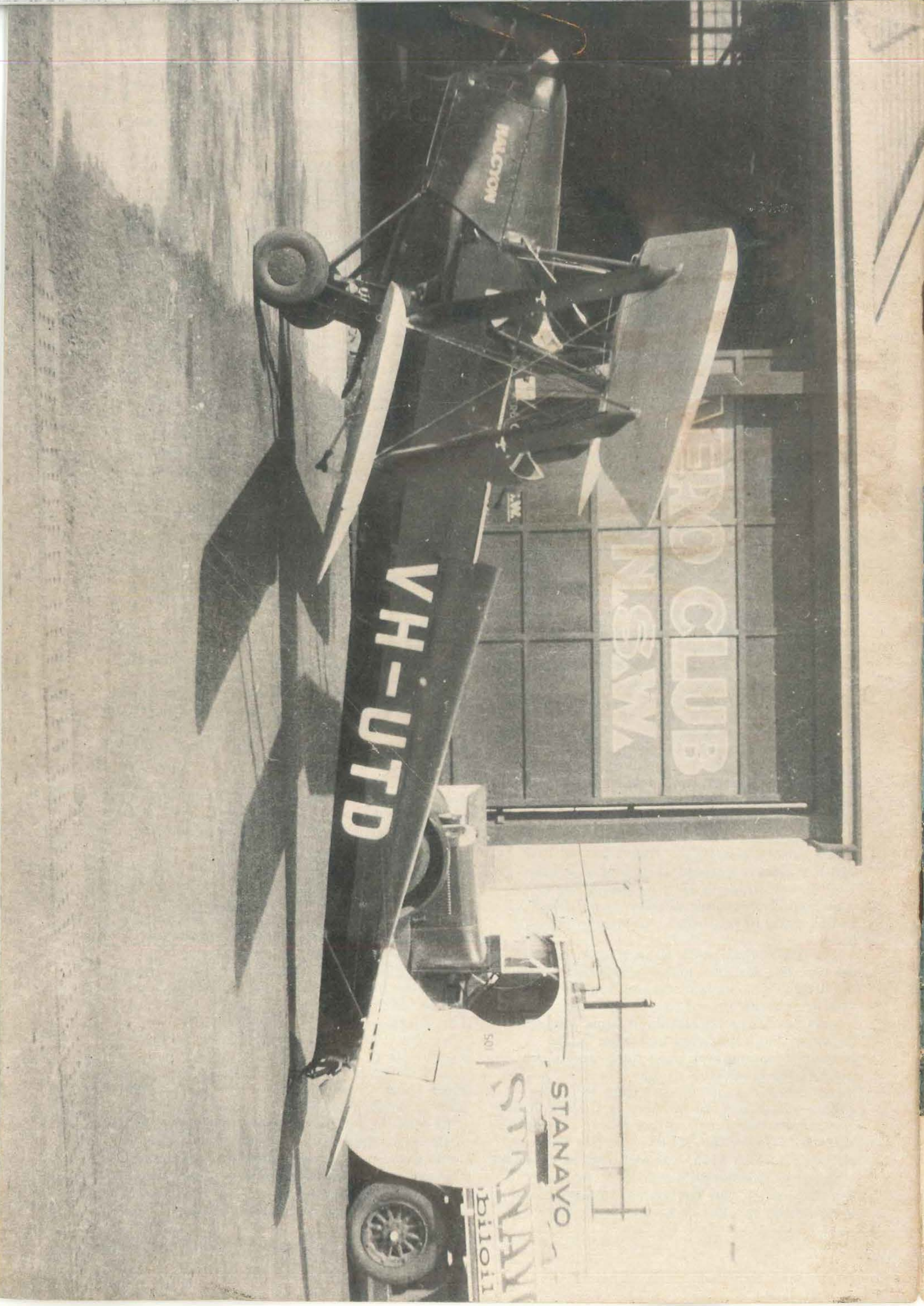

Aviation Safety Digest

AUSTRALIA

DEPARTMENT OF Transport Australia

113/1982

DEPARTMENT OF Transport Australia

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In this issue we commemorate the 50th anniversary on 26 October 1981, of the first flight of the DH-82 Tiger Moth at Stag Lane, Middlesex.

Front cover
VH-BAR. Maitland. October 1978 (Aviation Historical Society of Australia)

Back cover
VH-UTD. Mascot. c. 1937 (Reddall Collection — Aviation Historical Society of Australia — NSW Branch)

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

Readers on the free list experiencing problems with distribution or wishing to notify a change of address should write to:

The Publications Distribution Officer,
Department of Transport,
P.O. Box 1839Q, Melbourne, Vic. 3001.

Aviation Safety Digest is also available on subscription from the Australian Government Publishing Service. Enquiries and notifications of change of address should be directed to:

Mail Order Sales,
Australian Government Publishing Service,
P.O. Box 84, Canberra, ACT 2600.

Subscriptions may also be lodged with AGPS Bookshops in all capital cities.

Reader contributions and correspondence on articles should be addressed to:

The Assistant Secretary (Air Safety Investigation),
Department of Transport,
P.O. Box 1839Q,
Melbourne, Vic. 3001.

RM79/30212(2) Cat. No. 81 2666 8

Printed by Ruskin Press, 552-566 Victoria Street, North Melbourne, Victoria.

Editorial

Aviation Safety Digest is distributed free of charge to holders of Australian flight crew licences (except student pilots), licensed aircraft maintenance engineers, designated medical examiners, registered aircraft owners, and other bodies such as licensed flying schools, charter and other operators, and gliding clubs. In addition, other organisations may also receive the Digest free of charge. It was at this latter group that the review of the free distribution list (Digest No. 111) was principally directed. Those recipients were asked to complete a questionnaire and return it to the Department if they wished to remain on the free list.

The purpose of the review was primarily to enable us to bring our records up to date and, if possible, contain costs by pruning unnecessary production.

Reader comments

A secondary aim of the review was to canvass reader comments on the Digest, and to this end all readers were invited to complete the comments section of the questionnaire. We were pleased not only with the number of responses to this invitation, but also that the majority of those responses expressed satisfaction with the Digest. In particular, the present balance of accident reports and related technical articles received favourable comment. A frequent remark was that the Digest is used as a reference library, and in this regard we have taken notice of both the requests and the suggestions for specific articles. We are also acutely aware of the desirability of producing more frequent issues.

Only two readers expressed total dissatisfaction with the Digest. One was a LAME who believes that it is almost useless to an engineer, and the other a pilot who took the opportunity, anonymously, to 'fire a broadside' at the Department and at the same time charge that the present style of Digest is, among other things, 'an insult to professionals'. He believes that we should return to the 1950s style with its emphasis on 'interesting and exciting' accident reports.

There is no doubt that aircraft accidents are of great interest to those involved in aviation, and it is a fact that reading about someone else's misadventures holds a particular fascination for most of us. However, safety education studies and history have proved that the publication of accident details alone is not necessarily the most effective means of preventing further accidents from similar causes. A case in point is the continuing incidence of weather-related accidents in the face of all the publicity given to these over many years.

There is obviously a place for detailed reports on accidents and incidents in the Digest, but these are intended to complement and illustrate articles designed to prevent the accident from happening in the first place. The problem is of course to find the correct balance.

Several readers expressed a wish for more reader contributions. This we endorse enthusiastically, because the promotion of aviation safety is enhanced by the dissemination of your ideas and actual experiences. But we need to receive contributions before we can print them. Contributions need not be literary masterpieces, nor need they be lengthy. We ask only that they contain a safety message.

As a final point, we again invite reader comments and criticism of the Digest. Our aim is to produce a magazine that helps you avoid accidents. But we cannot achieve that aim if you do not read what we write or if we write the wrong stuff; and we can only gauge the effectiveness of what we write by listening to collective reader feed-back. So if you are satisfied with the Digest, or are dissatisfied and have a suggestion or a constructive criticism please write to us. Don't just complain among yourselves or address your grievance through the medium of a letter to some other publication. As stated earlier, our aim is to help you avoid accidents. Help us achieve that by providing the constructive feed-back we need ●

Navigating the lanes of entry

From time to time the incident reports contain accounts of controlled airspace penetrations by aircraft transiting the lanes of entry around our major city airports. In many cases the pilots of these aircraft are inexperienced and lack local experience — factors which contribute to their navigation difficulties. Frequently though, these are only peripheral to the more fundamental problems of inadequate preparation and the application of unsound or inappropriate navigation procedures. Experience and local knowledge certainly make it easier, but any pilot who recognises the problems and techniques peculiar to the task and prepares accordingly can navigate the lanes of entry without undue difficulty. However, all too often the pilots rush through the planning phase of the flight, failing to devote sufficient time to permit a complete and unhurried examination of the task ahead. While thorough preparation should precede *every* flight, the confines of the lanes of entry demand extra attention if an incident-free passage is to be guaranteed. The airborne workload can be high, and a poorly prepared pilot will be fully occupied with just the task of navigation and may not be able to cope in the event of unforeseen distractions.

The following account briefly relates the details of one penetration incident and discusses some of the significant factors behind it. It is offered not to castigate the pilot, but to illustrate how such incidents can develop and to introduce some suggestions for flight planning and navigation techniques.

The aircraft had departed Moorabbin for a flight to Ballarat. The pilot intended to track via the western lane (a narrow corridor only 2.5 miles wide between Melbourne and Laverton control zones) to Rockbank, and then direct to Ballarat, with Rockbank nominated as a reporting point. But things did not go as planned. From somewhere near Westgate Bridge the actual track flown took the aircraft over Laverton and Werribee, well inside Laverton control zone. At Werribee the pilot reported his position as Rockbank. Shortly afterwards, however, he noticed that his heading was grossly in error and realised also that he was not at Rockbank. At about the same time he was intercepted by an RAAF aircraft for identification and shortly thereafter was advised of his position by Flight Service and instructed to turn right and leave the zone. He was subsequently given navigation assistance from Melbourne ATC to track direct to Bacchus Marsh, from where he completed his flight without further incident.

