Gulf, with Windsor, 25 miles north-west of Parafield. There were no other papers amongst the wreckage to indicate that the pilot had prepared any flight plan or flight log, or that he had obtained a weather forecast.

The aircraft was equipped with a venturi-driven artificial horizon, directional gyro and turn and bank indicator but, of these instruments, only the turn and bank indicator subsequently proved to have been fully serviceable before impact. Both the artificial horizon and directional gyro had dry rotor bearings, which would have resulted in considerable precession, producing unreliable attitude and directional indications. The instruments had been fitted to the aircraft six years before the accident, but in this category of aircraft there was no requirement to have them serviced and it was apparent that they had not been inspected since this time.

The pilot had 1100 hours experience, most of it in the aircraft involved in the accident, but there was no record that he had undergone any formal instrument flying training or had any other experience of instrument flight.

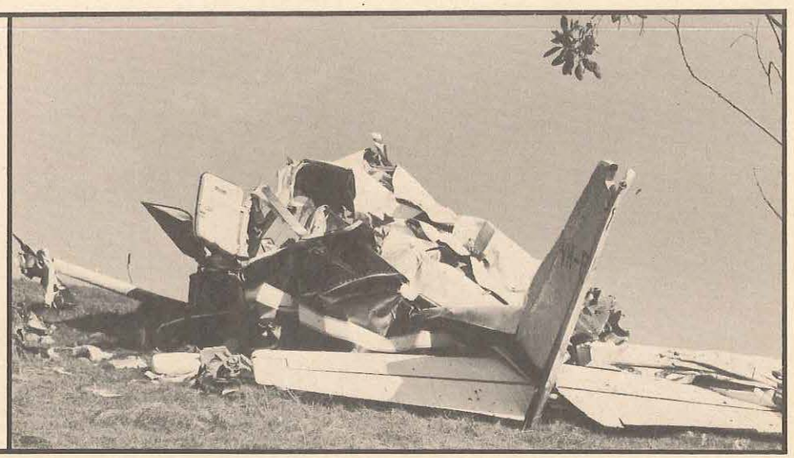
The pilot was the owner of the aircraft and used it in connection with his business to visit clients and business associates in country areas. It was learned that, at about 0830 hours at Parafield on the day of the accident, he had filled two 4½ gallon jerry cans with aviation fuel, which he was seen to load into his aircraft before boarding it alone and taxi-ing away. Shortly after this time, the aircraft had called Parafield tower and advised that it was "Taxi-ing for the Port Pirie area, below 5,000 feet, NOSAR NO DETAILS." The aircraft had then departed normally.

Enquiries established that the pilot, rather than flying to the Port Pirie area, had gone to Eyre Peninsula, where he made business calls at Darke Peak and Kimba. He had then returned to Darke Peak in the afternoon to pick up a passenger who was to accompany him on the homeward flight to Parafield. By this time, the weather in the area was obviously deteriorating, and a heavy shower fell during the time the aircraft was on the ground at Darke Peak. It was still raining lightly when the aircraft took off to return to Parafield.

At about 1640 hours the aircraft was seen passing over Cowell, en route to Parafield. A witness, who held a private pilot licence, said it was raining steadily at the time. The sky was completely overcast, with heavier cloud to the east of Cowell over the gulf, and the witness estimated that the visibility would have been only about a mile and a half.

A number of witnesses in the Elizabeth, Salisbury, and Edinburgh areas to the north of Parafield, heard or saw what was undoubtedly the Cessna 172, flying comparatively low shortly before the accident occurred, but there were no

The almost complete destruction of the forward section of the fuselage is indicative of the force with which the aircraft struck the ground.



witness reports from the Parafield area itself. It was dark and raining at the time and some of the witnesses described the lights of the aircraft as being just below the cloud base and that it appeared to be flying at less than normal cruising speed. This evidence, together with the fact that the aircraft could neither be seen nor heard from Parafield tower, suggests that after reaching Outer Harbour in virtual darkness, the pilot had mistakenly tracked east-north-east towards Elizabeth and Edinburgh, rather than east-south-east, towards Parafield. It is also evident that in the Elizabeth area, the aircraft was substantially lower than the 1,000 feet altitude the pilot had reported, and it seems probable that in this situation, he lowered some flap, as indicated by the wreckage examination, to fly at less than normal cruising speed in the poor visibility.

The evidence of the investigation as a whole points strongly to the accident having occurred at 1746 hours, only seconds after the pilot's last, incomplete transmission. It seems probable that after orbiting over Elizabeth, the aircraft became caught in heavy cloud and rain. Thus deprived even of what little visual reference had been available to him from the lights of Elizabeth, he became disorientated and lost control of the aircraft. As a result, it entered a steep spiral dive from which the pilot was unable to recover.

* * *

There can be no doubt that this accident, like so many others that have occurred in similar circumstances, could have been prevented if the flight had been conducted with proper regard for the principles of elementary airmanship.

Even if the weather had been satisfactory for visual flight, the aircraft would still have arrived at Parafield after last light, and it is quite clear that the pilot gave little attention to flight planning. As it was, the weather over much of South Australia was deteriorating, and the area forecasts issued early on the day of the accident indicated generally unsatisfactory conditions for visual flight. As well as this, a number of special weather reports were issued at Parafield from 1200 hours onwards. These reports indicated a low cloud base, gradually deteriorating to 600 feet, with reducing visibility and almost continuous rain. To have undertaken a VFR flight to Adelaide or Parafield in these circumstances without first obtaining weather information was imprudent in the extreme. Although the cloud base was still comparatively high at Darke Peak when the aircraft took off for Parafield, the deterioration that was taking place in the weather had been quite apparent for some time. Had the pilot telephoned Parafield or Adelaide Airports before departing, he would of course have learnt that both airports were closed to VFR traffic because of the weather. In the actual event, neither Adelaide nor Parafield had any information on the flight until the pilot called at Outer Harbour only a minute before official last light when, in the existing conditions, it was already dark. Had he only called a few minutes before reaching Outer Harbour and reported his flight conditions realistically, Adelaide Radar facilities might have been able to give the pilot assistance for a visual approach to land at Adelaide Airport, where conditions were marginally better.

But even when he found himself in the very critical situation in which the flight was placed from Outer Harbour onwards with extremely poor visibility and low cloud, it seems that the pilot still refused to acknowledge the situation or to declare an emergency that would have alerted the whole airways system in the Adelaide area to his predicament. Instead, he persisted in conveying the impression that he could make a landing at Parafield without assistance, effectively delaying the adoption of full emergency procedures until it was too late. Although the pilot answered "affirmative" when asked if he had Parafield in sight, it seems unlikely that the aircraft approached Parafield at any stage.

Once the pilot became caught in the low cloud and rain, as was almost inevitable in the existing conditions, the outcome of the flight was almost a foregone conclusion. The dangers inherent in instrument flight by pilots without instrument qualifications have been dwelt upon in detail in recent issues of the Digest and should need no greater emphasis. These dangers can obviously only increase when the aircraft is neither equipped nor approved for instrument flight.

But this needless accident is not only another costly and tragic object lesson on these unpalatable truths. It offers as well, a further example of the likely outcome of regarding a light aeroplane as some sort of aerial motor vehicle which one can simply "get in and go". No matter how uncomplicated a particular aircraft may be, no matter how easy it may be to fly from a manipulative point of view, the demands and responsibilities of flying have no basis for comparison with those of motoring. It is not for nothing that a pilot in charge of an aircraft, regardless of its size or type, is referred to as the pilot "in command". It is axiomatic that persons in this privileged position are expected to approach their task with a due and proper regard for what "command" means. ——————➥

BELOW MINIMA

During the evening meal at the camp, the pilot expressed his concern about the weather, and mentioned that it might not be possible to get into Nullagine, 84 miles to the south, the next morning, where he was to pick up two passengers for the return flight to Perth. The pilot explained that to operate into bush airstrips without navigational aids, it was necessary to fly visually.

During breakfast very early next morning, the pilot again talked about the weather and the problems he had encountered during the flight up from Perth. He mentioned that if the cloud base was not too low, he would again fly low as far as Nullagine, to remain in visual contact with the ground. Soon afterwards the pilot accompanied by two passengers from the Shay Gap camp who were also to return to Perth, left the camp in a borrowed Landrover to drive to the airstrip, which is on a small plateau on top of the range. At the time the sky was heavily overcast by low cloud.

At Derby that morning, the flight service operator on duty heard the Baron calling Port Hedland on 3418 kHz at 0629 hours. Ionospheric conditions were poor at the time, making radio propagation difficult, and five minutes later the aircraft called again on 6610 kHz. Again Port Hedland did not hear the call, so the Derby operator answered the aircraft, but its subsequent transmission was difficult to read. A minute and a half later the aircraft called again, this time much more clearly, and asked Derby to relay to Port Hedland that it had departed Shay Gap for Nullagine at 0637 hours, flying below 5000 feet, with an endurance of 250 minutes. The aircraft also requested the area forecast winds "when available". The Derby flight service operator transmitted the winds to the aircraft and, after a number of unsuccessful attempts, passed the aircraft's departure details, which contained no reference to any SAR watch requirements, to Port Hedland. There were no further transmissions from the aircraft.

Later that morning, in Perth the manager of the company operating the Baron was puzzled at not having heard from the pilot. He had left a message with a passenger who was to be picked up at Corunna Downs Station, en route to Perth, requesting the pilot to telephone the office in Perth before continuing the flight southwards. When the manager learnt that the aircraft had not arrived at Corunna Downs and there was no report of it having been delayed at Shay Gap, he telephoned Meekatharra flight service unit and was told that the aircraft had departed Shay Gap at 0630 hours on a NOSAR NO DETAILS flight. The manager became concerned when a further telephone enquiry to Port Hedland indicated that the aircraft was not at any other airstrip in the area. He reported the circumstances to the Department and the Uncertainty Phase was declared. Two hours later, when there was no further news of the aircraft, despite widespread communication checks, the Distress Phase was introduced.

Because of the weather, an air search conducted during the remainder of the day had to be limited to a track crawl from the vicinity of Mt. Newman to Nullagine aerodrome. A further search, planned to begin at first light the following morning with three aircraft, was also delayed because of fog and low cloud, but eventually a Departmental Aero Commander was able to depart and hold visually in the Shay Gap area to await an expected improvement in the weather. Shortly before 0800 hours, the Aero Commander reported having sighted wreckage on a hillside in rugged country 23 miles south of Shay Gap. A Bell helicopter despatched from Marble Bar, reached the crash site at 1000 hours and it was confirmed that the wreckage was that of the missing Baron. None of the three persons on board had survived.

The site of the crash was 33 feet below the top of a rocky, steep-sided ridge 777 feet AMSL and 23 nautical miles almost due south of Shay Gap. This ridge was the first obstructing terrain crossing the aircraft's track to the south of the plateau on which the Shay Gap airstrip is situated. The terrain separating the two ranges consists of undulating, low-lying country, with an average elevation of about 350 feet.

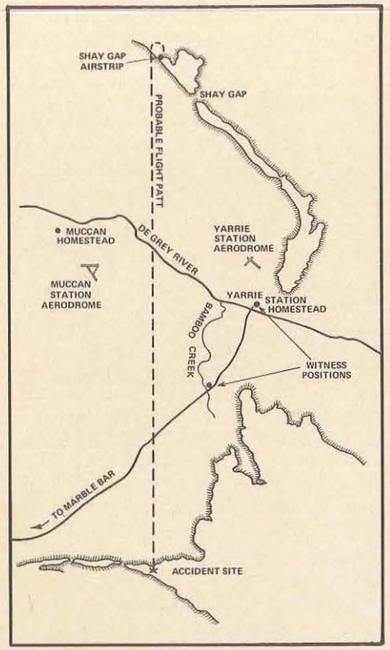
From the initial point of impact on the ridge's northern face, the wreckage had bounced and slid over the rounded top of the first spur of the ridge and into a hollow, portions of the aircraft being carried up the slope of a second, parallel and slightly higher spur. The accident site was on the direct track from Shay Gap to Nullagine, and it was evident that the aircraft, with the undercarriage and flaps retracted, and both engines operating normally, was in level flight at cruising speed when the accident occurred. Clocks and watches found in the wreckage indicated that this had occurred shortly after 0647 hours local time.

