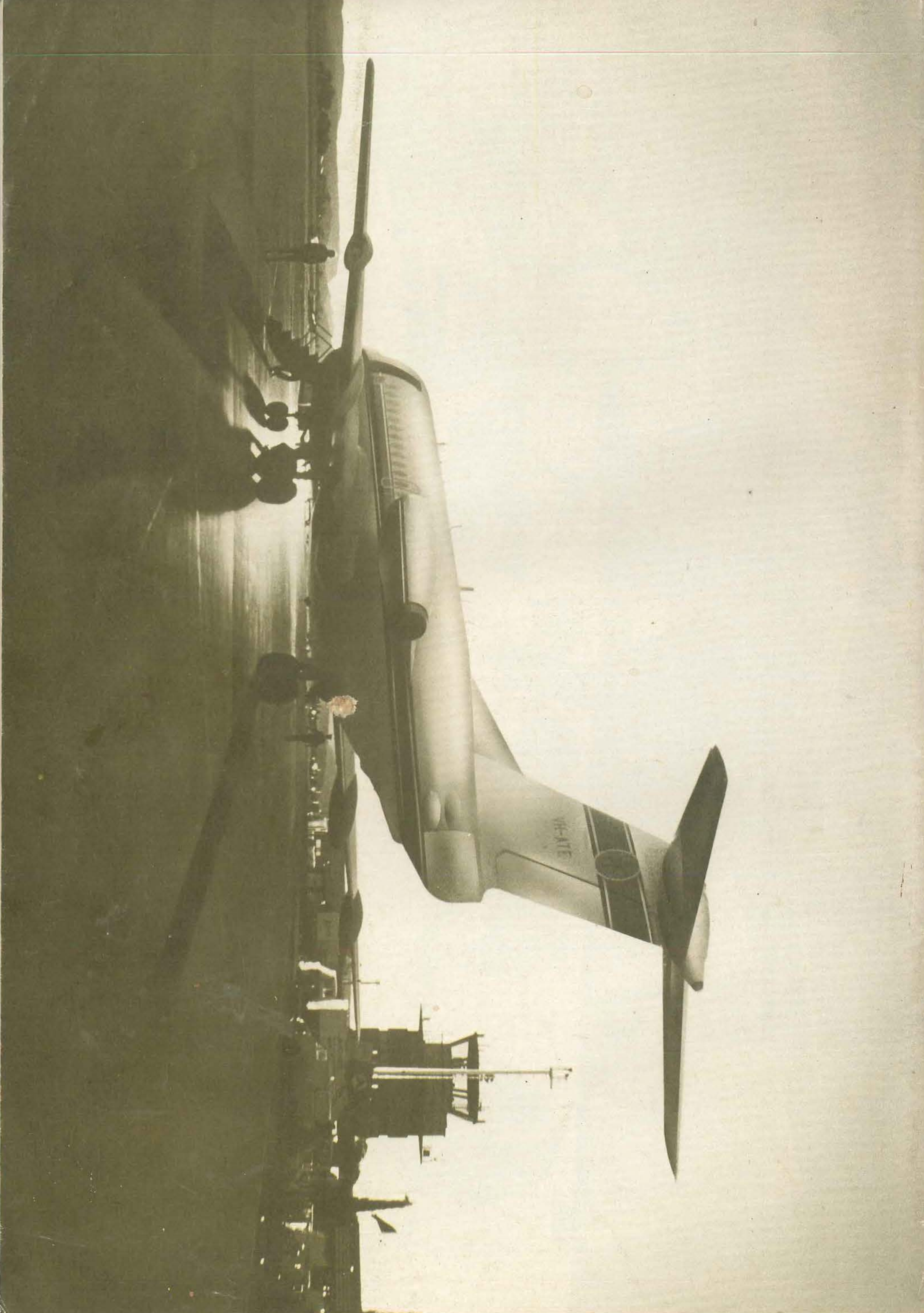

109/1980

Aviation Safety Digest

Department of Transport

Contents

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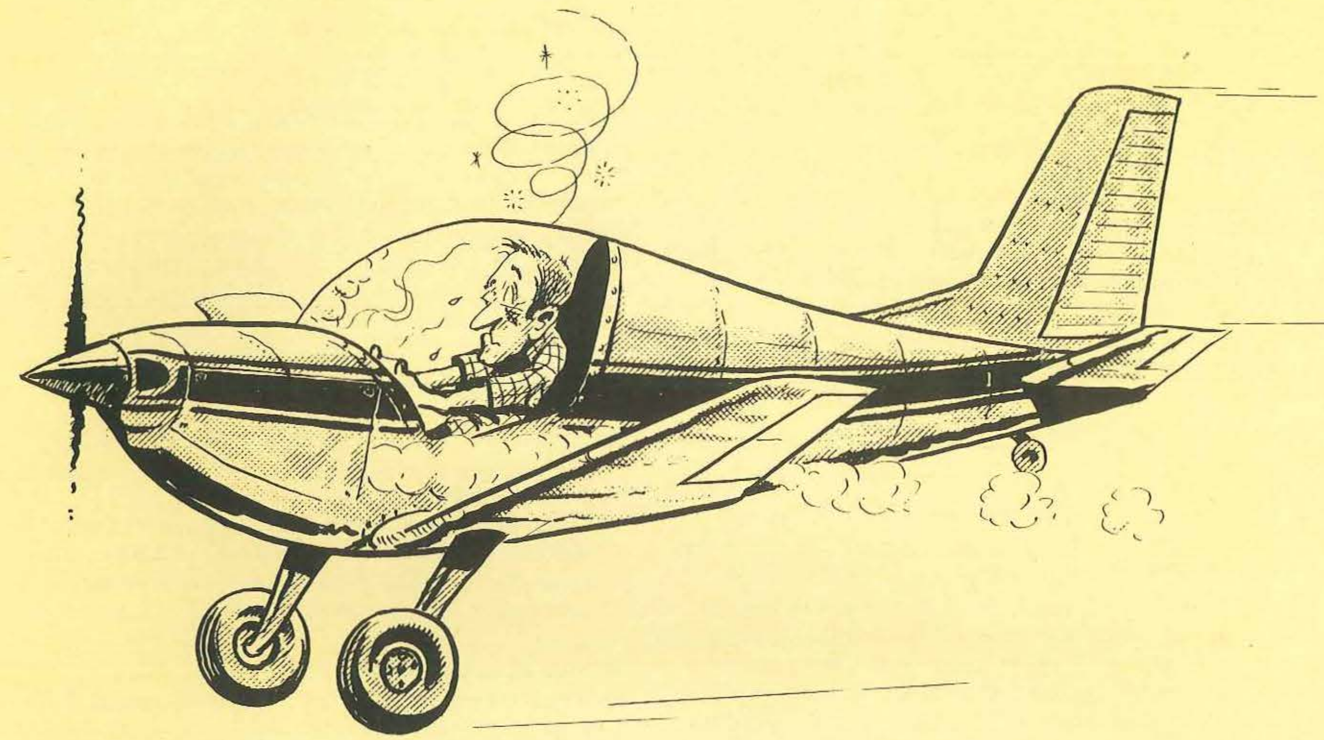
Note: Metric units are used except for airspeed and wind speed which are given in knots; and for elevation, height and altitude where measurements are given in feet.

Front Cover
An Airbus A300 in the livery of the manufacturer, Airbus Industrie, at Melbourne Airport.
—photograph courtesy of TAA

Back Cover
Sunset at Alice Springs — a DoT Fokker F-28 calibration aircraft at the end of a day's work.

Inside Back Cover
A capital city approach and departure cell, radar controllers in the foreground and procedural controllers to their right.

Carbon monoxide poisoning



The occupants of modern aircraft rarely suffer from carbon monoxide (CO) poisoning and consequently the danger it presents is often overlooked. However, the circumstances of a recent incident involving two pilots in a Cessna 150 warrant a revision of our knowledge of this insidious hazard.

The Chief Flying Instructor of a northern NSW flying school tells the story:

'Earlier this year, I was to give a student pilot a training session on steep turns, stalls and forced landings. We departed at about 0900 hours local time and climbed to 2000 feet, beneath the base of the heavy, overcast cloud. The student practised a few steep turns at 45 degrees of bank but he had considerable difficulties maintaining the correct attitude. I attributed this to the lack of a clearly defined visual horizon.

'The student pilot then commented on the "weird effects of gravity" and this prompted me to demonstrate a series of 60 degree banked turns to show him the effects of gravity. Following this demonstration the student attempted a similar turn but became disoriented and it was necessary for me to take over the controls and return the aircraft to straight and level flight. I noticed that the student appeared to be unusually distressed and I decided to conclude the flight with a practice forced landing.

'Closing the throttle, I returned the controls to the student for a landing on the aerodrome. He set the aircraft into a glide and turned on to downwind. The base turn was flown normally but from that point onward the student's judgement and manipulative skills deteriorated rapidly. I repeatedly instructed him to increase power but instead he selected full flap when the aircraft was very low on final approach and the airspeed was below 45 knots.