This penetration was the culmination of a number of factors and events, starting with the pilot being delayed by road traffic on his way to Moorabbin. He arrived at the briefing office later than he had intended and in his subsequent haste did not devote sufficient time to gain a full appreciation of the weather, made mistakes in his flight plan computations, and did not check the completed flight plan for accuracy. His take-off and departure were without incident, but approaching the lane he briefly encountered some light mist which caused him to feel some concern about the weather at Ballarat, although it was causing him no difficulty at that stage, nor would it do so during the lane transit. However, as he proceeded he became increasingly concerned about the appearance of the weather well ahead and began pondering alternative courses of action should he not be able to continue beyond the lane. As a result of this diversion he was not attending to the immediate task of navigation and did not return to it for some time. By then he was well off track and inside the CTR.

Perhaps a more typical example involves the pilot who does virtually no preparation, thinks about the transit even less, forgets to set his directional gyro or fails to check the track, and proceeds to 'eyeball' his way along the wrong railway line or road. Melbourne's western lane again provides the setting for an excellent example. Many a pilot has blissfully followed the Bendigo railway line from abeam Westgate Bridge over Brooklyn light straight into Melbourne CTR. The lanes demand a little more attention to preparation and navigation technique than those pilots give.

The following discussion is addressed primarily to pilots who do not routinely use the lanes of entry and to those who may be intimately familiar with the geography of their home-town lanes but are considering a trip interstate. Other pilots might examine the procedures and techniques offered and compare them with their own methods.

Preparation should start with the selection of a route (although this is, of course, academic if there is only one lane). But where there is a choice, several considerations should be examined before a decision is made. Don't select a route necessarily because it is marked on the VTC or because it is the shortest. Prevailing conditions may militate against that one in favour of another that is more circuitous, but offers easier navigation, greater separation from controlled airspace, more hospitable terrain, better weather and so on.

Southern end of the western lane of entry, Melbourne

While selecting the route, identify a feature on the approach to the lane over which the aircraft can be accurately positioned to start the transit. That point should be a reasonable distance outside the lane so that airspace constraints are not immediately pressing. Make a detailed study of the weather forecast, noting specifically significant weather, visibility, ceiling and wind. Consider the weather in relation to the topography of the lane and ensure that terrain clearance is adequate. Be aware of the turbulence that can be expected with high winds at the low altitudes to be flown during the transit and also consider the effect a changing synoptic situation might have on the weather around the time of the transit.

If preparing a flight plan, take time to check all computer work, and when finished thoroughly check the whole plan for accuracy and completeness. Apply a mental logic check to heading and groundspeed computations — airborne is not the place to discover that drift corrections, for example, have been applied in the wrong sense. If not preparing a flight plan, check the relationship between the forecast wind and the track and develop an awareness of what the wind effect will be.

Navigation technique. The close proximity of controlled airspace boundaries requires the adoption of navigation techniques that will permit precise track keeping throughout the transit. This begins with the aircraft being accurately positioned at the start. Aim to arrive over the start point previously selected with all unrelated tasks completed. These might include after take-off checks, a departure or position report, fuel management checks, copying terminal information and so on. Check the weather ahead before leaving the start point and decide whether to continue or adopt an alternative course of action, but do not let a decision to continue influence judgment later on. Have a plan developed to cover a deterioration in the weather, or any other contingency that might make it imprudent to continue. Ensure that the directional gyro is aligned with the magnetic compass, or if a remote indicating compass is fitted, that it is indicating correctly.

Take up the planned or estimated heading from the start point and then adjust it as required to avoid straying from track. The aim is to stay on track and within the confines of the lane by identifying the various features and tracking visually over them or avoiding them on the correct side. Use the aeronautical beacons if they are available, but do not rely on seeing them. Use them as just another landmark — that is, as an aid to navigation, not as a means. Monitor progress continuously. Look for navigation features well ahead and stay ahead of the aircraft. Do not dwell on finding a particular feature if it is not seen when expected — start looking for the next one while flying the best known heading to maintain track. This is particularly important when visibility is restricted.

Concentrate on navigation, but not to the total exclusion of other considerations such as engine and fuel monitoring. Remember also that the lanes are focal points, often with two-way traffic at the same level in a relatively confined area. Keep an effective lookout going and use the radio. Broadcast intentions, listen for other traffic information and be alert for possible conflictions. Remember Flight Service does not provide a traffic information service for aircraft using or crossing the lanes. Be particularly cautious near the designated VFR approach points. These are often used as holding points by aircraft waiting for an airways clearance to enter the control zones.

Finally, do not be reluctant to request assistance if things start to turn bad. A pilot who blunders along trusting everything will be all right in the end is doing himself, other pilots and ATC a disservice. Remember that the ATC problem is greatly simplified and the controller can provide a better service if he can talk either directly or through Flight Service to a pilot who is experiencing difficulties. Furthermore, a timely request for assistance may prevent a penetration from occurring in the first place.

Conclusion

To many pilots the foregoing recommendations may appear to be unnecessarily laborious, complicating what is essentially an easy exercise. At times such a comment may be valid. In good weather, for example, an experienced pilot may well be able to navigate his way through any of the lanes with little or even no preparation. However, the penetration records show that the lanes can hold hidden surprises for the experienced and inexperienced alike. Application of the principles described will reduce the airborne workload and allow pilots to devote their attention to the navigation and other tasks immediately associated with the lane transit.

Many of the reported transgressions into bordering control zones would have been avoided firstly by thorough preparation and the application of sound navigation techniques, and secondly by a timely request for assistance when difficulties were first experienced ●

Long range intercom

The inadvertent transmission on tower frequency of comments intended for intercom resulted recently in a full alert for the emergency services and the declaration of a distress phase at one of our general aviation airports.

The transmissions came from a helicopter which was airborne in the circuit for a maintenance test flight related to blade tracking. When the aircraft was on short final the aerodrome controller heard a clipped phrase '...severe vibration...' on tower frequency. The pilot did not reply to an ATC request to confirm that operations were normal, so the controller assumed that the helicopter was in trouble and activated the crash alarm. However, as the approach progressed the helicopter entered a hover in a normal manner and the pilot subsequently called on surface movement frequency, completely oblivious to the drama that surrounded the last few seconds of the flight, having not heard the tower's request to confirm operations normal. The pilot explained that during the approach a discussion had taken place with the engineer passenger, on intercom, about the various vibrations associated with the exercise at certain speeds. Snippets of that discussion were apparently transmitted.

The investigation of this incident revealed that inadvertent radio transmissions from aircraft are becoming an increasing problem at some secondary airports.

Pilots of aircraft in which an intercom facility is fitted are therefore urged to take particular care with both their own and, if appropriate, their passenger's radio and intercom switch selections ●

Thermos flask hazard

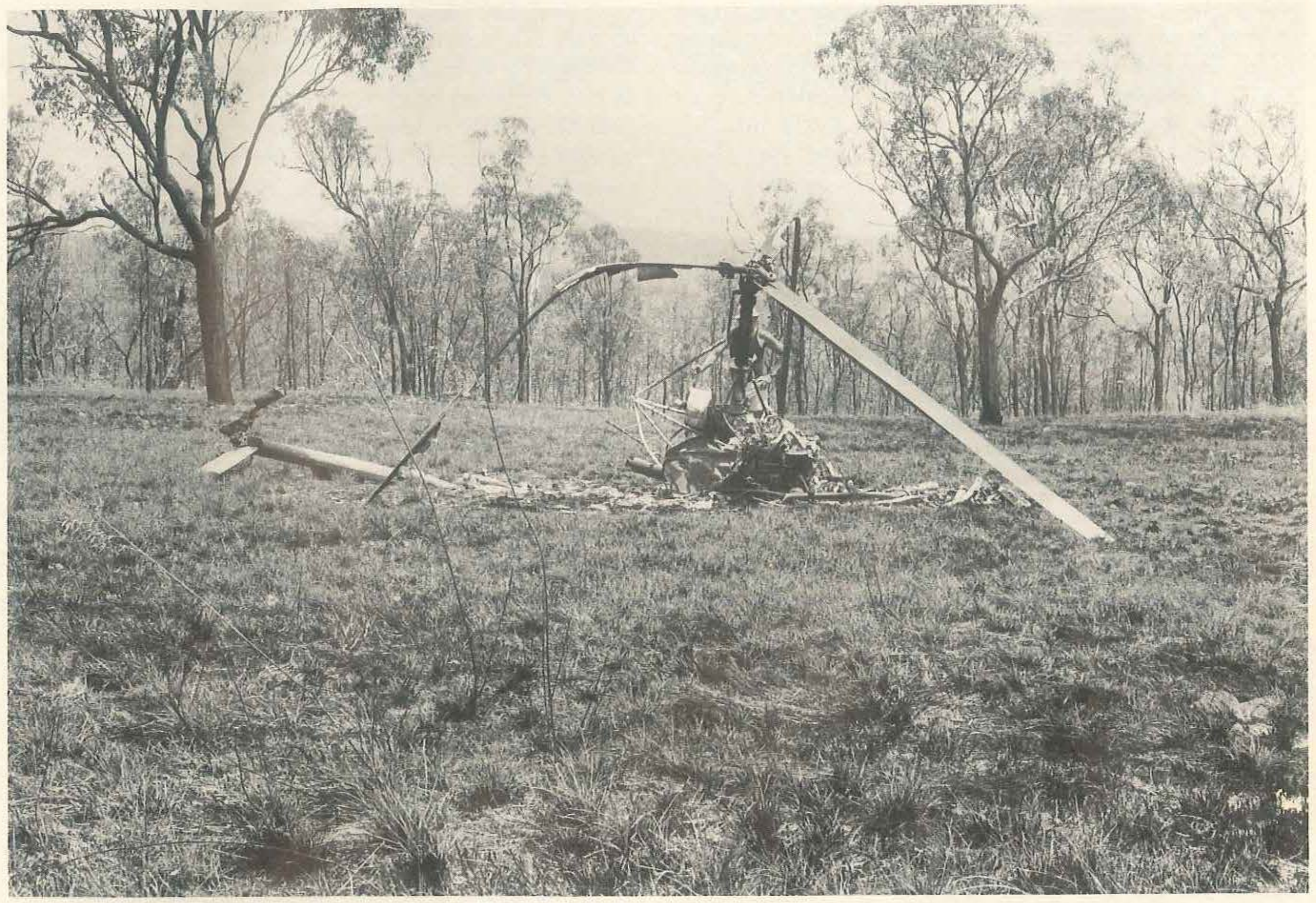
In a recent overseas incident the cabin attendant of an unpressurised turboprop twin-engined aircraft was scalded by hot coffee which sprayed on to her neck and face when she opened a thermos flask. The coffee was ejected from the flask with sufficient force to spray adjacent seats and the cabin roof. Fortunately the seats were unoccupied.