Papers and documents recovered from the wreckage included World Aeronautical Chart 3230 with the Shay Gap – Nullagine track drawn on it, a partly completed IFR flight plan that had evidently been prepared before departure, a sheet of paper on which the area winds passed from Derby flight service unit had been copied out, and a smaller piece of paper on which time intervals and other flight plan calculations had been made. There was some evidence that the pilot was working on these figures when the aircraft collided with the face of the ridge.

The pilot held a senior commercial pilot licence with a first class instrument rating and had logged nearly 1300 hours. He had been flying regularly into the Port Hedland area for some time and had used the Shay Gap airstrip on numerous occasions.

At Shay Gap, Western Australia, a drilling site in a spur of bare, flat-topped hills that form a far-northern outcrop of the mineral-rich Chichester and Hamersley Ranges, a chartered Baron had arrived from Perth late in the afternoon. The weather at the time was being affected by a depression off the coast, producing a moist northwesterly airstream and widespread low cloud, with showers and poor visibility. During the last leg of the flight, the pilot, though he held a first class instrument rating and his aircraft was IFR equipped, had been forced to fly very low to maintain the visual contact necessary to ensure a landing at Shay Gap airstrip. In fact the Baron was so low as it approached Shay Gap, that a man working near the engine of the drilling rig, mistaking the sudden noise for a mechanical failure, had dropped some equipment in fright!

Palmer



Left: Map of accident locality showing relationship of Shay Gap airstrip, witness positions, and ridge on which aircraft crashed.

Above: View from accident site looking back in direction of flight. The plateau on which the Shay Gap airstrip is situated is just visible on the horizon.

It was not possible to accurately define the cloud base in the Shay Gap area on the morning of the accident but there was abundant evidence that the sky was completely overcast by low cloud, and that the morning was showery with poor visibility. Although the cloud base was above the level of the plateau on which the airstrip is situated, it was lying on slightly higher terrain further to the north. One witness at the camp who made regular weather observations for his company, described the morning as "murky", with the wind blowing from the north at about eight knots. A drilling hand, who had driven past the airstrip soon after the aircraft left, said that the heavily overcast cloud was low and he "would not care to be flying that morning". The drilling foreman, who saw the aircraft at the southern end of the strip shortly before it left, also described the cloud base as very low. From the airstrip, the ridge on which the aircraft subsequently crashed is normally clearly visible, but on this particular morning he was not able to see it at all.

Two witnesses living at Yarrie station, 12 miles south-east of Shay Gap, heard the aircraft in flight on the morning of the accident. One of them, who was inside the homestead at the time, heard it in the distance at about 0640 hours, apparently taking off in a northerly direction. At the time, the overcast cloud was "low and dense" and the hills to the east of the homestead were in cloud. The other witness, who held a private pilot licence, had left the station homestead at about 0500 hours that morning to drive into Marble Bar. It was still dark and raining when he set out, and by first light he had reached the crossing at Bamboo Creek five miles south-west of the homestead. The creek was in flood from the overnight rain, and he had to wait nearly two and a half hours before the water had subsided sufficiently for his vehicle to cross. While waiting there a little before 0700 hours, he heard an aircraft, which he thought was a light twin, passing his position on a southerly heading. Although it seemed to be quite low and its engine noise was loud, it was obviously in the overcast cloud, the base of which he estimated to be about 300 feet above ground level. Later, as he drove southwards, he noticed that the tops of the range, on which he subsequently learnt that the Baron had crashed, were covered in cloud.

The witness evidence was entirely in accord with what would be expected in the area under the influence of a moist airstream from the north-west. From Goldsworthy, 35 miles north-west of Shay Gap, where the elevation is only 35 feet AMSL, and where the cloud base that morning was observed to be 1,000 feet, the general level of the ground rises gradually to the south and to the east, reaching 712 feet at Shay Gap and 1,300 feet at Nullagine. The height of the cloud base above the ground would thus have become progressively less along the aircraft's planned track. Local effects such as that produced by sharp change in the elevation at the ridge on which the aircraft crashed, would be likely to lower the cloud base even further.

* * *

From the evidence brought to light by the investigation, it was possible to reconstruct the likely sequence of events between the time the aircraft was last seen at the southern end of the Shay Gap airstrip, and its disastrous collision with the ridge less than 25 minutes later.

The pilot would probably have started the engines a little before 0630 hours and, while waiting for them to warm, called Port Hedland on 3418 kHz. At 0635 hours the pilot again called Port Hedland on 6610 kHz and was answered by Derby. By this time the pilot was probably ready for take off, and thinking that it was Port Hedland, he asked for the area forecast winds. Derby replied that they were unable to read his transmission. The pilot then took off into the north, and began a turn on to a southerly heading to intercept the direct track to Nullagine. Immediately after take-off, and during this turn, the pilot would have had to hold the aircraft down to a height of about 100 feet above the ground to remain below the cloud base. But shortly after completing the turn, its height above the ground would have increased almost instantaneously to about 500 feet as it crossed the southern edge of the

Total destruction : The end result of a high-speed encounter with obstructing terrain.

airstrip plateau and continued out over the wide undulating valley in the direction of Nullagine. At this point, a minute and a half after his previous call, the pilot again called Derby to pass his departure message and to request the area forecast winds "when available," no doubt in order to complete the flight plan that he had prepared before departure and, with appropriate SARWATCH details, pass it by radio to Port Hedland. The low-lying ranges in the distance ahead would have been obscured by the overlying cloud and poor visibility and, possibly believing that his vertical separation from the terrain was adequate for the time being, it seems likely that he selected the auto-pilot master switch on, ready to copy down the forecast winds and complete his flight plan.

Just before 0640 hours, when the aircraft would have been about abeam Muccan station homestead, Derby flight service unit transmitted the forecast winds to the aircraft and the pilot wrote them down on the piece of paper he had prepared for the purpose. Having done this, it seems that he gave his attention to the calculations to complete his flight plan. The aircraft continued southwards towards the lowering cloud base while he was working on these figures, probably entered cloud and, still flying on the auto-pilot, continued in level flight in instrument meteorological conditions until it impacted against the face of the ridge.

* * *

Careful consideration of the whole circumstances of this accident renders it impossible to escape the conclusion that it resulted from the manner and the conditions in which the flight was being conducted. The pilot-in-command was both experienced and well qualified for the type of operation, and was undoubtedly familiar with the standards to be expected of a professional, instrument-rated pilot. Why he chose to diverge so far from these standards, with such terrible consequences, can only be a matter for conjecture, but three possible factors suggest themselves from the results of the investigation.

The first is that age-old problem, common to all complex human endeavour, which is frequently oversimplified in the words "familiarity breeds contempt". The pilot had a lot of experience in the area and on the aircraft type, and had flown this route many times. Combined with the confidence he would undoubtedly have in his own ability and qualifications, this perhaps led him to believe that he could safely "bend" accepted operational standards to meet the particular situation, relying on his local knowledge to compensate for the reduced margin of safety.

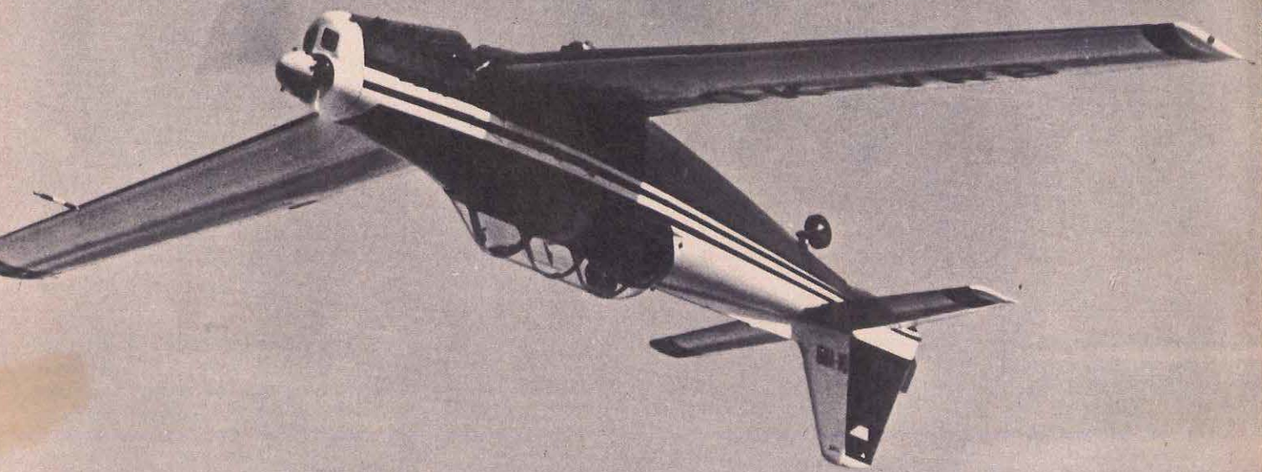
Secondly, it is possible that, although the pilot had operated from Shay Gap a number of times and knew the "official" lowest safe altitude for the route (and had in fact entered it on his flight plan), he might not have realised that a steep-sided escarpment lay directly across the aircraft's track only 23 miles south of the airstrip. Despite its precipitious nature, the ridge on which the aircraft crashed rises only about 500 feet from the surrounding undulating terrain, and, as seen from normal cruising heights, would be of no significance. It thus seems possible that, once the aircraft had cleared the plateau on which the Shay Gap airstrip is situated, and was flying just below the cloud base about 500 feet above the ground, the pilot might have been lulled into thinking his terrain clearance was adequate for the time being – at least until he had completed his flight plan.

The third factor that could possibly have had a bearing on the accident, was the commercial priority of the flight. The pilot knew that the passengers he had been instructed to pick up at Nullagine on the return flight to Perth were important to his company. He also knew there would be no chance of getting into Nullagine in the overcast conditions if he did not remain in visual contact with the ground.

Pressures and influences of this sort, however undesirable they might be, or however difficult they might seem to make matters, are nevertheless a fact of life – even an "occupational hazard" – for many general aviation pilots. It hardly needs to be said that whatever these pressures are, it remains a pilot's first responsibility to operate his aircraft at all times in accordance with the "margin of safety" philosophy on which the Air Navigation Regulations are based. These margins have not been arbitrarily chosen and a wealth of experience has established their necessity. As pointed out before, flight is an alien environment for man, and for it to be acceptedly free from danger, it is necessary that it be performed within limitations that allow for the inevitable errors, misjudgements, and other contingencies that will occur from time to time. The abiding relevance of these limitations is vindicated once again by the outcome of this attempt to operate an aircraft other than in accordance with the dictates of sound airmanship.

Pilot Performance par Excellence!

And Some Food for Thought for Would-Be Aerobatic Champions!