'I cannot remember anything specific after hearing the student mutter something like "I can't land . . .".

'Witnesses on the ground observed the aircraft pass very low over a large tin shed near the threshold and land about 300 feet before the threshold markings. The aircraft taxied to the normal tie down point where we disembarked and walked to the clubhouse. I went back to the aircraft with a screwdriver and opened the cowls to look at the engine, then, realising that I didn't know what I was doing, I returned to the clubhouse and sat down.

'After a short period of time the student left the clubhouse and started to walk about 50 metres to his car but halfway there he lost his balance and fell on to another parked car. He paused for a while then made off towards his car again but walked into a telegraph pole. He held on to the pole for a while then sat on the ground. Having watched all this happen, apparently unconcerned, I eventually made my way over to him and helped him to his car.

'About this time the local veterinary surgeon arrived and realised something was wrong. We were not very rational in explaining the problem. I told him I suspected CO poisoning and the vet. suggested we go to his surgery for oxygen. I remembered there was oxygen in a Navajo parked nearby and we made our way there. Even after breathing oxygen the student was drifting in and out of consciousness so we took him to the local hospital where he was admitted to intensive care. Blood tests subsequently revealed that he had in excess of 10 per cent carbon monoxide poisoning. It was two weeks before he fully recovered.

'Inspection of the aircraft revealed that three exhaust gaskets had failed and the sock around the pilot's left rudder pedal steering rod had split. This had allowed gases from the engine nacelle to enter the cockpit.

'There is no doubt that we were both suffering from CO poisoning and the total flight time involved was only 17 minutes. Perhaps the saving grace in this instance was the fact that I had the upper right hand air vent open and pointing at my face whereas the student's was pointing at the windscreen. Although I do not specifically remember landing the aircraft there is little doubt that I did . . . even if only from habit!'

The occurrence of this incident has prompted us to reprint the following adaptation of an FAA Advisory Circular on the subject of CO contamination in aircraft.

General
Carbon monoxide is the produce of incomplete combustion of carbonaceous material. It is found in varying amounts in the smoke and fumes from burning aircraft engine fuels and lubricants. The gas itself is colourless, odourless, and tasteless but is usually mixed with other gases and fumes which can be detected by sight or smell.

When carbon monoxide is taken into the lungs, it combines with haemoglobin, the oxygen-carrying agent in blood. The affinity of the haemoglobin for CO is so much greater than for oxygen that oxygen starvation results. Oxygen starvation of the brain reduces a person's ability to reason and make decisions. Exposure to even very small amounts of CO over a period of several hours will reduce a pilot's ability to operate an aircraft safely. Long exposure to low CO concentrations is as hazardous as short exposure to relatively high concentrations.

Susceptibility to carbon monoxide poisoning increases with altitude. As altitude increases, air pressure decreases and the body has difficulty getting enough oxygen. Add carbon monoxide, which further deprives the body of oxygen, and the situation can become critical. Inhalation of tobacco smoke also introduces CO into the body in significant quantities.

Many light aircraft cabins are warmed by air that has been circulated around the engine exhaust pipes. A defect in the exhaust pipes or cabin heating system may allow carbon monoxide to enter the cockpit or cabin. The danger is greatest during the winter months when the temperature is such that use of the cabin heating system becomes necessary and windows and vents are closed. But there is danger at other times too, for carbon monoxide may enter the cabin through openings in the firewall and around fairings in the area of the exhaust system.

Symptoms
Early symptoms of CO poisoning are feelings of sluggishness, being too warm and tightness across the forehead. The early symptoms may be followed by more intense feelings such as headache, throbbing or pressure in the temples and ringing in the ears. These in turn may be followed by severe headache, general weakness, dizziness and gradual dimming of vision. Large accumulations of CO in the body result in loss of muscular power, vomiting, convulsions and coma. Finally, there is a gradual weakening of the pulse, a slowing of the respiratory rate and . . . death!

What to do about exhaust odours and symptoms
If you smell exhaust odours or begin to feel any of the symptoms previously mentioned, you should immediately assume carbon monoxide is present and take the following precautions:
- Immediately shut off the cabin air heater and close any other openings that might convey the engine compartment air to the cabin.
- Open a fresh air source immediately.
- Avoid smoking.
- Inhale 100 per cent oxygen if available.
- If you are flying, land at the first opportunity and ensure that any effects from CO are gone before further flight.
- Determine that CO is not being allowed to enter the cabin because of a defective exhaust, unsealed opening between engine compartment and cabin, or any other factor.