This incident is a useful reminder to us that the boiling point of liquids lowers under reduced atmospheric pressure. When the cabin attendant opened the flask at altitude, the sudden reduction of pressure in the flask to ambient atmospheric was sufficient to cause the hot coffee to boil violently.

Crews of unpressurised and pressurised aircraft alike should take note of this incident and ensure that due care is exercised when opening thermos flasks of hot liquid if the cabin altitude is much above sea level. It is worth noting that at 5000 feet water boils at 95 degrees Celsius, and at 10 000 feet, a little under 90 degrees ●

Helicopters and grass fires

In 1967 *Aviation Safety Digest No. 50* featured an article on the danger of helicopters starting fires when landing in long grass. Following that discussion the incidence of these occurrences reduced significantly, but recently the problem seems to have re-emerged. Three helicopters have been destroyed and one damaged in a period of less than two years.



In the most recent accident the pilot landed his Hughes 269C in long grass to drop a passenger. He was aware of the fire danger and intended to take off again as soon as his passenger was clear of the aircraft. The passenger started to disembark 10 to 15 seconds after touchdown but was prevented from doing so by a wall of fire immediately outside the aircraft. He hastily withdrew into the cockpit. By then the pilot could feel the fire singeing his own legs as it spread, so he vacated the aircraft with his passenger in hot pursuit. Both men then retreated to a safe distance and watched the fire consume the aircraft.

In an earlier accident the pilot of a Hughes 269 landed in an open grassed area to allow his passenger to disembark to check the water level in a creek some 500 metres to the east of the landing site. The passenger, who was the manager of the property, intended to fire the area east of the creek if there was sufficient water to form a firebreak. The pilot intended to keep the engine running during his passenger's absence. Shortly after the passenger had departed, the pilot heard the engine run down and noticed that the grass to the left and rear of the aircraft was alight, with flames reaching the top of the fuselage. He hastily vacated the aircraft through the right door and retired to a safe distance to watch the aircraft burn out.

Prior to the accident this pilot did not consider it possible for the Hughes 269 to start a fire. He normally flew Bell 47 helicopters and was conscious of the possibility with that aircraft, but considered that the higher ground clearance of the Hughes eliminated the problem. However, history has shown that his belief was ill-founded. Six aircraft destroyed in grass fires since 1967 have been Hughes 269s.

The solution to the problem is simple — do not land in long dry grass. However, that might not always be operationally acceptable. Another solution is offered to Hughes operators by Rex Aviation, the Australian Hughes distributor, who have produced an approved drawing (RA-C-1406) of a plate which forms a heat shield between the engine exhaust system and the ground. Operators might consider this modification worthwhile if they are likely to operate in areas of long dry grass ●

Pilot contribution: 'You're not on your own'

On reading the article 'Pilot continued VFR flight into adverse weather . . .' in *Aviation Safety Digest 111/1980* I was again reminded of my belief that a great number of weather-related accidents occur not only because the pilots continue flight into conditions with which they cannot cope, but also because they are unwilling to call for assistance when they first experience difficulties. The article also reminded me very much of circumstances in which I found myself several years ago on a flight from Canberra to Rockhampton in a Cherokee Arrow.

The weather was perfect as I departed Canberra but the forecast suggested that I would strike increasing cloud as I proceeded northward, and this proved to be the case. However, the first portion of the trip, Canberra to Moree, was routine.

After refuelling and having lunch in Moree I departed in light drizzle. I had planned to cruise at the appropriate quadrantal levels of 5000, 6500 and then 7000 feet, but it soon became obvious that I would not maintain VMC at those levels so I decided to stay at 500 to 1000 feet above terrain, keeping the highway in sight. At this point I might mention that I have held a Class Four Instrument Rating for several years and have flown a considerable number of hours on dark nights over most areas of Australia as far afield as Perth, Darwin and Alice Springs. It was, therefore, very tempting to climb above lowest safe altitude and navigate from NDB to NDB. But I resisted that temptation even though I thought at the time that remaining visual at a low altitude made the flight more arduous. The wisdom of this decision became increasingly obvious later and made me more aware than ever that Class Four Instrument rated pilots must remain in VMC at all times.

I had no difficulty following the Newell and Leichardt Highways past Moonie, Miles and Taroom to Theodore. However, soon after leaving Theodore I committed the error of judgement that led to my becoming uncertain of my position later. At this point the highway swung considerably to the left of track. Since the direct track to my next reporting point, Banana, was only 31 miles, and for 10 miles of that the highway would be in sight, I argued that I would only have to maintain my present heading for 21 miles to arrive very close to Banana at my flight plan ETA. However, my plans soon began to go astray as I ran into isolated heavy showers which caused me to alter heading several times to maintain visual flight. Nevertheless, shortly after the time at which I should have passed three miles abeam of Banana I saw a small township five miles to the port side and gave my Banana position report. I continued to follow the road leading out of this township but shortly afterwards had to alter my heading almost 60 degrees to track around the edge of a large Cb. When I turned back to regain track I could not find the road. It was then that I wondered briefly whether the small town was in fact Banana. I considered returning to Theodore but the Cb now blocked that route whereas the weather ahead was much clearer.

I now took stock of the situation. As I saw it there was no way I could get back to Theodore safely. My ADF was temporarily useless as I was still about 60 miles from Rockhampton and the instrument was pointing straight back at the Cb behind me anyway. I reasoned that if I maintained my present heading I must eventually pass over either the Burnett Highway or the railway line into Mount Morgan. Furthermore, I thought that as I got closer to Rockhampton and further from the Cb I could get a bearing on RK NDB. Nevertheless the fact was that I was uncertain of my position and not even sure now whether the town I had passed was Banana or nearby Moura. I was also acutely aware of several articles I had read in *Aviation Safety Digest* about pilots pressing on in bad weather and crashing, often giving ATC or Flight Service no indication that they were in any difficulty. In at least one account it appeared that had the pilot told Flight Service of his trouble he could have been given a radar vector to safety. Another article I recalled was entitled 'You're not on your own' (*Aviation Safety Digest No. 85*). Recalling the advice in those articles I swallowed my pride and informed Rockhampton Flight Service that I was unsure of my position and not certain that the town I had passed was actually Banana. They asked me whether I was still visual, to which I replied in the affirmative, and they then suggested that I return to Theodore. I pointed out that I could not do that safely.

The events that followed were quite an eye-opener to me. Not only did Rockhampton provide prompt assistance, but almost immediately two other pilots who were familiar with the region began to give me useful information. I soon sighted the highway and railway line, and with the help of Flight Service and the two pilots I was able to make a positive identification of the township of Wura. Shortly afterwards I saw a river with much brilliant green effluent, suggesting that I was nearing Mount Morgan. After being requested to hold for a short time over Mount Morgan I was given a clearance to track direct to Rockhampton.

I learned several valuable lessons from that trip. Firstly, no matter how confident you may be of your ability to fly on instruments, don't fly in IMC unless you are appropriately qualified and your aircraft is equipped for IFR flight. I am sure that (quite apart from the illegality of it) had I entered cloud I would have ended up in one of the Cb surrounding Rockhampton at the time.

Secondly, with hindsight I can now see that I should have kept the highway in sight, even though it meant a considerable diversion from track.

Thirdly, don't be too proud to ask for help, even if you are reasonably certain you could make it eventually. The assistance I received not only enabled me to determine my position quite rapidly but also helped me to concentrate on a successful conclusion to the flight, relieved of much of the anxiety generated by the situation I had allowed to develop. I might add that the assistance was provided at a time when Flight Service and ATC were handling a very heavy workload. I arrived in the Rockhampton area at the peak of activity associated with a large military exercise. When I saw the frenzied activity taking place at the airport — helicopters taking off and landing, formations of aircraft in the circuit, and Harriers darting in and out and hovering over the runway — I wondered how they even had time to acknowledge my calls, let alone find time to help out. Despite all of this I received personalised attention of a most helpful and courteous nature. I could not have been given better attention had I been the only aircraft in the vicinity. So in future remember as I shall, 'You're not on your own'!

Editor's note

The Digest article referred to by the pilot, 'You're not on your own', contained reference to a letter the then Director General of Civil Aviation sent to all pilots in 1972. The purpose of that letter was to encourage pilots to make full use of the facilities available to them, especially if they ever found themselves in a critical operational situation. To lend weight to that encouragement he stated that pilots who did request assistance from airways operations units in such circumstances would be immune from any resulting disciplinary action.

More recently the Secretary to the Department of Transport re-affirmed that policy in his editorial message in Digest 100, in which he stated: 'I will not impose any punitive measure upon any pilot who, because of navigational or other difficulties has need to request assistance from airways operations units'.

An examination of incident reports suggests that many pilots are still reluctant to use this facility. Whether this is through a lingering distrust of the system, ignorance of the help that is available or failure to recognise a developing problem until too late is not clear. Perhaps each of these and other factors may apply in varying degrees. While Airways Operations Officers are alert to the signs of a developing problem and have many times recognised when a pilot was experiencing difficulties and offered assistance, they are not clairvoyant. All the help possible is there for the asking, but it is up to you to take the initiative ●

ILS glide-slope pointer stuck

The aircraft was established on the localiser for an ILS approach, but the glide-slope pointer was not visible. The pilot, who was undergoing an initial instrument rating test, assumed from the absence of an OFF flag that the instrument was functioning correctly and that he had flown through the glide-path. He set up a high rate of descent to regain it, but when the pointer did not appear as expected he abandoned the approach. At touchdown after an NDB approach the pointer appeared from the top of the instrument, where it had evidently been stuck. The instructor commented that with no FAIL flag showing he would have expected that the pointer should be visible and expressed concern that such a failure could induce a pilot to increase rate of descent such as to risk a collision with obstacles.