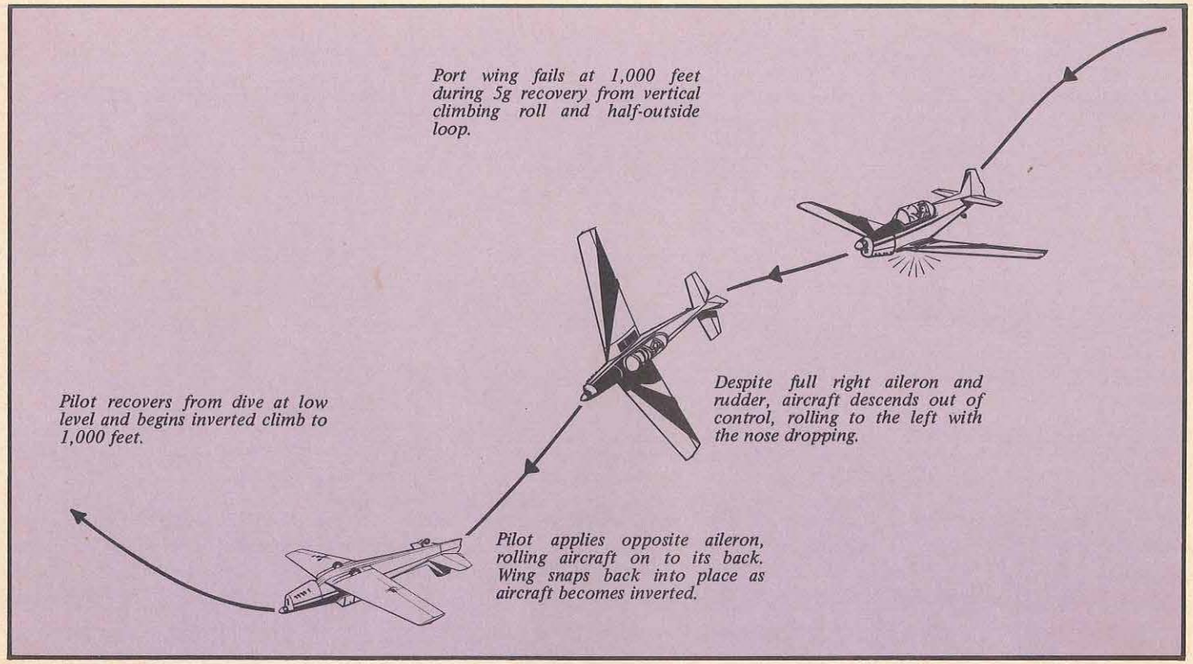
The "safety message" of the manipulative aspects of the accident discussed on these pages is admittedly not likely to have a wide application! But so incredible is the story, showing how skill, airmanship and aircraft knowledge can overcome seemingly impossible odds, that it is a "must" for Digest readers.
The account is based on the official report published by the Department of Trade and Industry in the United Kingdom, but the section in the pilot's own words has been reproduced from the Flight International article "Structural Failure", which the pilot wrote at the invitation of the publishers shortly after the accident. We are indebted to Flight International for permission to use it in Aviation Safety Digest.

While practising aerobatics in a Zlin "Trener" Z526A, at Hullavington, Wiltshire, U.K. the pilot heard a loud bang and the port wing deflected upwards. After rolling the aircraft on to its back to restore the wing to its normal position, the pilot made an inverted circuit and approach to land. At the last moment he rolled the aircraft upright again and crash landed wheels up. The aircraft was damaged beyond repair but the pilot was only slightly hurt. Examination of the airframe revealed a fatigue failure of the centre section lower front spar boom.

* * *

The aircraft which was privately owned, was being used as a practice machine for the forthcoming World Aerobatic Championships. The practice flying was taking place at Hullavington, a disused R.A.F. aerodrome at which the World Aerobatic Championships were to be held, and where hangar accommodation had been made available to the British team during the practice period.

The flight on which the accident occurred was the aircraft's third sortie for the day. After taking off and climbing to his intended practice altitude, the pilot went through his set aerobatic sequence twice with the aircraft behaving perfectly normally. The pilot then began the sequence for the third time. He takes up the story himself:



"Everything progressed normally until the completion of the fifth figure, which was a vertical climbing half roll, half outside loop to a vertical dive, and pull out to level flight at about 1,000 ft. During this pull-out, as the nose came up to the level attitude, with 5g indicating, there was a loud bang and a severe jolt was felt through the airframe. At the same instant there was a sudden and very peculiar increase in slipstream noise, and I found myself leaning against the straps to the left. I had reduced power and centralised controls instinctively at the first signs of trouble.

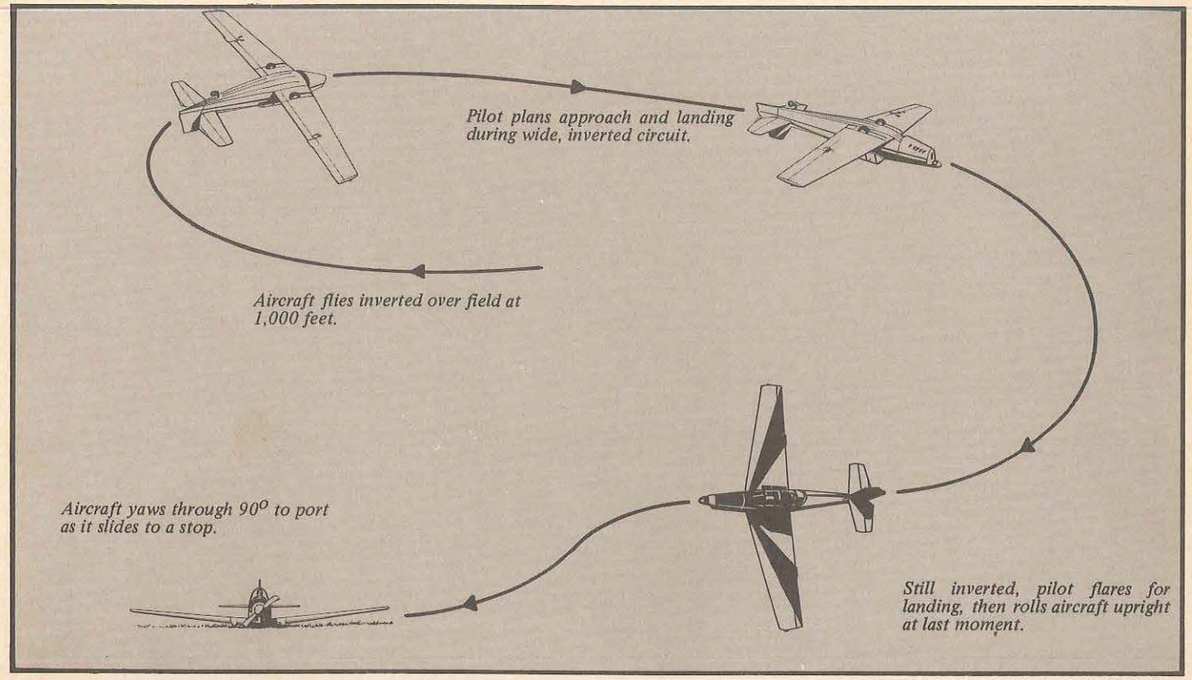
"The reason for the sensation was very soon apparent. Although the left wing was flying more or less level, the rest of the aeroplane was rolling left around the failure point. I throttled fully back to reduce speed and the flight loads, but this caused the nose to drop further. Dihedral was increasing steadily and the roll and yaw to the left were becoming progressively more determined. Full power was applied to get the nose up, but this had no effect at all. By this time the aircraft was losing height fast. It was my intention to try to keep the wings as level as possible and to achieve a shallow flight path with the intention of arriving, if possible, right way up in the most convenient field. It was, however, apparent that if control was being lost at that rate, it would have gone completely before reaching the ground. In fact, all control was finally lost at about 300 feet.

"At this stage the aircraft had turned left nearly 90° from its original heading, and was banked 90° to the left. I thought the wing had folded to about 45° but it was probably less than that, if one takes into account the fright factor. Full right aileron and rudder were being held on and the throttle was wide open as the bank reached 90° left and the nose finally dropped. The sideslip was very high, and the instinctive reaction to pull the stick back only worsened the situation. I had heard a report from Bulgaria some years ago where a top wing bolt had failed on an early mark of Zlin whilst under negative g and that the aircraft had involuntarily flick rolled right way up, whereupon the wing came back into position, and the aircraft was landed by a very frightened, but alive, pilot. I had guessed by this time that a lower wing bolt had failed and that I was faced with a similar situation, albeit inverted.

"It seemed that if positive g had saved the Bulgarian, negative g might work for me. In any event, there was nothing else left to try. I centralised the rudder, rolled left and pushed, still with full throttle. The wing snapped back into position with a loud bang which made me even more concerned for the structure. Immediately the negative g started to rise and the nose started coming up. Altitude was very low by this time and I had no instrument readings at all. For just a moment I thought I was going into the trees, but then the nose was up and the machine was climbing fast, inverted. I was just beginning to think that I might make it after all when the engine died. I checked the fuel pressure – zero. A check around the cockpit revealed the fact that the main fuel cock had been knocked off. I selected reserve fuel and almost immediately realised that this position would take fuel from the bottom of the gravity tank, which was of course now upside down. I therefore re-selected main tank, and after a few coughs the engine started and ran at full power.

"I was quite low again by this time and initially satisfied to climb straight ahead. I then turned back towards the airfield and continued the inverted climb to 1,000 feet. By this time, the remainder of the team had been very quick off the mark and had alerted crash facilities. I throttled back to conserve fuel as I knew the gravity tank was only good for about eight minutes safe inverted flight. I then trimmed the aircraft in steady flight and held the stick between my knees whilst I used both hands to tighten my shoulder harness even more. Had a parachute been carried I would have climbed as high as possible and used it.

"I then considered using undercarriage and/or flaps, but rejected both. Flaps



were no use to me whilst inverted, and I could not fly right way up anyway. Also if only one flap extended it would cause an immediate loss of control. The undercarriage required more thought. If I could make an inverted approach with a last minute rollout and if the aircraft arrived on its wheels damage might be minimised. However, if the gear fully or partially collapsed the aircraft might turn over. Also, and this was the biggest argument against, the Zlin undercarriage usually extends with a fairly solid thump. I did not know exactly what damage had occurred and I was concerned in case the strain of lowering the wheels might remove the wing altogether. It was just as well that I left the wheels up, because the failure was not the wing bolt after all, but in the centre section inboard of the undercarriage leg.

"I also considered four possibilities for landing, namely, inverted ditching, deliberately crashing inverted into trees to take the impact, inverted crash-landing on the airfield, or an inverted approach with a last minute rollout and hope for the best.

"The last seemed to hold the best chances for survival, but I decided to experiment to see which way was the best to rollout; if the rate of fold of the wing was sufficiently slow it might have been possible to exercise some control over what was obviously going to be a belly landing (I hoped). A rollout to the left was attempted, and the wing immediately started to fold, with the result that the inverted flight was quickly re-established. The rollout to the right was not investigated, as the left wing was obviously being weakened by these manoeuvres. Also the supply of adrenalin was getting rather low by this time!

"A wide inverted circuit was made for the grass strip parallel to the runway. The threshold was crossed at 112 m.p.h. at about 200 ft. with the throttle closed. Petrol and switches were left on in case it was necessary to overshoot; also the canopy was retained, since I did not want my height judgement affected by slip-stream. A slow inverted flare was made and the aircraft was levelled as near to the ground as possible.

"As the speed fell to 87 m.p.h. a full aileron rollout was made to the right, and just a trace of negative g was maintained in order to hold the left wing in place. The aircraft responded well to the controls, but as it approached level flight the left wing started to fold up again. The aircraft hit the ground hard in a slight nose down, left bank attitude. I released the controls and concentrated on trying to roll into a ball, knees and feet pulled up and in, and head down protected by arms. I had a blurred impression of the world going past the windscreen sideways and then, with a final jolt, everything stopped".