The glide-slope pointer on the ILS equipment involved is a conventional moving coil type as used on many types of indicators. These do stick occasionally, but it is not practicable to include this failure mode in the flag monitoring circuit. It is important that pilots cross-monitor with a second glide-slope display or, if there is only one instrument, correlate with other navigational aids. Remember also that approach charts show the correct glide slope altitude at the outer locators and marker beacons and include an altitude/DME distance chart for verification of glide slope indications ●

(Courtesy CAA General Aviation Safety Information)

Fuel tank vents

When the hangar flying sessions get around to the 'There I was. . .' situations, fuel tank vents are unlikely to generate even a passing reference. However, a malfunction of these seemingly innocuous systems can get a pilot's attention as few others can.

Tank vents have three main functions: to prevent a lowering of pressure in the tank by allowing air to enter as fuel is consumed; to prevent a build-up of pressure in the tank with increases in temperature, and to provide a small positive pressure over the fuel to ensure a positive flow to the engine in flight. Failure of the vents to do their job can result in fuel starvation, fuel tank collapse (which becomes really exciting if the tank is of 'wet wing' construction) or, in the case of excessive tank pressurisation, tank rupture and wing damage.

In a recent incident the pilot of a Bonanza was surprised when fuel pressure fell suddenly at about 2000 feet during climb after take-off. He had monitored fuel flow carefully during the previous stage of the flight and had calculated from published data and indicated fuel flow that the tank should have contained 40 litres of fuel. This belief was supported by the fuel contents indicator; however, post-flight inspection revealed that the tank was empty.

Investigation established that the tank vent, which protrudes from the bottom of the wing, had been bent rearwards and, in flight, was creating a negative vent pressure in the tank. The result was a collapsed fuel cell and the loss of some 40 litres of fuel through the vent. The fuel contents indication was erroneous because float arm movement was restricted by a crease which had formed in the bottom of the cell as it collapsed.

The particular vent on the Bonanza is a six millimetre diameter tube which protrudes from the lower surface of the wing behind and inboard of the main landing gear. According to the Beech A36 shop manual it should protrude at least 45 millimetres below the wing surface and be canted 10 degrees forward of perpendicular to the skin. The manual also warns that any other configuration may create a negative vent pressure which will pull air and fuel from the tank.

Most pilot's handbooks contain only sparse detail of what the pre-flight inspection of tank vents should include. In general, the pre-flight inspection should include a check for obstructions and a look at the condition and configuration of the vent. In the absence of any information on the correct configuration a comparison with other vents may be useful in detecting abnormalities. But as a general comment any configuration that might create a negative pressure in the vent system in flight should be treated with suspicion and be checked by a qualified person.

*

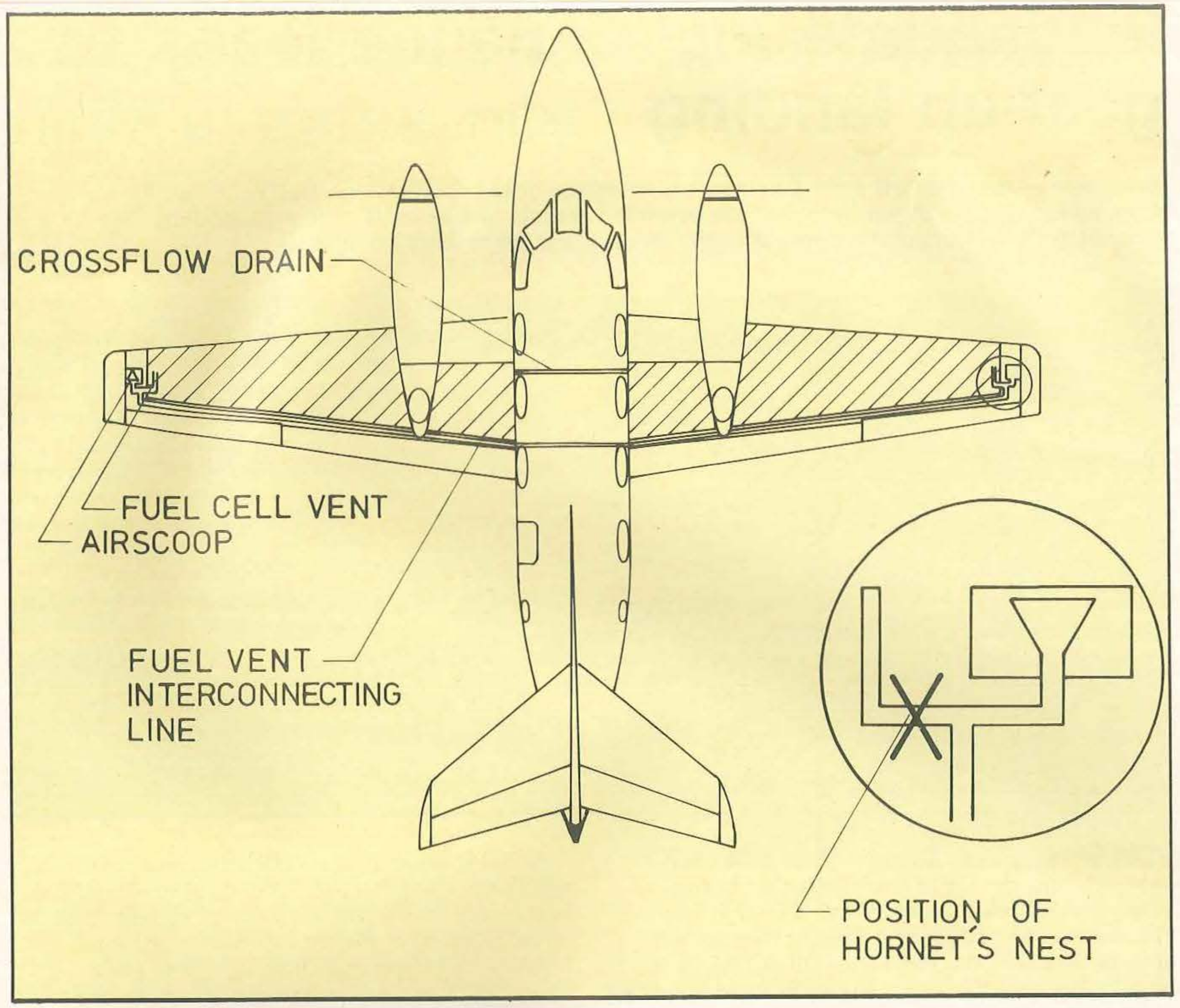
In an overseas incident a Merlin III was cruising at FL240 on an overwater flight when a passenger pointed out to the pilot that the top of the right wing was taking on a ribbed appearance. Within another 15 or so minutes it developed a pronounced 'collapse inwards' appearance and the pilot concluded that there was a partial vacuum in the wing. He diagnosed a fuel tank vent problem and then reasoned that he could relieve the depression by opening the cross-flow valve — which he did. An immediate transfer of fuel from left to right corrected the ribbing, but the resulting fuel imbalance was near the prescribed limit for landing and was increasing. With the valve closed again the ribbing soon reappeared, so the pilot elected to leave it open. He considered several courses of action to alleviate the problem but finally decided that the best option was to attempt a landing at higher than normal speed and as soon as possible, accepting the excessive imbalance — which increased rapidly during descent as increasing atmospheric pressure forced more fuel into the already heavy tank.

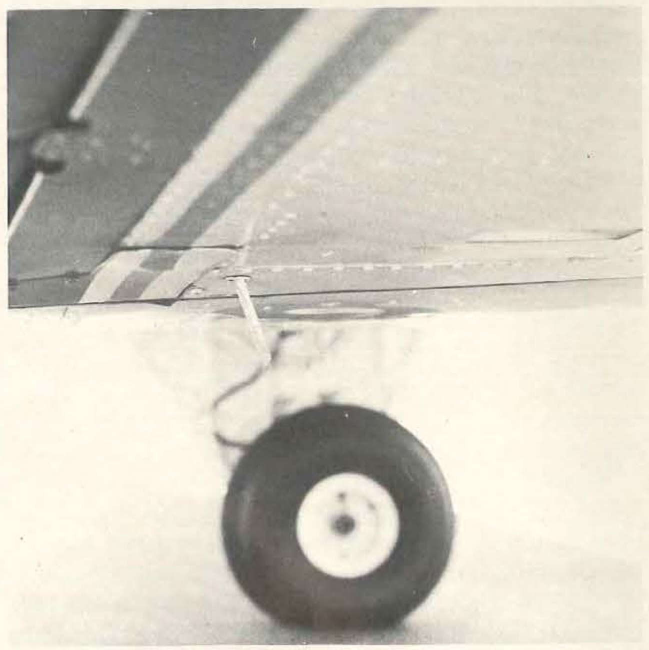
The fuel tanks in the Merlin III are of 'wet wing' construction and each is vented by a single vent. In addition, there is a vent balance line which vents one wing from the other in the event of a blockage. However, the balance line does not run directly into the fuel tank, but joins the primary vent line at a junction about 50 millimetres from the tank. As Murphy's Law predicts, the hornet which had built its nest in the vent built it between the junction and the tank. As a result there was no venting to the tank at all.

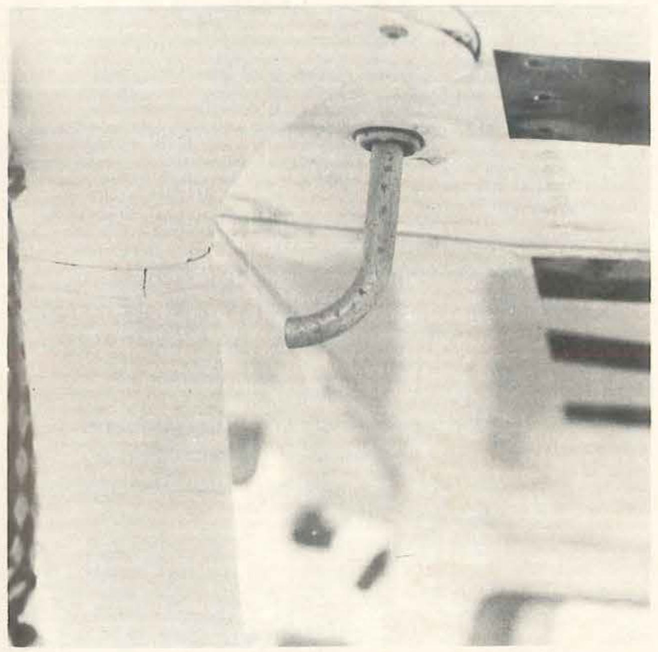
This incident not only confirms Murphy's Law yet again, but also illustrates that insects will not always build where their nests can be seen. An answer to this problem is to deny them entry — either by installing fixed screens if the vent design and configuration permit, or by fitting appropriately designed covers whenever the aircraft is parked.

*

While the two incidents described in this article relate to specific aircraft types, the points concerning pre-flight inspection of the fuel vent system and protection against entry of foreign objects have universal application. Furthermore, pilots must have not only a good knowledge of the vent configuration of all the aircraft they fly, but also a thorough understanding of the whole fuel system so that the causes of problems can be quickly and accurately diagnosed and appropriate remedial action taken. Inappropriate action taken through either a lack of understanding of the system or an incorrect diagnosis may well aggravate an already critical situation ●



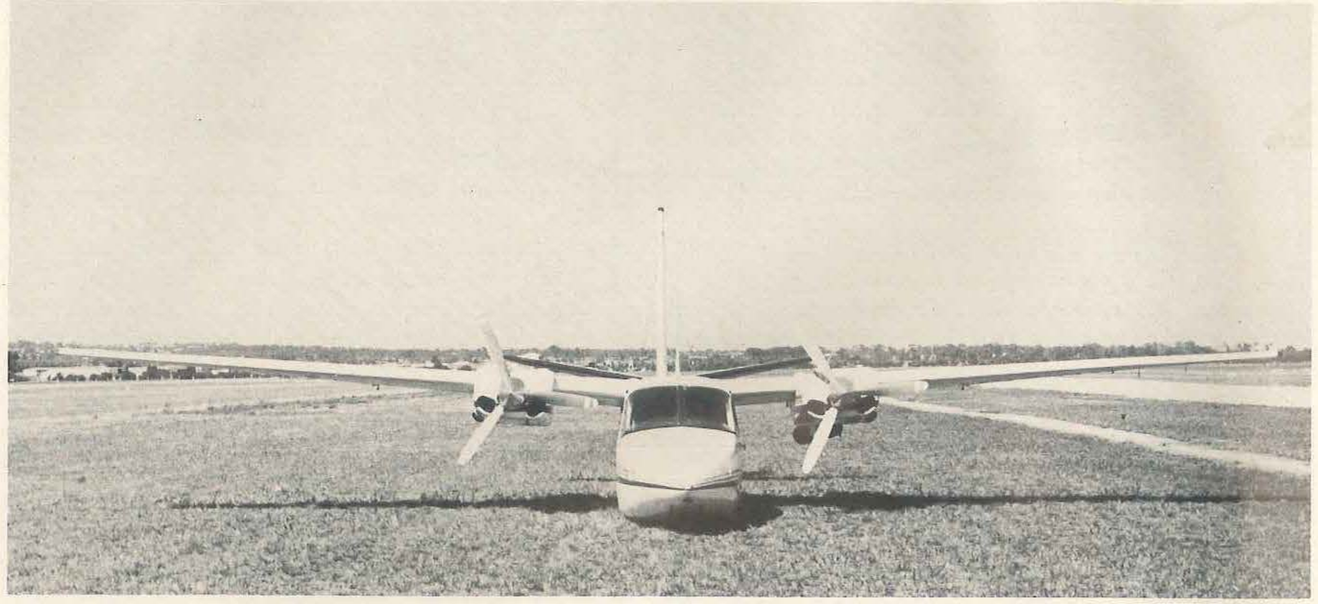




Typical light aircraft fuel vents

Inadequate maintenance leads to gear-up landing

Unable to extend the left main landing gear on arrival at his destination, the pilot of an Aero Commander 500S elected to retract the extended wheels and execute a gear-up landing. The aircraft suffered only minor damage in the landing and there were no injuries.



The landing gear had retracted normally after take-off, and the flight was conducted in smooth conditions without incident. On arrival at his destination the pilot selected gear down on the downwind leg of the circuit and obtained down and locked indications for the right main and nose gear, but the left main extended only about 300 millimetres and then stopped. The pilot tried several times to free the jammed gear but was unsuccessful. Hydraulic pressure was normal throughout. Realising that a gear-up landing was becoming a distinct possibility he elected to divert to a major airport where better emergency services and maintenance facilities were available.

The pilot succeeded in retracting the left main gear by the application of negative 'g', but on arrival at the diversion airport his attempts to extend it were again unsuccessful. The left main gear again extended only partially and jammed. Repetition of the emergency extension procedures and the application of both positive and negative 'g' failed to change its position. On ATC and Company advice the pilot then diverted to a nearby general aviation airport where emergency services had been alerted.

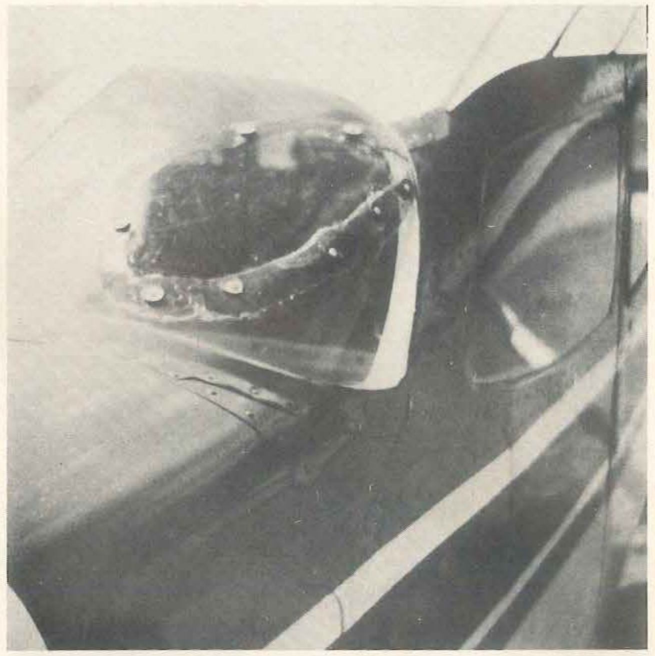
After briefing his passengers on emergency procedures the pilot started his landing approach to the grassed flight strip beside the runway. He used full flap, aiming to touch down at low speed but without stalling on. The aircraft touched down smoothly, 300 metres in from the threshold of the runway and skidded 175 metres, suffering only minor skin abrasion to the underside of the fuselage. The occupants vacated the aircraft without assistance.

Initial investigation revealed that two bushes which accommodate the landing gear torque link had failed, interfering with the 90 degree rotation of the inner strut during extension and retraction. However, the failure of these bushings alone should not have prevented gear extension. Further investigation revealed that the upper and lower needle bearings in which the inner strut rotates had partially seized. They showed evidence of moisture ingress, severe corrosion and lack of grease. This had prevented strut rotation and, in turn, gear extension beyond the partially extended position shown in the photograph.

In 1978 an Airworthiness Advisory Circular (No. 104) was issued to draw operators' attention to the importance of regular lubrication of landing gear systems. Furthermore, the manufacturer recommends a 3000 hour overhaul period for landing gear components in this aircraft. The relevant components had, in this case, been in service for over 11 000 hours and there was no evidence in the aircraft log book to indicate that any such overhaul had been carried out.

While recommendations of this type are not of a mandatory nature they are certainly not made lightly. Rather, they are made on the basis of service experience over a wide range of operating conditions. Individual operators may see fit to vary such recommended servicing periods in the light of their own experience, but they should recognise the possible implications of unduly large extensions ●

Objects ejected from aircraft during flight in turbulence



The aircraft, a Cessna 172M, was on a VFR flight below 5000 feet. The area forecast for the period of the flight predicted a south-easterly wind at 15 knots with visibility 40 kilometres and light turbulence. However, 25 minutes after take-off the pilot reported to Flight Service that he was experiencing severe turbulence. Nine minutes later he further advised that the rear window of the aircraft had been broken when a 4.5 litre plastic container full of water was ejected during turbulence, and that he was returning with the ruptured container wrapped around the leading edge of the horizontal stabilizer. Shortly afterwards the container fell away and the aircraft landed without further incident.

After landing the pilot discovered that a magneto which he was carrying in the cargo compartment behind the rear seat had also been ejected. Neither the magneto nor the container had been restrained.

Fortunately the occurrence did not cause injury to anyone in the aircraft or on the ground, and the aircraft suffered only minor damage. Consider, though, the potential for disaster. Had the magneto struck the pilot, or had it damaged the tailplane after being ejected the result could well have been catastrophic. Similarly, it was indeed fortunate that the occurrence did not take place over a populated area.

While a magneto may not be the most common of articles carried as cargo, other potentially lethal missiles (tie-down stakes, tool boxes etc.) are often carried. Furthermore, an object need not be heavy or large to cause a problem. Any unrestrained object can create a distraction if it is being tossed around in the cabin and may pose more serious problems if it comes into contact with controls or switches. To be safe tie those loose articles down!

The pilot involved in this occurrence has since purchased a cargo restraint net for use in his aircraft ●

Report those incidents

Seven people were killed and two seriously injured in an overseas accident last year when a commuter aircraft crashed during a Localiser/DME approach in bad weather. The aircraft hit the top of a hill on the approach path 4.5 miles short of the runway, and 854 feet below the published minimum altitude at that point of the approach. The investigation concluded that the pilot had made a premature descent to MDA based on distance information displayed from a DME station located at the Initial Approach Fix, approximately 4.5 miles from the runway, instead of the DME associated with the published procedure, co-located with the localiser near the runway threshold.