The aircraft came to rest in an upright attitude after sliding about 70 yards, and swinging 90 degrees to the left. The pilot sustained only slight bruises and was able to extricate himself from the wreckage without assistance.

* * *

Examination of the aircraft revealed that the lower front spar boom of the wing centre section had failed. The spar is a welded tubular steel structure, consisting of upper and lower booms connected by bracing members and the fracture had occurred adjacent to the point where the pivot bracket for the port undercarriage is welded to the spar. The upper spar boom and wing joint were bent upwards, with associated damage to the bracing structure as well as the rear spar attachments and the port side of the fuselage, indicating that the wing had flexed upwards at least 20 degrees. The aileron control circuit had remained connected. A small crack was also found in the lower boom on the starboard side, in a position corresponding to the failure on the port side.

At the time of the accident the pilot, Mr. Neil Williams, held a commercial pilot licence and had a total of 6,500 hours flying experience of which 300 hours had been gained on Zlin "Trener" aircraft. He also has extensive experience as a R.A.F. pilot, including duty with the Experimental Flying Department of the Royal Aircraft Establishment, and is a graduate of the Empire Test Pilot's School. He has been an active participant in international aerobatic competition flying for a number of years.

The weather at the time of the accident was fine with a light wind. There was no turbulence and it was evident that the conditions had played no part in the development of the accident.

The aircraft had been bought new for the use of the British aerobatic team and had flown a total of 450 hours, most of it on aerobatic practice. It had been maintained in accordance with the manufacturer's instructions and there was no record of any defect or repair which could have had any bearing on the accident. The failed pieces of the lower front spar boom, together with the cracked section from the starboard side, were sent to the Royal Aircraft Establishment and subsequently to the manufacturer for examination. It was confirmed that the failure was the result of fatigue, and that no material or welding defect had initiated the crack.

The construction of the centre section spar is common to three Zlin aerobatic types that have been produced in large numbers and operated in all parts of the world, but this was the first case in which fatigue cracking of the structure had led to an accident.

As a result of the accident, the manufacturer undertook the checking of every aircraft likely to have been involved in competition aerobatics. Of some one hundred Zlins examined, only two Z526A aircraft were found to have cracks in the same position as those in the one involved in the accident. Both these aircraft had had similar use, i.e. aerobatic practice for the World Championships. The fatigue life of the other two airframes in the series is unlimited, but Z526A aircraft are limited to 2,200 hours in the aerobatic role when operated to load limits of +6g and -3g. But because high aerodynamic loads can greatly reduce the fatigue life of an airframe structure, the aerobatic life of the type was limited to only 100 hours when flown to loads of +7g and -4.5g.

Although the type is capable of advanced aerobatics, the loads to which this particular aircraft had actually been subjected during its life could not be determined. In view of the class of flying for which it had been used however, and the demands that would have been made on the structure by aerobatics of the class performed in international competitions, it seems likely that its load limitations had been inadvertently exceeded. A reduced fatigue life would have been the result.

In summarising their findings, the investigation noted that the pilot had "demonstrated superb airmanship in executing an emergency landing." All pilots will echo this note of admiration. In hands less skilled, a fatigue failure resulting from repeated aerodynamic overloads would unquestionably have become a fatal accident.

The findings of the investigation also serve to reinforce the point made in the Digest article "The Stress of the Moment" in our November issue last year (Aviation Safety Digest No. 76), on the ease with which aerodynamic limitations can be exceeded during aerobatic manoeuvres.

AIR SAFETY ADVICE - ILLUSTRATED

"Light aircraft parking is available at the base of the Tower".

(A Westland Widgeon of Guinea Airways by Mascot's "Tower" as it was in 1937 – Photograph courtesy J. Payens).

Taming the Tiger

Of all the aeroplanes that have contributed to the advancement of Australian aviation, possibly no other type has fulfilled so many roles, seen such widespread use, or earned the respect of so many pilots, as the evergreen Tiger Moth.

Mr. David Friday's ex-service Tiger VH-BIJ, based at Mansfield, Victoria, snapped over the snow at Mt. Buller.

First introduced to Australia as long ago as 1935, this simple but sturdy biplane, with its ubiquitous forebear, the Gipsy Moth, was used as a touring and training aeroplane in the years that led to World War 2. With the outbreak of war, the Tiger quickly adapted to service life and was the means by which thousands of trainee aircrew, many of whom were to achieve distinction and even fame as operational pilots, first knew the exhilaration of solo flight.

Released in 1945 from this vital, if unspectacular role in the defence of the nation, large numbers of Tiger Moths soon found their way into civilian use. The majority were acquired by aero clubs and flying schools and, throughout the Commonwealth, the type quickly became the standard basic training aeroplane. A short time later, yet other Tigers were modified for aerial agricultural operations and though by no means designed for this task, nor capable of lifting a heavy load, did much to set our fledgling agricultural aviation industry on its feet. As time went by, more and more Tigers were pressed into service until, by the early 1950's, Tiger Moths accounted for no less than a third of the Australian Civil Aircraft Register!

The next few years however, saw the introduction of more modern training and touring aircraft, and the increasing demand for these types at last began to detract from the popularity of the spartan Tiger Moth. Slowly but surely, the Tigers were retired from the fleets of the training schools and, together with ex-agricultural machines rendered surplus by the introduction of other new aircraft specially designed for this task, a number found their way into the hands of private owners. Most of these had learned to fly on the type in the first place, and at this stage saw the Tiger merely as an economic compromise until they could afford "something better".

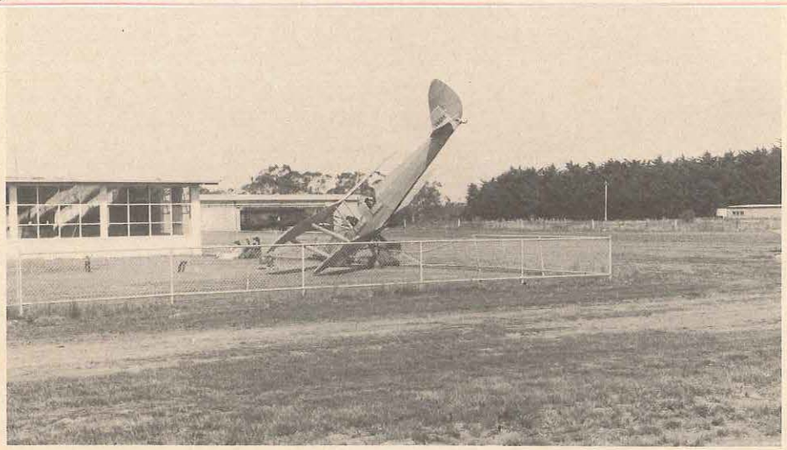
But interest in the Tiger Moth for its own sake never completely died, and after an initial, fairly sharp decrease in registrations, the number in active use has remained almost constant at about 120. More recently, there has been an up-surge of interest in the type, no doubt because of its increasing appeal as a vintage aeroplane, with a record of service going back to a time when flying was frequently an adventure and always a challenge! As these aeroplanes have changed ownership with the passage of time however, they have come more and more into the hands of pilots whose training and experience has been confined to the present era of controlled airspace and cabin heaters.

By contrast, the Tiger Moth as a type, is really one of the last examples of an earlier, distinct style of aviation that dates almost from the beginning of World War I. It is hardly surprising that many of today's pilots have little knowledge of the conventions of this now historic era, with its universally established and disciplined rituals that were so necessary for the safe handling of these low wing-loading, unbraked, tail-skid aeroplanes.

As light aeroplanes have developed over the years into the complex and efficient machines of today, with such innovations as brakes, flaps, nose wheel undercarriages and electric starters, many of the fundamental skills and procedures that were once an integral part of learning to fly, have been forgotten. Thus, for pilots trained in modern types, learning to fly the Tiger Moth is far from the simple matter it first appears, despite the basic simplicity of the Tiger, both in concept and design. The following three examples, selected at random from our recent records, illustrate the treatment that can be meted out to Tiger Moths by latter-day exponents of the helmet and goggles age :

* Before attempting to start the engine for the first period of a private pilot's conversion on to the type, the flying instructor, who himself had little experience on the Tiger, briefed his pupil on the engine starting procedure. After strapping his pupil into the rear cockpit, the instructor went to the front of the aeroplane and, without chocking the wheels, prepared to swing the propeller from behind. In response to his call, the pupil switched on the magnetos and, unaware that the throttle had been left in the fully open position, moved the mixture control slightly forward, believing he was setting the throttle for starting. When the instructor swung the propeller, the engine started and immediately surged to full power. Forced to jump clear to avoid being run down, the instructor watched helplessly as the aeroplane gathered speed and began turning in a wide arc toward a wire fence.

Realising at last that he was operating the wrong lever, the pupil located the throttle and closed it, but too late to prevent the aeroplane colliding with the fence. The Tiger pitched forward on to its nose and came to rest with a broken propeller and other damage.



Left: "The fundamental safety measures for hand starting are frequently overlooked or disregarded." All the more embarrassing when it happens in front of the club-house!

Right : "The handle of the main pressure oil filter should be rotated two or three times before the first flight of each day."

Right : "Particular care is necessary when applying forward elevator control, with engine power, to go around from a touch-and-go landing" – this even includes experienced flying instructors!

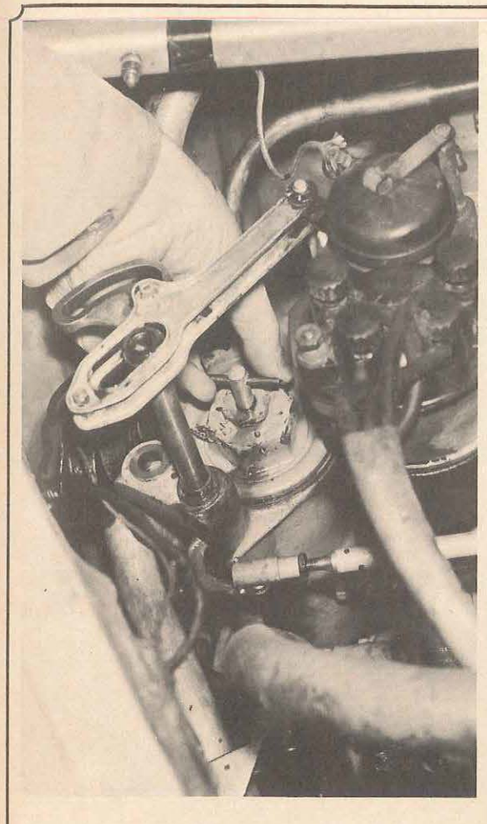
** Planning to carry out a local flight from Parafield, an owner-pilot started the engine of his Tiger and, after obtaining taxi instructions, moved off with a burst of power, intending to taxi on the grass parallel to the edge of the concrete apron. Several other aircraft were parked on the grass close to the concrete but, believing he could manoeuvre the Tiger between them and the edge of the apron, he continued to taxi, yawing the nose as he went to improve his view ahead. Approaching the row of parked aircraft, a gust of wind swung the Tiger to port. By the time the pilot had corrected the swing, his aeroplane was only a short distance behind a Cessna 182 and heading straight towards it. Realising that he would be unable to turn in time to avoid the Cessna, the pilot closed the throttle and switched off the engine. Unbuckling his harness, he leapt from the still-moving aircraft, but his efforts to bring it to a halt were in vain. In the pilot's own words, the Tiger "slowly crashed into the rear of the Cessna 182".*