The factors involved a complex interaction of aircraft instrumentation characteristics, approach chart presentation, limited planning time for the approach and probable distractions at a critical point of the approach. However, these are not relevant to the point of this article.

The moral of this accident surfaced during the investigation, when several pilots contacted the investigation team to relate incidents in which they had made procedural errors on this same approach — errors which in bad weather would have resulted in their flying into the same hill. All had descended on the wrong DME. None submitted an incident report. Each was embarrassed about making such a mistake and believed his was an isolated incident.

Tragically this hazard was brought to everyone's attention one accident too late. The moral is obvious: report those incidents! ●

Pre-flight pointers

Each year the accident and incident reports contain a disturbing number of occurrences in which inadequate pre-flight preparation and inspection of the aircraft feature as significant factors. The two most common deficiencies observed are failure to ensure that sufficient fuel is carried for the intended flight and failure to calculate and apply performance data in operations from ALAs. These will be featured in separate articles in a future Digest. Some examples of other checks and pre-flight actions that have been overlooked in the past are illustrated in the following brief accounts of a few selected accidents. In addition, the articles on pages 10 and 13 of this Digest are relevant.

*

The pilot of a Beech A36 conducted only a cursory pre-flight inspection prior to starting the engine for a short travel flight. He had flown the aircraft earlier that day and said that he had carried out a full daily inspection before that flight.

After start-up he taxied for an intersection departure and completed the take-off checks while the engine temperatures came up. He then entered the runway after checking for traffic and applied full power for take-off. At about 75 knots he attempted to rotate the aircraft to lift off, but the control column would not move. At this stage sufficient runway remained for the pilot to abandon the take-off, but instead he continued and attempted to rotate the aircraft with elevator trim.

This, however, had the opposite effect and the aircraft 'wheel-barrowed' off the end of the runway under full power. The aircraft was destroyed and the pilot suffered head and chest injuries through contact with the control wheel and instrument panel during the ensuing ride through the rough. He had not fastened his shoulder harness. His injuries were, however, slight compared to what they might have been: a heavy generator unit he was carrying unrestrained on the rear floor was ejected through the side cargo door of the aircraft and not forward.

Investigation of this accident revealed that the pilot had not removed the control lock before flight.

*

The engine of a Cessna 182 failed soon after take-off and the pilot was faced with a forced landing on unsuitable terrain from about 150 feet. He attempted to stretch the glide and reach a clearing, but the aircraft stalled and impacted in a nose-down attitude in a sparsely wooded area. The ensuing slide was short: the aircraft came to rest inverted only 30 metres from the impact point. Fortunately none of the three occupants was injured.

The aircraft had been refuelled from drums the previous day. On completion of that fuelling the pilot took fuel samples from the wing tanks to check for water. Next morning during his daily inspection he took fuel from the fuel strainer drain but did not take any more from the wing tank drains.

During the accident investigation almost half a litre of water was drained from the fuel supply line, filter bowl and carburettor. How the water got into the tanks could not be determined, but two significant points emerged from the accident. Firstly, a fuel drain from all points is essential before flight, particularly after an aircraft has sat overnight. Secondly, the method used to extract the fuel from the drums would have ensured that any water in the drum was pumped into the aircraft tanks. The drum had been tilted to allow water to drain to the lowest point — but the pump was then inserted at that point and fuel drawn from the low side.

*

In a similar accident the pilot of a Fletcher ran his aircraft through some fences during a forced landing when the engine failed soon after take-off. In this case the pilot had taken fuel from the wing tank drains during his daily inspection but not from the fuel strainer drain. Again, a substantial quantity of water was drained from the filter bowl during the investigation.

*

Apart from the requirements prescribed by ANOs 20.2 and 100.5.1 there are no hard and fast rules governing the extent to which a light aircraft should be pre-flighted, and opinions differ considerably from pilot to pilot. However, experienced pilots will agree that there are certain checks which should never be omitted under any circumstances, others which should be done before the first flight of the day and yet others which should follow any extended period during which the aircraft is not flown. The checks shown here are offered as a general guide only. Pilots should be familiar with the ANO requirements and should also refer to the operating handbook for detailed inspection requirements for each aircraft they fly.

The pre-flight inspection is a vital pre-requisite to safe flight and, as such, is deserving of the pilot's utmost diligence and undivided attention. Never be in a hurry during the pre-flight and don't try to conduct it when pre-occupied with other tasks or problems. A pilot with other things on his mind may well go through all the motions of the pre-flight, but he will often 'look without seeing'.

As a final reminder, don't forget to pre-flight the pilot. Ensure that you are physically fit and mentally prepared for the flight before starting any other preparation. A pilot who flies an aircraft when he is unwell or ill-prepared is a hazard to himself, his passengers and other aircraft.

We wish to extend our appreciation to the Royal Victorian Aero Club for the assistance given in assembling this article and, in particular, to the Chief Flying Instructor for his advice and supervision of its preparation.

Acknowledgement is also made to the New Zealand Civil Aviation Magazine *Flight Safety*, from which ideas for the format and many of the pre-flight pointers were taken.

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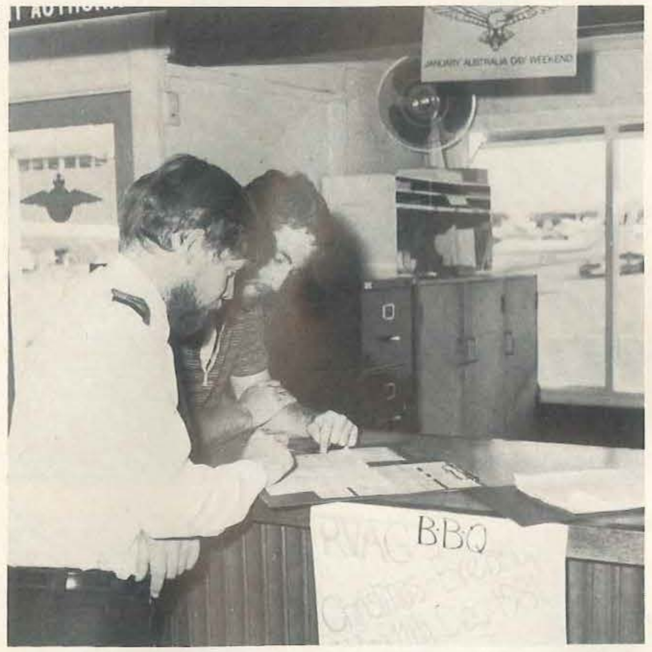

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1. *Check documentation: maintenance release, flight manual, and flight authorisation (if applicable) and then make any required performance or weight and balance calculations.*

2. *While approaching the aircraft observe chocks, ropes, external locks, pitot covers etc. to be removed appropriately. Note the position of the aircraft relative to other aircraft, hangars and other obstacles, and if confined consider manhandling it to a more open area before start. Observe that the aircraft sits level (flat struts, tyres, landing gear damage).*

3. *Check brakes parked, controls unlocked and full and free movement in correct sense, switches off, mixture idle cut-off, throttle closed, fuel on. Master switch as required to configure the aircraft for the pre-flight. Note fuel contents indication. Check windshield condition and cleanliness. Check cockpit cleanliness, dead paperwork, drink cans, ashtrays etc. Check security of fire extinguisher, first aid kit etc. Check provision of sick bags. Inspect seat rails and check locking mechanism. Check trims through full range and set to neutral. Ensure all placards are secure and legible.*

4. *Check fuselage for ripples, sprung rivets and stone damage. Check drainholes are free of obstruction.*

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5,6,7. Check rear fuselage, fin and horizontal stabilizer for buckling, ripples, sprung rivets, stone damage and cracks. Check rudder and elevator hinges, actuating rods, mass balance integrity, and full and free movement. Check trim tabs.

8. Check all communication and navigation aid aerials and components for security.

9. Landing gear. Check condition of tyres: wear, inflation, cuts, creep; check brake pads and discs; inspect hydraulic lines and unions for condition and leaks; ensure retraction mechanism is free of dirt and grime, inspect condition of moving parts; inspect attachment points for buckling or other evidence of a heavy landing; check struts for correct extension and fluid leaks. Ensure tow bar is removed from nosewheel. Obviously, the things to check here will vary widely with different types. With retractable gear a thorough knowledge of the system is essential.

10


11


10,11. Check flap and aileron hinges, actuating rods, mass balance integrity, full and free movement. Check trim tab.

12. Check wing tips, strobes, navigation lights for evidence of ground contact and hangar rash. Check wing tip fairings for cracks around attachment fasteners.

13. Check wing surfaces and leading edge for evidence of birdstrike and overstressing. Look for abnormal rippling between rivets on the upper surface and around wing roots, strut junctions and landing gear attachment areas. Ensure that any frost or ice on the wings is removed before flight. Check for fuel stains on lower surface and around wing roots.

14. Check stall warning tab for free movement and correct operation. In some aircraft the master switch may need to be on to check the light and warning horn.

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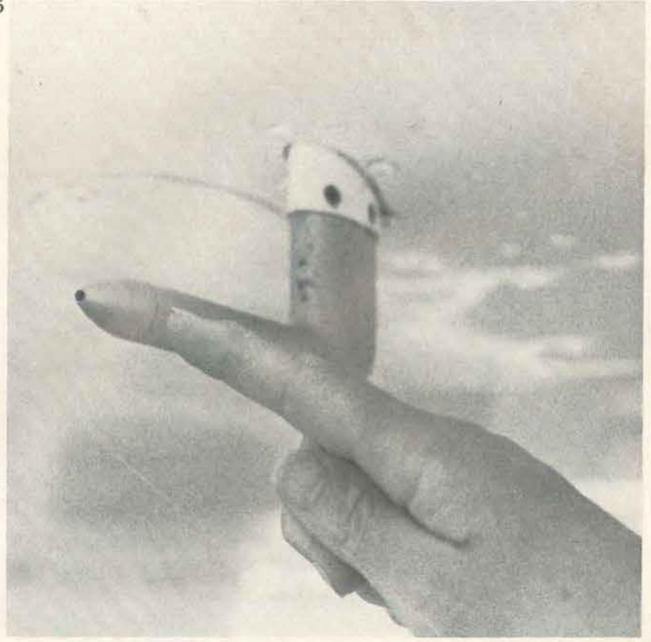

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15. *Remove covers from pitot heads and check for obstructions. Similarly, check fuel vents and static vents. If checking pitot heat wet your finger first. With no cooling airflow the pitot head can get very hot.*

16. *Fuel quantity — a vital check! But remember: visual estimate is unreliable unless tanks are full or filled to a defined level (tabs etc); dipstick may be inaccurate unless the aircraft is level; time card calculations are not always reliable; and gauges may lack sensitivity and be inaccurate. Therefore cross check, and then if in doubt fill up anyway or add enough fuel for the flight. Ensure caps are correctly fitted.*

17. *Another vital check! Without oil your engine wouldn't last a minute. Check also condition of the oil, tiny flakes of metal and water contamination. Ensure filler cap is correctly secured and the access panel is closed and fastened.*

18. *Check correct closing, fit and security of cowls after checking engine bay for: bird nests, cleaning rags or other foreign matter; cracked exhaust systems and heater muffs; frayed ignition harness or air ducting; security of engine control linkages; and chafed oil or fuel lines. Fuel leaks may be evidenced by staining and signs of washing on cowls. Check security of all inspection panels.*

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19, 20. *The oil cooler and induction air filter must be secure, clean and unobstructed. Landing lights should be clean. Check propeller for tip damage, leading edge nicks and cracks and spinner security. Even apparently minor nicks can lead to fatigue cracking and blade failure, so ensure that they are properly dressed out by a qualified person. Pull propeller through backwards to check compression. If all cylinders are not equal, have it checked. Do not compression check a hot engine.*

21, 22. *Contaminated fuel is deadly! Take samples from all tank drains and the strainer drain. Check for contamination by water or other foreign matter (methods of checking for water contamination are given in ANO 20.2). Check grade of fuel by colour. Ensure all drains are properly closed and not leaking. Do not return fuel to the tanks — discard it downwind clear of aircraft, smokers etc.*

23. *Stow baggage, equipment, chocks etc., tie them down securely and you are ready to go, with the assurance that your aircraft is mechanically sound* ●

23

Complacency leads to navigation error

Ask any 'old' pilot what his formula for aviation longevity is, and one of his pieces of wisdom will probably be to treat every piece of information with a certain amount of scepticism until its accuracy or authenticity can be verified. That is a fundamental rule of safe flying which has developed from experience over the years, but one which is frequently overlooked. This article relates to an incident that testifies to the continuing validity of it.

About 50 minutes after take-off in a modern turbo prop aircraft for a single-pilot IFR flight, the pilot recognised that all was not well with his navigation and set about establishing his position visually. Fortunately he was relatively familiar with the area and the visual cues were prominent, for he found himself to be 195 kilometres off track: a track error of 46 degrees.

How did it happen? The pilot had placed his faith in the accuracy of his No.1 compass system and did not think to cross-check it with either the standby compass or the No.2 (co-pilot's) system. Had he done so he would have discovered that his own compass was inaccurate.

After engine start, the pilot had set his compass system heading bug to the runway heading and taxied to the runway. On line-up, take-off and departure the compass appeared to the pilot to be working correctly. After take-off he engaged the auto-pilot, selected heading hold and intercepted the outbound track with reference to the departure point NDB. He commented later that the track appeared normal to him, but he did not check it visually: the radio navigation aids, ADF and DME, were giving the indications he expected to see.

Thirty minutes after departure the pilot reported at his first reporting point, having established his position with reference to the departure point NDB and DME. He was receiving an off-track VOR, but he did not use it, nor did he tune his No.2 ADF to other NDBs that were in range. After passing the reporting point the pilot tuned and identified the next on-track NDB, but the bearing indications led him to believe that his ADF was not tracking correctly at that time. However, he was unconcerned about this because of a history of ADF problems with that aircraft, and he continued to fly his heading. Shortly afterwards the VOR and DME 'dropped out' — at about the expected time. However, when the ETA for the next NDB was nearly up, with the ADF still not behaving correctly, the pilot started to feel some concern and decided to establish his position visually. It was after he had done this that he found that his No.1 compass was grossly in error. Trouble-shooting revealed that the slaving system had been inadvertently switched off and the compass had for some time — probably since departure — been operating as a free gyro with all its inherent drift and precessions. The auto-pilot dutifully followed this drift by following the heading bug.

How could an experienced, instrument rated, professional pilot allow a simple switching error to degenerate over nearly an hour into a navigation error of such proportions? Firstly, he had flown the route many times, applying the same navigation technique without previous difficulty; he had flown the aircraft on the preceding flight and experienced no navigation difficulties, and the weather was good. Complacency, then, probably played a big part. But let us look closely at some of the other factors.

- The company operations manual did not prescribe any specific checks of the compass slaving system or switch selections. Pilots were expected to monitor it along with their normal compass checks.
- The slaving selector switch is unguarded and positioned close to both the park brake handle and assigned altitude indicator where it can easily be operated inadvertently.
- The compass slaving selector and indicator are not visible to the pilot from his normal seated position.
- Continuing problems with the ADF over a long period had led the pilot into accepting the apparent lack of ADF performance as normal, when it should have indicated to him that something was amiss.
- Some of the visual cues available to the pilot on the track flown were, by coincidence, similar to those on the correct track.

This incident illustrates the dangers of complacency and the importance not only of checking information against another source, but also of making use of all available information. It also illustrates the danger of accepting 'negative' information. The loss of VOR and DME signals at about the expected time was, in fact, meaningless, but it reinforced the pilot's belief that all was well. He also accepted as normal, for a considerable amount of time, the lack of ADF bearing information when he should have been well inside the rated coverage of the NDB. Incidentally, the ADF problem persisted because the pilots had stopped complaining about it. This led management to believe that the problem had been corrected.

Fortunately, the terrain over which this incident occurred was not mountainous and terrain clearance on the track flown did not pose any threat. Fortune then smiled upon the pilot again, in that a diversion aerodrome with fuel available was within range when he discovered his position. But the question that will never be answered is. . .'what if there had been solid undercast in the area, with no chance of a visual fix, and out of range of all nav aids'? ●

Thunderstorms

All pilots have heard the warning, 'Don't land or take off in the face of an approaching thunderstorm'. But, as one ag. pilot recently learned, it can be equally hazardous to take off *away* from an approaching storm!

Super-spreading operations had been going on all day without incident. But the day was hot, and during the afternoon heavy cloud and thunderstorms began to build up in the area. After spreading his 76th load, the pilot landed into the light northerly wind as he had done all day and re-loaded. But when he taxied for take-off he observed that in the two to three minutes he was on the ground the wind had changed to a southerly and increased in strength. At the time two thunderstorms were centred about 20 kilometres to the north and east. The take-off was made into the south (away from the storms) and was normal; however, soon after turning left towards the spreading area, the aircraft briefly entered light rain and moderate turbulence, and then entered a rapid descent. The pilot dumped the load and applied maximum power — but in vain; he was unable to prevent a collision with the ground. Fortunately the aircraft was in a level attitude at impact and the area was flat and relatively unobstructed. The pilot, who was not injured, was able to stop the aircraft without it sustaining any more damage.

Within minutes of the occurrence the wind swung around to the east and became very strong for a few minutes before heavy rain started to fall.

A mature thunderstorm cell is characterised by powerful updraughts and downdraughts which are formed when cold dense air cooled at altitude displaces the warmer less dense air near the surface. The downdraughts are often accompanied by heavy rain, and sometimes hail, and can reach vertical speeds exceeding 6000 feet per minute. Furthermore, their effect can be displaced several kilometres from the centre of the storm; the descending air when it meets the earth's surface creates an outflow of air in all directions beneath the cell. An aircraft operating in this area at low level may encounter these rapidly changing horizontal and vertical winds and, in the worst case, sufficient corrective action may be beyond the capabilities of the aircraft ●

Spark plug fouling

Largely because of falling demand and rising costs, fuel companies have found it less and less attractive to continue marketing AVGAS 80 which, in Australia, began to disappear during 1976 and is now largely unobtainable. Consequently, operators have been forced to turn to AVGAS 100 or the replacement fuel AVGAS 100LL. For various reasons, however, low-lead fuel is not yet widely used and many engines are running on AVGAS 100, a fuel containing up to six times as much lead as that for which the engines are designed. This has led to several problems, the most evident to the pilot being spark plug fouling with associated loss of power and rough running.

While an abrupt engine failure from spark plug fouling is unlikely, the potential for an accident is nevertheless there whenever normal engine operation is impaired. The records contain many reports of aircraft failing to climb away after take-off or being unable to maintain height in the circuit. Fortunately most of the incidents have occurred near aerodromes and safe landings have been possible, though many pilot's adrenalin output has received the stimulus of a rough running engine over inhospitable terrain, and some aircraft have been damaged during forced or precautionary landings away from aerodromes.

The problem of lead fouling arises when low engine operating temperatures coupled with a rich mixture prevent the complete vaporisation of the tetraethyl lead (TEL) in aviation fuel. Under these conditions lead deposits can form in the combustion chamber and may adhere to the spark plug electrodes, causing misfiring.

By establishing and maintaining proper engine operating temperatures the problem is largely eliminated. Aviation fuel contains a scavenging agent which helps prevent the formation of lead deposits by keeping the TEL vaporised, allowing it to pass out through the exhaust system. But this agent is effective only when the spark plug nose core temperature is kept at about 430 degrees Celsius or higher. Operating techniques that result in low engine temperatures may not allow the plugs to reach that temperature.