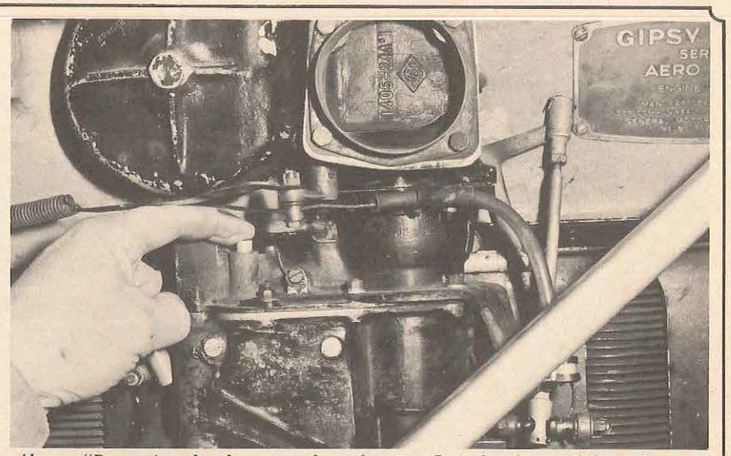
** At a flying school which retained one Tiger Moth for the use and interest of members, a senior flying instructor was giving another staff instructor endorsement training on the type. The senior instructor held a "B"-class rating and had logged well over 2,000 hours, much of it instructional experience on Chipmunks, but he had only five hours on Tiger Moths. The other instructor had nearly 1,300 hours, which also included considerable experience on Chipmunks, but this was his first flight in a Tiger Moth.*

After a normal take-off, the pilots flew to the local training area where the upper air sequences of the endorsement training were carried out. Forty minutes later, they returned to the circuit area and the pilot under instruction in the rear cockpit made a powered approach for a touch and go landing on the grass. After a satisfactory tail-down wheel landing, when the aeroplane had almost rolled to a stop, he opened the throttle to go around and moved the control column forward to raise the tail. But as the aeroplane gathered speed it adopted an increasingly nose-down attitude. Realising too late what was happening, the senior instructor attempted to correct the exaggerated attitude but before he could do so the propeller struck the ground. The senior instructor closed the throttle but the aeroplane, pitching forward even further, decelerated rapidly and stood almost vertically on its nose before falling sideways on to the starboard upper wing tip. It then came to rest on its wheels and nose.

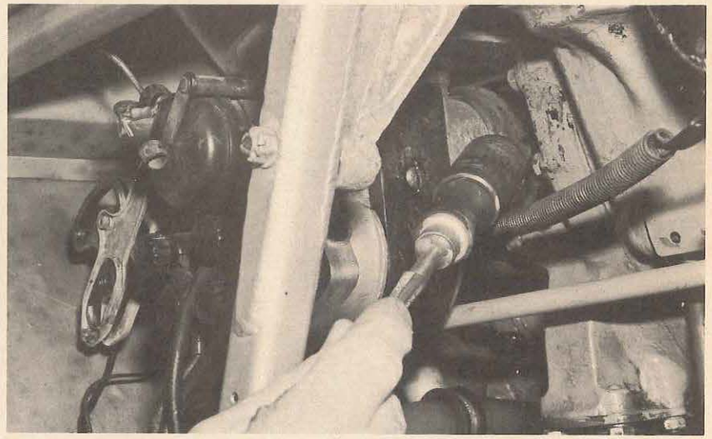
The pilots turned off the fuel and ignition switches and climbed out unhurt. The aeroplane's propeller was destroyed and both starboard wings were damaged.

From these and many similar accidents, it is quite clear that some pilots, though they might be competent in every way to command modern nose-wheel type aeroplanes, have to realise that flying a Tiger Moth proficiently and safely at all times can be a very different matter! They need to understand that, if the fundamentals peculiar to handling "strut and wire" aeroplanes are not properly grasped, the outcome of a Tiger flight, while perhaps not disastrous, can be both embarrassing and expensive. The discussion that follows provides a starting point for learning what these fundamentals are – undoubtedly the very characteristics that, properly mastered, make Tiger flying the fascinating experience it is!





Above: "Depressing the plunger on the carburettor float chamber until the carburettor floods."



Right: "A sharp tap on the magneto housing ..."

Pre-Flight Inspection

Although the pre-flight inspection procedure for the Tiger Moth follows much the same lines as the standardised check lists for today's training aircraft, there are nevertheless several aspects that require particular mention.

Before the external inspection is commenced, the ignition switches must be off and the wheels properly chocked. In the standard Tiger, two sets of switches are provided. These are mounted on the port side of the upper fuselage, just forward of each cockpit, and they function in the sense that "up is on". The switches are connected in series but both sets should be in the down or "off" position.

A physical check should be made of the fuel and oil tank contents. The Tiger's fuel system is simplicity itself, comprising a standard 19 gallon tank mounted in the centre-section of the upper mainplane, and gravity feeding through a simple on-off fuel cock to the engine. A sight-type gauge, visible from the rear seat, is mounted on top of the tank near the trailing edge. Because of the shape of the tank and the location of the gauge however, it will show a greater quantity of fuel than is actually in the tank when the aeroplane is in the tail-down attitude. The indications of the fuel gauge therefore, must be treated with caution on the ground. The fuel should be checked for the presence of water in the usual way through the sump drain plug at the rear of the tank.

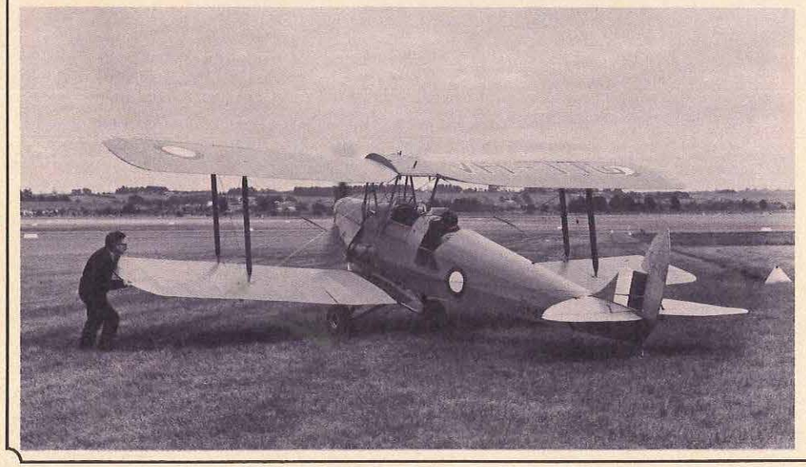
Oil consumption of the Gipsy Major is rather high compared to more modern engines, and a figure of as much as one quart per hour is not uncommon for normal operations. The 2.1 gallon oil tank is located on the lower port side of the forward fuselage and the filler cap is accessible under the port engine cowling. The handle of the main pressure oil filter on the starboard side of the engine should be rotated two or three times before the first flight of each day. In this type of filter, the oil passes between a series of thin spoked discs and spacer plates. Turning the handle rotates the element against fixed scraper plates, clearing the filter of sludge and other deposits extracted from the oil.

When conducting a ground inspection of an externally braced biplane such as

Above : "Hand swinging from 'behind' gives immediate access to the front cockpit switches."

Below: "The pilot's view over the nose is extremely limited."

"Taxi-ing in confined areas should never be attempted without wing tip assistance."



the Tiger Moth, detailed attention must be paid to the basic airframe structure. The flying, landing and other bracing wires and cables should be checked for condition and tension, and fixing nuts and bolts, and clevis and split pins must be in place and serviceable. The fabric must be free of cuts, tears and evidence of any other general deterioration, and the water drain holes free from obstructions. The undercarriage must be examined for bowed or broken members and general alignment with the fore and aft axis of the aeroplane.

Engine Starting

In its standard configuration, the Tiger Moth is endowed with neither brakes nor starter. The engine starting procedure therefore, involves something more than a few sharp pumps of the throttle and merely "pressing the button".

Although the correct procedures for hand-starting are far older than the Tiger Moth itself, the starting sequence remains the most common source of accidents in aeroplanes of this type. The fundamental safety measures for hand-starting have been established since the earliest days of aviation, yet even the most obvious precautions are frequently overlooked or disregarded. The most important requirement of all is to ensure that everyone involved in the starting sequence is thoroughly briefed and has a complete understanding of his separate duties and area of responsibilities.

When hand-starting aeroplanes such as the Tiger Moth that are not equipped with brakes, it is vital that the wheels be adequately chocked. Bitter experience has shown that pilots who try to make do with only makeshift chocks such as stones or the first piece of timber that

Take-off : "Excessive forward movement of the control column during take-off roll" should be avoided.

Landing : All set for a three-pointer! "The drag of the tail skid tends to restrain any tendency for the aeroplane to swing."

comes to hand, or even attempt to start the engine without using chocks at all, are simply inviting trouble.

The engine is prepared for starting by turning on the fuel and, if the engine is cold, depressing the plunger on the carburettor float chamber until the carburettor floods. With the throttle closed and both sets of ignition switches off, the propeller should then be turned through two or three compressions in the normal direction of rotation to prime the cylinders.

The engine is started by swinging the propeller cleanly through the compression stroke. Both sets of switches should be on, the throttle barely "cracked", and the control column held fully back. If, after several attempts, the engine fails to start, the cause may be excessive priming. Excess fuel may be "blown out" by turning the propeller backwards through about eight compressions with the throttle fully open and, of course, the ignition switches off.

If the pilot is starting the engine on his own, the control column should be lashed back with the safety harness. Hand swinging from "behind" not only ensures that the pilot will not be struck by the rotating propeller if, for any reason, the aeroplane jumps the chocks, but gives immediate access to the front cockpit switches should any unforseen problem develop.

The absence of a loud "click" as the propeller is pulled through indicates that the impulse mechanism on the starboard magneto is sticking. A sharp tap on the magneto housing, which is accessible on the starboard side of the engine, will usually free the retarding cam and return its operation to normal. If the engine is reluctant to start, the throttle should not be opened wider and wider in an attempt to hurry things along. When the engine does eventually start, the sudden burst of power that will result could easily lift the tail off the ground.

After starting, the engine should be run at 900 to 1,000 RPM for about four minutes to allow the oil to warm-up and circulate. Once properly warmed, and before removing the chocks and commencing to taxi, the engine should be run-up to 1,600 RPM and the magnetos checked individually in the normal way. If a run-up to maximum power is necessary to check magneto RPM drop, "static" RPM, or oil pressure, a ground assistant should be positioned at the tail to prevent it lifting. The engine should be held at full throttle for no longer than is absolutely necessary.

Taxi-ing

In modern tricycle-undercarriage aircraft, where such luxuries as nose wheel steering, differential braking and an uninterrupted view over the nose tend to be taken for granted, taxi-ing is one of the easiest manoeuvres to master. In light winds, a push on the rudder pedals and an occasional touch of brake are usually all that is necessary to keep the aircraft tracking accurately along the taxiway centre line. Even in strong and gusty wind conditions, taxi-ing is not normally too difficult provided the flying controls are used in the proper way to help keep the aircraft on an even keel.

But taxi-ing a Tiger Moth, without the benefit of brakes and with only rudder and tail skid to steer by, is an art in itself. For this reason, far greater judgement, as well as some understanding of the effects of inertia, are demanded of the pilot. As might be expected, most problems are caused simply because pilots do not confine taxi-ing speeds to a walking pace but travel too fast and are unable to slow down or stop when trouble looms.. To move the aeroplane from rest, only sufficient power to start it rolling should be applied. Once under way, power should be reduced sufficiently to prevent excessive speed developing. The same principle applies to turns, and after an initial, modest burst of power to commence the turn, the throttle should be retarded to allow the aeroplane to complete the turn under its own momentum.

The Tiger handles well on grass in reasonably calm conditions, and although coarse use of rudder is sometimes necessary to manoeuvre, the aeroplane responds readily and the rudder pedals retain their feel. However, this is far from the case in strong wind conditions or when the aeroplane is taxi-ing on a sealed surface as the limited tail skid steering effect is often unable to counteract the strong tendency for the aeroplane to weather-cock. Should it prove impossible to turn down-wind or even hold the aeroplane straight, it is sometimes preferable to turn in the opposite direction through a full 360 degrees until the desired heading is regained.

Taxi-ing the Tiger Moth is further complicated by the fact that, in the three-point attitude, the pilot's view over the nose is extremely limited. Thus, in order to improve the view ahead, the nose must be yawed from side to side while the aeroplane is being taxied In fact, the "golden rule" for taxi-ing a Tiger is never to travel in a straight line! To avoid shock damage to the finely balanced leading

edge slat mechanism, the slats must be locked for all ground operations.

When taxi-ing in strong or gusty winds, it is important that the pilot use all available means to help keep the aeroplane under control. Apart from the judicious use of throttle to increase the airflow over the rudder and improve its effectiveness, the correct positioning of the flying controls is most important in these circumstances. The control movements are much the same as those specified for more modern aircraft, but their role assumes a much greater significance. In winds blowing from any direction forward of the aeroplane, the elevators must be held in the fully up position, together with full into-wind aileron. Taxi-ing with a tail-wind component requires even more care and, in this case, the control column must be held forward of the central position to prevent the tail from rising. In this situation, application of aileron must be reversed and the into wind aileron held in the fully down position.

On those occasions where the wind is so strong that the pilot has difficulty in keeping the aeroplane under control, some external help is necessary and an assistant should be positioned at a wing tip. Taxi-ing in confined areas also requires special care and should never be attempted without wing tip assistance. Above all, the pilot must be conscious of the limited directional control available during taxi-ing and avoid placing his aeroplane in a position near an obstacle where there is even the slightest chance of his being unable to avoid it.

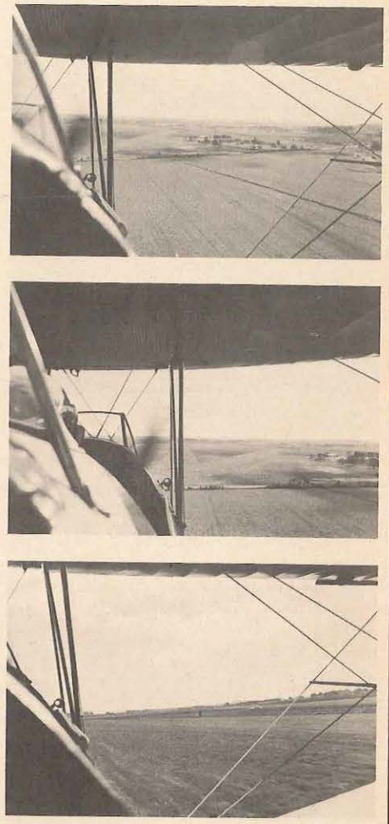
Take-Off And Landing

Most accidents involving loss of directional control during take-off and landing can be attributed to either the misuse of controls or incorrect allowance for wind conditions. Modern training types, with their generally superior steering and braking characteristics and wide lateral wheel bases are well equipped to cope with strong and gusty winds, especially cross-winds. The Tiger Moth, however, with its soft, narrow track undercarriage and lack of brakes requires particular care when operating in cross-wind conditions.

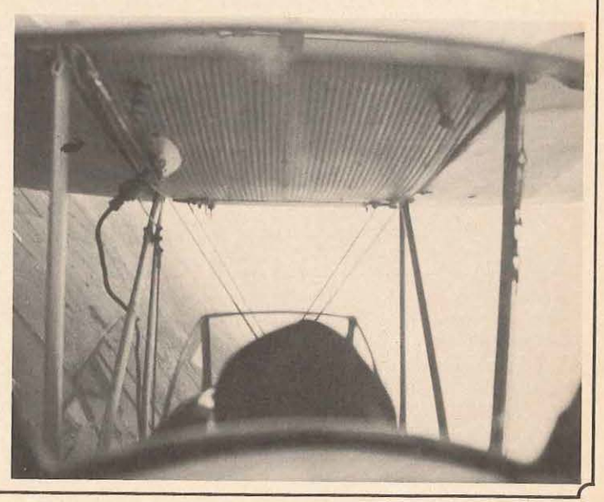
As explained in an earlier article in the Digest*, tail wheel aircraft are more prone to accidents of the ground loop type than some of their nose wheel counterparts. In tail wheel aircraft, of course, the centre of gravity is located aft of the main undercarriage and if a swing develops during the take-off or landing roll, or if the aircraft touches down in a cross-wind while drifting at an angle to the runway, turning forces are created which tend to increase the initial swing even further. An unstable situation is thus created in that the yawing moment causing the turn, becomes more powerful as the turn progresses and the spiral quickly tightens into the classic ground loop. The tendency of an aircraft to ground loop also depends to a large extent on the distance of the centre of

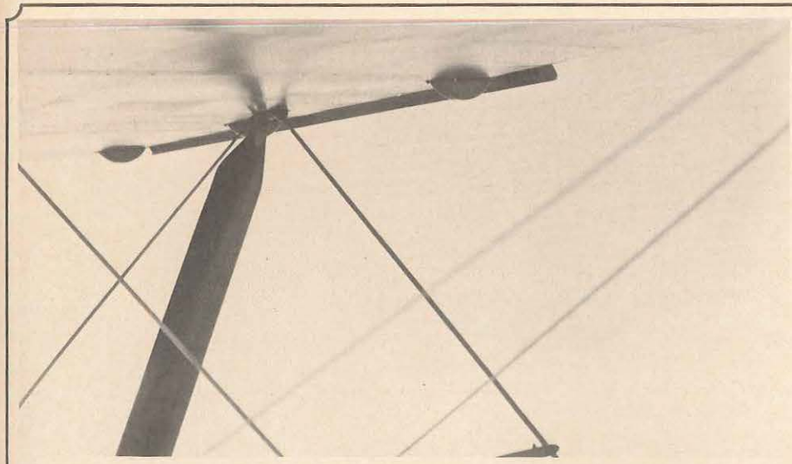
* See "Ground Looping in Nose Wheel Aircraft", Aviation Safety Digest No. 63. Reprints of this article are available on application to the Editor.

Approach and landing. Note the slats opening and "the very restricted view over the nose in the tail-down attitude."



"Any lack of instrumentation is more than compensated for by the excellent attitude cues provided by the centre-section bracing wires." Left : A medium turn. Right : A steep turn.





The leading edge slats "are fully extended one or two knots before the stall."

gravity aft of the main wheels; the greater this distance, the greater the turning moment and the more severe the resulting swing.

With its centre of gravity close to the main undercarriage the Tiger Moth is not especially susceptible to ground looping, despite its lack of brakes and narrow track. Furthermore, the drag of the tail skid, especially on grass, tends to restrain any tendency for the aeroplane to swing and thus makes a significant contribution to its directional stability. Naturally, the skid must be firmly on the ground to be effective! Nevertheless, with its light wing loading and high centre of gravity, the Tiger Moth is more than a little susceptible to strong lateral wind gusts. Its maximum cross-wind component is only 10 knots, but even so, great care is necessary to prevent a swing developing. The problems of maintaining directional control already described, as well as the very restricted view over the nose in the tail down attitude, all add to the difficulty in recognising and correcting a swing, particularly when operating from narrow, sealed runways in adverse wind conditions.

The ailerons should be used in the normal way during cross wind operations to assist in maintaining directional control. At the beginning of the take-off roll, full into-wind aileron should be applied, reducing this progressively as the speed increases and the controls begin to take effect. Immediately the aeroplane leaves the ground, it should be turned into wind sufficiently to compensate for drift and to track in line with the take-off direction. Landing out-of-wind calls for even greater skill and judgement. Any of the recognised methods of drift correction may be used and a wheel-landing technique, aiming to touch down in a nearly level attitude, should be adopted. After touchdown, into-wind aileron, together with careful application of rudder, should be used to keep the aeroplane straight.

Although the location of an aircraft's centre of gravity close behind the main wheels is advantageous in reducing the chances of a ground loop, it has the rather obvious disadvantage in that, the closer the C.G. is to the main wheels, the greater is the aircraft's tendency to nose over. The fact that Tiger Moths have been involved recently in an unusually high proportion of nose-over accidents indicates that more than usual care is also needed for this aspect of ground handling. Nose-over accidents commonly result from mis-handling such as excessive forward movement of the control column during the early part of the take-off roll or at the point of touchdown, loss of control during a bounce or when porpoising, or even by simply taxi-ing too fast for the prevailing conditions. Aerodynamic forces and the effect of controls vary with the square of the airspeed, and this can lead to a sudden and, perhaps, unexpected response to controls operated incorrectly. For these reasons, particular care is necessary when applying forward elevator control, with engine power, to go around from a touch-and-go landing.

Any tendency to nose-over will of course be greatly aggravated by soft, wet ground or long grass and, although it may not always be possible to avoid operating off such surfaces, extreme caution must be used in applying forward elevator control in these circumstances.

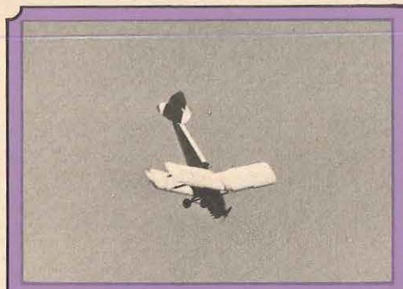
Stalling and Spinning

Designed long before artificial stall warning devices were thought of, the Tiger Moth's cockpit is devoid of either the warning light or horn which are almost universal in light aircraft today. However, apart from such obvious signs of an approaching stall as the aeroplane's nose attitude and a marked sluggishness in the controls, not to mention the airspeed indicator reading, a most effective "visual" warning is provided by the leading edge slats. These normally start to "nod" at airspeeds in the mid-forties and are fully extended about one or two knots before the stall which, with power off and at the maximum take-off weight of 1,825 lb., occurs at 40 knots IAS.

A practice stall in the Tiger Moth is a straightforward exercise and the aeroplane exhibits no unconventional characteristics. Unless the difference in stalling speeds with the slats locked and unlocked is to be demonstrated, deliberate stalls should be performed with the slats locked. In a normal straight-ahead stall, the nose pitches down cleanly, in contrast to the "mushing" type manoeuvre that characterises some of the present generation of light training types. In common with other aircraft types, the ailerons should not be used in an attempt to pick-up a wing at the stall as this will probably result only in the wing dropping further!

Unlike the rapid spiral dive that sometimes results from normal spin-entry action in modern training types, the Tiger Moth exhibits a true, stable spin with a steep, almost vertical nose down attitude and a high rate of rotation. For a practice spin, the normal entry technique from a power-off stall should be used. With the slats locked, the nose should be raised and the airspeed allowed to decrease gradually until, just before the point of stall, the control column should be fully back. Simultaneously, full rudder should be applied in the desired direction.

In the spin the aeroplane loses height at the rate of about 300 feet per rotation. There is no limit to the number of turns



"The Tiger Moth exhibits a true, stable spin with a steep almost vertical nose-down attitude and a high rate of rotation."

provided, or course, recovery to level flight can be effected before reaching the statutory minimum height of 3,000 feet! The recovery technique itself is entirely conventional and the standard method of applying full rudder opposite to the direction of spin, pausing, and then moving the control column forward until the rotation ceases, should be used. Once the correct recovery action has been taken, the aeroplane stops spinning almost immediately, a characteristic which makes it possible, with practice, to recover from a spin on a desired heading.