Lycoming Service Letter No. L192A, March 1981, addresses the subject in respect of Lycoming engines and recommends some operating techniques which can reduce or eliminate the problem. These recommendations also apply in principle to other makes of piston engine and are not restricted to those designed to use 80 octane fuel, but operators should ensure that manufacturers' instructions do not prescribe procedures or limitations that would prohibit their adoption. The recommended techniques are contained in the following advice:

- Ensure by consulting spark plug recommendation charts that correct plugs are installed. In the event of a continuing or severe problem it might be advantegous to experiment with slightly 'hotter' or 'colder' plugs from the range approved for use in the engine.
- When changing spark plugs do not simply replace with plugs of the same part number — incorrect plugs may have been installed previously.
- Do not continue to operate an engine that exhibits symptoms of an over-rich idle mixture such as incorrect or unstable idle speed, black smoke from the exhaust, or a tendency to accelerate excessively when idle-cut-off is selected. Have the mixture adjusted.
- When temperatures have risen sufficiently after a flooded start, slowly run the engine to about 1800 RPM for a short time to melt and scavenge any lead deposits that may have formed.
- Avoid unnecessary closed-throttle operation on the ground. A minimum engine speed of about 1200 RPM is required to keep the spark plug nose core temperature high enough to allow the lead scavenging agent to do its job. But when taxying use whatever power is required to maintain the desired speed. Do not taxi with power against brakes — this leads to brake overheating and premature wear. Following prolonged taxying, check for plug fouling before take-off by conducting another switch check.
- Lean the mixture when cruising — regardless of altitude — but observe any limitations on leaning at high power settings. Re-lean after the application or removal of carburettor heat or alternate air.
- Schedule cross-country flights for training aircraft whenever possible. Continuous rich mixture, low-power operations associated with circuit work may allow lead deposits to accumulate.:
- Keep cylinder head temperatures near the middle of the normal operating range — around 190 degrees Celsius. Many people believe that engine life is prolonged by operating with cylinder head temperatures as low as possible. This is a fallacy and the practice leads to spark plug fouling and likely accelerated engine wear.
- In winter use oil cooler baffles to keep oil temperature up.
- Avoid fast, low-power descents. Plan a descent profile that allows the use of sufficient power to keep engine temperatures up.
- Before shut-down run the engine up to 1800 RPM for 15 to 20 seconds, then reduce to 1200 RPM and shut it down with the mixture control.
- Swap top and bottom plugs every 25 to 50 hours — top plugs scavenge better than bottom.

In some cases use of the primer may also contribute to spark plug fouling. A Cessna 172B operator in Queensland reported that the unacceptable fouling he experienced when forced to use AVGAS 100 appears to have been eliminated since he stopped using the engine primer for starting. He found that under his operating conditions he could obtain satisfactory starting by 'pumping' the throttle once or twice immediately before engaging the starter. The primer was apparently injecting too much fuel which was resulting in an over-rich mixture with consequent fouling while the engine was running cold just after start. Operators in cooler climates may find it necessary to make some use of the primer, but over-priming should be avoided.

A number of advanced design spark plugs which resist lead fouling are available. In one, the mouth of the plug is so shaped as to provide maximum temperature on the central insulator during the firing stroke and maximum cooling during induction. Another has an extended centre electrode and insulator which allows the plug to continue to fire even when substantial lead deposits have formed, while others use special electrode materials which resist fouling. However, before installing any new plug operators should check that it has been approved for use in the particular engine type.

The foregoing advice is directed principally at preventing the formation of lead deposits. In many cases though, adoption of the techniques described will also remove deposits that have already formed. And fouling detected on the ground can often be cleared by a short period of operation at about 1800 RPM with lean mixture. However, caution should be exercised in following this procedure because incorrect or prolonged execution can result in excessively high cylinder head temperatures and detonation with consequent engine damage. Furthermore, the indications of lead fouling may also be symptomatic of more serious problems and should normally dictate investigation by a qualified person before the aircraft is flown ●

Carbon monoxide enters aircraft cabin through defective door seal

Articles on the dangers of carbon monoxide infiltration into aircraft and motor vehicle cabins appear regularly in most aviation and road safety publications (see *Aviation Safety Digest 109*), usually highlighting the need for proper maintenance and inspection of exhaust and heater systems. However, following a recent incident in which the pilot suffered symptoms of carbon monoxide poisoning, the gas was detected in the cabin of a near-new Cessna 185F which was fitted with a special purpose belly pack. Investigation established that the belly pack modified the airflow under the aircraft, deflecting the exhaust gas flow over the bottom of the right door from where the gases entered the cabin through a faulty door seal. The door seal appeared from a visual inspection to be in good condition and the leak was found only when a stream of smoke was directed at the bottom front corner of the door. Rectification of the defective seal eliminated the gas entry problem.

This incident illustrates how a seemingly minor defect can have potentially disastrous consequences, and demonstrates that even a thorough visual inspection can, in some circumstances, be ineffective. Rigorous maintenance of door seals and locking systems is clearly necessary, but as an added precaution the carriage of carbon monoxide detectors in light aircraft would seem to be wise. Operators' and pilots' attention is again drawn to the availability of simple 'spot' type detectors. These are small plastic cards containing a disc of chemical which darkens when exposed to carbon monoxide. They presently sell for less than two dollars and, at that price, must surely be very cheap insurance against the insidious effects of this colourless, odourless and tasteless, but *lethal* gas ●

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Notes:

Fifty years on . . . the TIGER MOTH

In this age of mass production and glossy products, row upon row of sleek modern designs confront us at any airfield we may visit. Small, medium and large, of varying hues, these aircraft perform a wide variety of tasks in relative comfort and efficiency ...... but are they 'aeroplanes'?

As one walks the lines of modern aircraft, more often than not an anachronism appears amongst them, immediately identified as a 'real aeroplane'. Its antiquity is apparent: two wings, open cockpit and fabric covering, held together by wire, and nearly always in immaculate condition. This is a TIGER MOTH.

The Tiger Moth evolved from the De Havilland DH-51 of 1924 and its successor, the DH-60 Moth of 1925. The DH-60 engendered a line of variants culminating in the DH-60T Moth Trainer, first flown in April 1931. Of the 72 DH-60Ts built, eight were constructed with a small amount of sweep-back on the mainplanes and designated Tiger Moth, the second De Havilland type to bear this name. (The first was the Monoplane DH-71 Racer of 1927.) In turn, one of these eight was further tested with dihedral on the lower wing and increased sweep-back, effecting a change of type number to DH-82.

Bearing the Class B test marking E-6, airframe number 1733 — the first true DH-82 — made its first flight at the hands of De Havilland's test pilot Hubert Broad on 26 October 1931 at Stag Lane Aerodrome, Middlesex. Built to meet Air Ministry Specification 15/31 the design led to immediate military orders, and a total production of 135 examples of this model followed. Designated MK1 by the RAF it was powered by the 120 HP De Havilland Gipsy MKIII engine. The prototype, registered G-ABRC, received its Certificate of Airworthiness on 18 March 1932 and served with De Havillands for many years. At the outbreak of war it was impressed into military service and alloted serial number BB723. After serving in RAF and RN units it was sold as surplus in January 1951 and scrapped in 1953 without being re-registered. No example of either the DH-60T or DH-82 came to Australia — contrary to popular belief.

The Tiger Moth as we know it in Australia is the type DH-82A, the major production version of the design. This variant was the result of Air Ministry Specification T26/33 which called for installation of the De Havilland Gipsy Major MKI engine of 130 horsepower and other design changes including a plywood turtle-decking in place of the fabric-and-stringer structure, an increase in fuel tank capacity from 18 to 19 gallons, elimination of the deep front-cockpit door and installation of a fixed rear seat in place of the adjustable seat of the DH-82. The first DH-82A, airframe number 3175, was registered as G-ACDA and certificated on 10 March 1933. At the outbreak of war this aircraft was impressed and subsequently saw service with both the RAF and RN. Known to the RAF as the MKII, 8811 examples of this sub-type were constructed.

A further 420 Tigers were built with wooden DH-60GIII fuselages. These were designated DH-82B 'Queen Bee' target aircraft. Some Canadian production was designated DH-82C, a variant which included those fitted with the Menasco D4 Pirate engine of 120 horsepower and the De Havilland Gipsy Major MKIC of 145 horsepower.

The Tiger Moth in Australia

The first Australian Tiger Moth, VH-UTD, was placed on the register on 28 May 1935. This was the 126th production aircraft and carried airframe number 3320. It was the fore-runner of 18 civil and 20 military examples imported prior to the outbreak of war. Another six arrived in 1940 for civil use. Of those 24 civil-registered Tiger Moths, three were purchased by the RAAF and 18 were impressed.

VH-UTD became A17-675 on 22 July 1940 and saw service with No. 8 Elementary Flying Training School at Narrandera, NSW.

As the war progressed Australia undertook to train aircrew under the Empire Air Training Scheme and, as part of this commitment, production of 350 Tiger Moths was started at De Havilland's Mascot Factory. Ultimately 1135 aircraft were constructed there, the last 65 being delivered unassembled. Of the 1070 aircraft assembled, one was released directly to Broken Hill Aero Club as VH-AEB, two went to Burma, 18 to the USAAF, 20 to the RNZAF, 41 to India, 62 to the Netherlands East Indies, 96 to Rhodesia, 120 to South Africa and 712 direct to the RAAF. As well, 100 British built ex-RAF aircraft were shipped here, bringing the total number of Tigers in Australia by the end of the war to 1127. RAAF serial numbers ranged from A17-1 to A17-759.

Post-war, the majority of the military Tiger Moths were entered on the civil register. The type was used for practically every purpose imaginable, although primarily in the training and crop-dusting roles. A few were placed on floats and several were fitted with canopies. Many were privately owned. Of the original 21 civil Tiger Moths acquired by the RAAF eight were returned to civil use post-war. One of these was airframe number 3623, originally imported as VH-UYQ. This aircraft was re-registered VH-CCE in November 1955 and is now the oldest surviving Tiger Moth in Australia. (It has been in storage since 1975.) VH-UTD — the original Australian Tiger Moth — was written off in February 1945 after an accident in which it stalled and spun in.

In 1954 there were still more than 300 examples of the Tiger Moth on the register and high numbers were maintained until the mid-sixties. The current register lists well over 100 examples — not a bad record for a type that ceased production in Australia 37 years ago ●