The control column must be laterally central at the point of entry and held in this position throughout the spin and the recovery. The application of aileron opposite the direction of spin is necessary in some aircraft, notably the Chipmunk, to ensure the spin is fully developed, but in the Tiger Moth this will only increase the rate of rotation and flatten the spinning attitude, thus tending to delay the recovery. The throttle must remain fully closed while the aeroplane is spinning, as the application of power will also tend to flatten the spin and prolong the recovery. If the aeroplane enters an inadvertent spin during aerobatics, the throttle should be closed immediately.

Despite the Tiger's excellent spin-recovery qualities, the steep nose-down attitude can be deceptive and pilots converting to the type are often reluctant to move the control column forward from the fully back position once rudder has been applied. Perhaps stemming from the erroneous belief that, with the aeroplane already in such a steep attitude, further reduction in angle of attack is unnecessary, this practice will not only delay the recovery but, in all probability, will prevent it altogether.

Particular care must be taken to centralise the rudder immediately rotation ceases, otherwise the aeroplane will quickly enter a spin in the opposite direction. Once the spin has stopped, the aeroplane should be eased out of the ensuing dive, the wings levelled, and power applied as the nose once again reaches the horizon.

General Handling

To a pilot flying the Tiger Moth for the first time, the flying controls may seem awkward and even unresponsive. Certainly, the rudder pedals in the Tiger are not merely "foot-rests" and, in order to maintain balanced flight, the rudder must be used much more coarsely than in many modern aircraft. But despite this lack of control harmonisation, the Tiger, once mastered, can be a most pleasant and rewarding aeroplane to fly.

The cockpit instrumentation can at best be only described as "basic" and, in the aeroplane's standard configuration, the usual minimum flight and engine instruments are grouped around a large, two-needle slip and turn indicator. This instrument differs from the "bat-and-ball" in general use today in that the top needle indicates slip or skid and not rate of turn as in the latter and care must be taken not to confuse its readings. However, any lack of instrumentation is more than compensated for by the excellent attitude cues provided by the centre section bracing wires and the fact that the pilot is sitting on the aircraft's centre line. Lining-up the intersection of these two wires with the horizon establishes level flight; in a medium turn, one of the wires takes up a vertical position and during a steep turn, the other wire lies horizontal, just above the horizon.

All the normal aerobatic manoeuvres may be carried out in the Tiger provided the maximum take-off weight is restricted to 1,770 lb. However, in common with many other aerobatic aircraft, flick manoeuvres and manoeuvres involving high inverted loads must not be attempted. To avoid possible damage, the slats must be locked before performing aerobatics.

* * *

As light training and touring aircraft continue to develop, the gap between today's standards of performance and handling and those accepted as normal in the era of the Tiger Moth, can only widen further. For this reason an even greater awareness of the things that make Tiger flying so different is likely to be required of pilots flying the type for the first time.

Although not a complex aeroplane, the Tiger Moth's very simplicity, as already pointed out, can be deceptive and, in many respects, it is much more demanding in skill and judgement than most of its modern counterparts. Far more susceptible to the varied effects of gusts, crosswinds, wind shear and turbulence, the Tiger is clearly not the "any-time, any-weather" type of aeroplane that is so often taken for granted today. But provided its limitations are recognised and allowed for, and pilots themselves have a complete understanding of the basic principles involved in its operation, the Tiger is an eminently safe aeroplane. In the right conditions it can be a source of enormous satisfaction and enjoyment to those enthusiasts for whom open cockpit flying has an appeal of its own.

Late in the afternoon, while flying a Cessna 172 from Moorabbin to Bankstown, a private pilot and his wife decided to land at Goulburn and stay overnight.

Early next morning, when they returned to the aerodrome, the pilot calculated that he had sufficient fuel remaining for the flight to Bankstown and did not wait to have the aircraft refuelled. After experiencing some difficulty starting the aircraft, they eventually took-off at 0720 hours and the pilot passed a NOSAR, NO DETAILS departure report to Sydney, giving an ETA of 0806 hours for Bankstown.

About an hour later, it dawned on the pilot that all was not well. He was not able to pin-point the aircraft's position and saw that they were in the vicinity of a large town, which he was unable to identify. Only then did he realise that the time was 0830 hours, 25 minutes after his ETA Bankstown!

By this time the aircraft was obviously very low on fuel, so the pilot looked for somewhere to land. Selecting a rectangular paddock adjacent to a main road, he made two low runs over his intended landing path, but as the aircraft was climbing away after the second run the engine failed. From the aircraft's low altitude, the pilot was forced to attempt a landing over power lines and across the width of paddock, towards the main road and the trees flanking it. Touching down about mid-way across the paddock at comparatively high speed the aircraft continued on and tore its way through the far fence. The port wing was almost demolished by a tree, and the starboard wing was substantially damaged when it struck a steel post. The impact spun the aircraft around and it rolled to a stop tail first in the middle of the road. Neither the pilot nor his wife was hurt.

It was later discovered that the pilot had been navigating by reference to the directional gyro only, which he had not aligned with the compass. As a result he had a track error of 60 degrees. In these circumstances it is little wonder that the pilot was not able to recognise the town of Wellington, some 130 nautical miles north-west of Bankstown!

The owner-pilot of the Meta Sokol in the picture had flown it from Canberra to Bankstown to have a new radio fitted. Later that afternoon, when the installation was completed, the pilot boarded his aircraft, taxied out and departed. Shortly after lift-off however, he was alarmed to see that the fuel pressure indication had dropped to zero. He immediately changed tanks and began operating the wobble pump, but the needle only flickered. He advised Bankstown Tower of the problem and said he was returning for an immediate landing.
Once on down wind leg he carried out a pre-landing check, but not realising that he had failed to raise the undercarriage after take-off because of his preoccupation with the loss of fuel pressure, he inadvertently selected it up. Still manipulating the wobble pump, he completed an approach, and it was not until after rounding out, when the propeller struck the ground, that he realised his mistake. The cause of the loss of fuel pressure indication was later traced to a loose electrical plug.

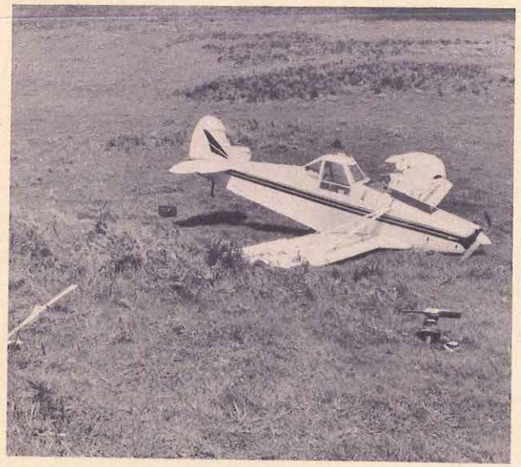
After flying for almost five hours on a flight from Cambridge, Tasmania, to Essendon, Vic., and when in the vicinity of Moorabbin airport the engine of this aircraft failed because of fuel exhaustion. The starboard wing tip and wheel spat were damaged in the ensuing forced landing, but the four occupants on board were not hurt.
During the subsequent investigation, it was found that the pilot had based his endurance calculations on a consumption rate of 7.5 GPH, and had documentary evidence based on the aircraft "owners manual" to support his use of this figure. He had leaned the mixture but, even so, had not reduced the consumption rate to 7.5 GPH. As well as this the fuel tank capacity proved to be one gallon less than the figure specified in the Flight Manual. A head wind component five to ten knots greater than forecast provided the "last straw".
Had the pilot not been misled by the low fuel consumption rate quoted to him and planned the flight on a more realistic figure, he would have seen that a refuelling stop was necessary if the flight was to be completed with the statutory 45 minutes reserve intact. Even so, a more experienced pilot would probably have landed at the nearest available aerodrome to check the tank contents when the fuel gauges indicated abnormally low readings.

With a friend as passenger, the pilot of this Cessna 180 departed from Smithton early in the afternoon and landed on a paddock strip adjoining the beach at Couta Rocks a few minutes later to pick up two more passengers. After staying for about 30 minutes, the party boarded the aircraft for a flight to Sandy Cape. The wind had now freshened from the south-west so the pilot, deciding to take-off in this direction, taxied to the eastern end of the field and completed his pre-take-off checks. Having lowered one stage of flap, he applied full power and commenced a turning take-off. The aircraft appeared to accelerate normally, and when the pilot estimated the aircraft was about ready to fly, he lowered another notch of flap. The aircraft lifted off, but almost immediately settled back on to the ground. By this time almost the entire length of the field had been traversed. The aircraft ran off the end of the strip, down a slight embankment and on to the sand, which dislodged the undercarriage. It came to rest on the beach just short of a rocky outcrop, and immediately one of the rear seat passengers noticed that a small fire had started in the engine bay. The occupants scrambled from the wreckage and attempted to put out the fire, but the aircraft burnt to destruction.

The pilot of this Cessna 180 had planned to make a flight from his property to Tyabb, Victoria but before loading the aircraft he decided to carry out a quick circuit. He taxied to the north-western corner of the paddock he used as a landing field, completed the normal pre-take-off checks, and aligned the aircraft for a take-off into the south-east. After holding the aircraft on the brakes while he applied full power, the pilot commenced the take-off run. The aircraft seemed to accelerate normally until it had gained about 45 knots, but the airspeed did not appear to increase beyond that point. The aircraft became airborne but too late to avoid striking the far fence. The pilot abandoned the take-off, touched down in the adjoining paddock and applied heavy braking, but the aircraft continued on, crossed a small creek which dislodged the undercarriage, and eventually came to rest as shown in the photograph. During the investigation it was discovered that the field contained patches of grass up to 15 inches high, and that the take-off was made with a 15 knot downwind component.

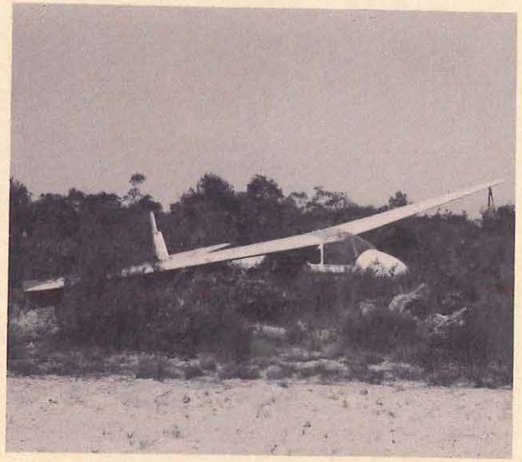
Before departing from Perth, Western Australia the pilot of a Cessna 337 carried out a short flight to familiarise himself with the operation of the auto-pilot. The aircraft was then refuelled to capacity and the pilot took-off for Newman. Landing at Newman some four hours later, the pilot decided to refill the auxiliary tanks only, as the fuel gauges indicated there was still 50 U.S. gallons in the mains. With an estimated fuel quantity of 81 U.S. gallons, and an endurance of four hours the pilot then departed for Marble Bar. En route to Marble Bar, the pilot in consultation with his passengers decided to continue to Broome, as he had calculated he still had sufficient fuel for the diversion, plus the mandatory 45 minutes reserve. However, when about 10 miles from Broome, the front engine failed because of fuel exhaustion and, as the aircraft had been flying just off the coast, the pilot turned towards the shore. Shortly afterwards, the rear engine also failed from fuel exhaustion, so the pilot selected a large paddock near a homestead and prepared for a forced landing. From the air, the pilot assessed the field surface as being rough, and decided to land with the undercarriage retracted. The touchdown was smooth but, just before the aircraft slid to a stop, it swung to the left and the belly cargo pack disintegrated. It was later discovered that the fuel quantity gauges were grossly inaccurate. The pilot had based his endurance calculations on these indications.

A commercial pilot had been engaged to make a charter flight from Bankstown to Griffith, N.S.W. in a Piper Cherokee. Arriving at the aerodrome early on the morning of the flight, the pilot obtained the relevant area forecast and completed a flight plan. The forecast indicated that a front was approaching Sydney from the south-west. After the passengers had boarded the aircraft, they departed in clear weather.
As the flight proceeded the weather gradually deteriorated, until over the Great Dividing Range the aircraft was flying through sleet and snow just below the cloud base, about 400 feet above the ground. By this time, the weather had also closed in behind the aircraft, and the pilot realised he was trapped in a valley, with cloud lying on the tops of all the surrounding hills. Rather than enter the cloud the pilot decided to make a precautionary landing and chose a field which he judged as suitable. In reality, the field was short and rough and soon after touching down the aircraft's nose leg collapsed. The aircraft slid to a halt on its main wheels and engine cowling, but all three occupants escaped without injury.



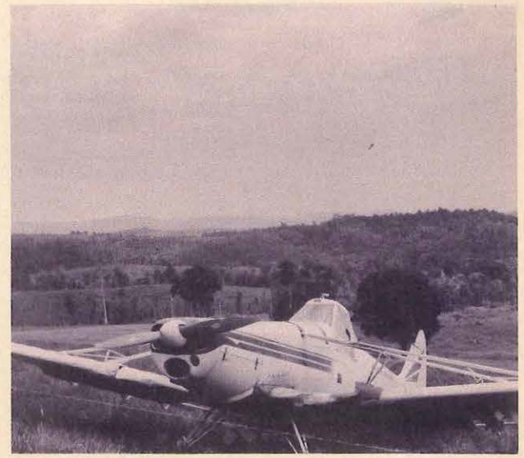
After completing an hour and a half of aerial spraying in Victoria, the pilot climbed the PA25 Pawnee to about 400 feet, so he could plan the clean-up run he was about to do. At this point, the engine faltered and the pilot immediately selected carburettor heat. This improved the running of the engine and after about 15 seconds he returned the selector to cold. Shortly afterwards, the engine faltered again, so the pilot pumped the throttle and reselected carburettor heat, but this time it did not restore power to the engine. He turned off the fuel and magneto switches, and began gliding towards the only clear area in his vicinity. The sloping terrain was undulating, with outcrops of rock and while trying to reach the selected landing area , first the wing tips, then the undercarriage, struck some rocky outcrops. Substantially damaged, the aircraft continued on down the slope, swung through 120 degrees, and eventually came to rest on its belly. The pilot vacated the aircraft uninjured. No fault could subsequently be found with the engine.

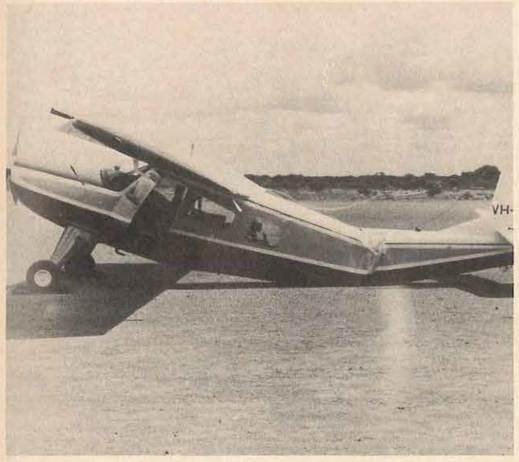
Tully, Queensland, had been under the influence of a moist south-easterly airstream for two days, with associated low cloud and heavy rain showers. As a result the pilot of this PA 32 had been prevented from carrying out an intended flight until the afternoon of the accident. Noting a slight improvement in the weather, the pilot and his three passengers took-off to have a look at the local area. But after the aircraft had been airborne for only about 15 minutes, weather conditions deteriorated to such an extent that the pilot decided to divert to nearby Dunk Island with which he was very familiar. Arriving over the airfield, he made an approach to the single strip, but went around. He then decided to land on the taxi-way, but badly misjudged his approach, and did not touch down until about half the available area had been traversed. Heavy braking did not decelerate the aircraft to any marked extent and it continued down the taxi-way, clipping a parked Aztec as it went past. Still travelling fast it crossed a small creek, which dislodged the starboard undercarriage leg, then the port wing struck a palm tree and was ripped bodily from the aircraft. The nose leg was torn off and the aircraft finally slid to a stop only 43 feet from a fuel dump and 90 feet from the resort's lounge and bar, in which some fifty people were gathered.



At Elliott gliding field, near Bundaberg Queensland, this ES 52 Kookaburra was winch launched to a height of about 1,000 feet. On board was an instructor and a student, and after releasing from the winch they continued in the same direction, attempting to find a thermal so the student could be instructed in the further effects of controls. When the glider had descended to 800 feet, without having located a thermal, the instructor decided they should return and land. By the time they had rejoined the circuit at the winch end of the runway, they were down to 600 feet and, as the wind was only light, the instructor elected to make a "down wind" landing. After the spoilers were opened, the glider sank quite rapidly, but when about mid-way down the runway, the instructor realised they were overshooting. At a height of about 100 feet he eased the nose up to reduce the speed to 45 knots and increase the rate of sink. But suddenly the glider stalled, dropped the starboard wing and began to turn in that direction. The instructor immediately recovered from the stall, but on touchdown the glider was still askew to the runway and ran off to the right into the surrounding bush. The occupants were not injured.

After flying for about an hour and a half, the pilot of this PA25 Pawnee had almost completed the area he was spraying and had only one clean-up run to do. The operation was being conducted in hilly, timbered terrain in Queensland, and the area being treated was an irregularly shaped, roughly cleared field, which had a "tongue" of timber about 60 feet high, extending into it from the eastern side. As the clean-up run would take the aircraft over this obstruction, the pilot flew just above the height of the trees. However, unknown to him, one dead tree was about 20 feet taller than the rest and he did not see it until it was too late to miss its upper branches. Both wings and the port elevator were substantially damaged in the encounter, but the pilot was able to retain control of the aircraft, and force-landed in a clear area about a mile further on, without further damage.



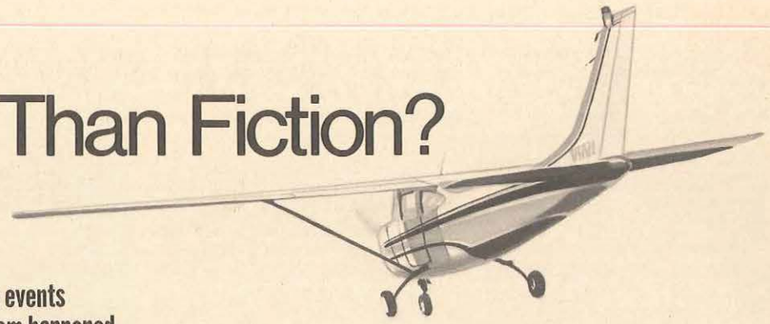


When does a heavy landing become an accident? Undoubtedly by this point!
The owner-pilot of this Helio Courier decided to carry out some circuit practice at a country aerodrome. The first two circuits were carried out without any particular problem using an approach speed of 55 knots and 30 degrees of flap. On each approach however, the pilot had noticed an unusual amount of lift, followed by a high rate of sink just before reaching the threshold of the runway, so on the third circuit he planned to touch down well beyond the beginning of the runway with the object of overcoming this effect.
The speed and flap setting used for this approach were as before, but at a height of about 100 ft the aircraft encountered an area of pronounced sink. The pilot applied some power and lowered the nose in an attempt to arrest the rate of descent and gain airspeed which had fallen to approximately 48 knots. The high rate of descent continued however, and just above the ground the pilot rotated the aircraft into the three point attitude. The tail wheel struck the ground first very heavily and the aircraft bounced back into the air, landing a further 100 feet down the strip. Stepping from the cockpit after the aircraft had come to a stop, to assess the extent of the "heavy landing", the pilot was aghast to see that the aircraft's back was broken!

The pilot of this CA 28 Ceres had been engaged to carry out some aerial spraying on a property in inland N.S.W. He was to operate from a one-way agricultural strip situated on the property, and because he had not used it before, he rang the owner and discussed the strip with him. Although it had an overall slope of no more than five per cent, this consisted of three separate "humps" which meant that the top end of the strip was lost to view during more than half the landing run.
After flying from his base aerodrome the pilot sighted the area and saw that the loader vehicle was parked on the top end of the strip. Following a normal approach, the aircraft touched down 150 feet inside the threshold. As it decelerated up the slope, the pilot lost sight of the loader vehicle and, when about 600 feet from the end of the strip he applied the brakes. The grass was wet, the brakes locked without appreciably slowing the aircraft and when the pilot next caught sight of the loader vehicle the aircraft was rapidly sliding towards it. Although the pilot attempted to turn away to starboard, the aircraft continued on and struck the truck with its port wing. The aircraft sustained substantial damage.

Pilot Contribution

Stranger Than Fiction?



A number of people witnessed the events described in this story. One of them happened to be a private pilot. He has written about it for the Digest because it presents such an unusual variation on the old theme of the dangers of low flying.

ON a warm afternoon several weeks ago while operating a bulldozer on the Northern Territory highway reconstruction project south of Renner Springs, I noticed an aeroplane approaching from the north. Being naturally interested, and having covetous thoughts about the occupancy of the pilot's seat, I ceased work for the moment and clambered on top of my machine to better view its passage.

From my elevated position I saw the aircraft to be a Cessna 172. Flying at about 200 feet, its occupants were obviously enjoying a low level cross-country and, for ease of navigation, were faithfully following the road south towards Tennant Creek. I was able to read the aircraft's registration as it flew past, and was pleasantly surprised to recognise it as one belonging to a flying group from down south, and indeed, one that I had personally flown some time previously.

The Cessna had gone past and I was still sitting there thinking of the pretty girl who had waved to me from the right hand seat, when the arrival of the works foreman jolted me back to reality. Further down the road, workmen were holding up the traffic and someone yelled: "That damn fool in the plane is going to cop it if he's not careful – there's a blast due any second now!"

With my heart in my mouth, I watched helplessly as the aircraft swept on towards a bend in the road about a mile further on, where an explosion of some 15 cases of gelignite to widen the road, was about to take place. The seconds passed like hours and after what seemed an eternity, the aircraft commenced a gradual turn to follow the road. Almost simultaneously the charge went off, and I could see rocks and dust shooting skyward to a height greater than that of the aircraft. From my vantage point I could not tell whether it was approaching, abeam or past the blast area, but wherever it was, the aircraft was very close. However, it carried on in a normal fashion and eventually disappeared from sight.

Somewhat shaken, I got down off my machine and wondered to myself if the occupants of the Cessna were aware of the dangerous situation in which they had unwittingly been placed by poor airmanship. I resolved even more firmly than before that unplanned and unapproved flight below the minima set down in A.N.R. 133 was strictly for the birds!!

* * *

As the author pointed out in his letter to us, fact is sometimes "stranger than fiction". Certainly aviation seems to have an inexhaustible supply of unpleasant surprises for those who insist on "bending" the rules. No doubt the pilot of the aircraft concerned, like the author, has resolved to be more circumspect about flying at the minimum height in future!

CAN YOU RECOVER FROM A BOUNCE?

It takes a lot of skill and judgement to make a good landing out of a bad one.

Nose legs are vulnerable to this sort of treatment —it's much safer to go around!