Is your aircraft a death trap?
Concentrations of CO exceeding one part in 20 000 parts of air (0.005 per cent) are hazardous. To prevent an aircraft from becoming a deathtrap, a thorough examination of the exhaust manifold and heater assembly should be conducted at regular intervals, and whenever CO contamination of the cockpit or cabin is suspected, because cracks and holes may occur in a relatively short time.

Some aircraft manufacturers recommend that exhaust and heater systems be inspected as often as every 25 hours of flight time. Carbon monoxide in the cabin or cockpit has been traced to worn or defective exhaust stack slip joints, exhaust system cracks or holes, openings in the engine firewall, blowby at the engine breather, defective gaskets in the exhaust manifold, defective mufflers and inadequate sealing or fairing around strut fittings on the fuselage.

It is a good practice to supplement inspections of cabin heating and engine exhaust systems with operational CO detection tests. Carbon monoxide tests are reliable and may be accomplished without any disassembly operations. Tests should be conducted on the ground and in flight to determine the extent of CO contamination. These tests should be conducted with the cabin heat both on and off.

CO detection equipment
There are two types of indicators currently available that are practical for determining the concentration of CO in the air at any given time. One type is operated by drawing a sample of air into a transparent tube containing material which changes colour according to the amount of CO present. An accurate measurement of the CO in the sample may be made by comparing the colour in the tube to a colour standard provided with the instrument.

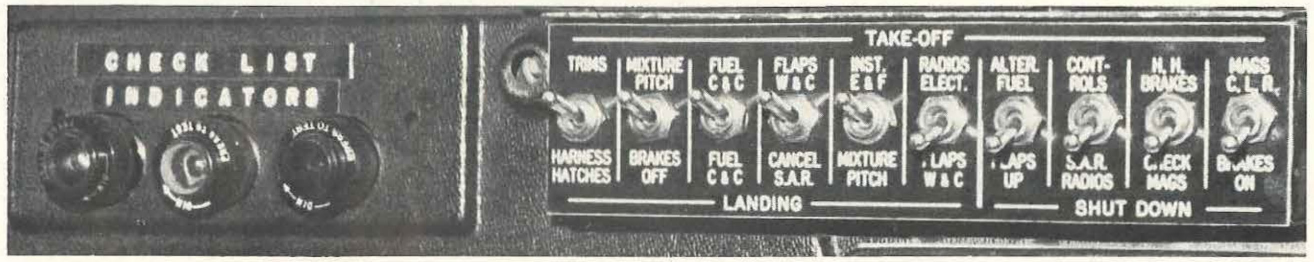
Another type of CO indicator consists of a porous plastic disc about the size of a 10 cent piece mounted in a solid plastic plate about five cm square and 2.5 mm thick. The porous plastic contains a chemical that changes colour upon contact with carbon monoxide. Measurement of the CO present is made by exposing the porous plastic disc to the atmosphere to be tested for a specific period of time, then comparing the disc colour to a colour standard on the instruction card. A reading of 'safe', 'marginal', or 'dangerous' is determined. Although not as accurate as the first type, its accuracy is adequate, and it has the advantage of being light in weight and low in cost.

Design requirements governing the airworthiness of aircraft include standards aimed at keeping cockpit and cabin air contamination within safe limits. Under these standards, the maximum acceptable concentration of carbon monoxide in air is 50 ppm. Carbon monoxide contamination checks are carried out as a routine part of the type certification for all new aircraft types brought on to the Australian register and for other aircraft which have undergone major modification, or are engaged in special operations such as support or parachute dropping, which involve the removal of doors or windows.

If at any time, an owner or pilot has reason to suspect carbon monoxide contamination in his aircraft, he should advise the Department of Transport and arrange to have the cabin air sample-tested under operational conditions. These checks are simple and reliable, and the time involved in conducting them is small indeed — especially when compared with the possible consequences of exposure to carbon monoxide in flight ●

Had your exhaust system inspected lately ?

Electronic checklist for general aviation aircraft



Pilots of large, sophisticated aircraft are familiar with the automatic take-off warning systems fitted to some aircraft to warn the flight crew that an important control is not correctly positioned for take-off. Controls such as spoilers, flaps and slats, control locks, etc., are connected electrically into the system so that when the throttles are advanced to take-off power, an aural and/or visual warning is operated.

Many general aviation pilots in the past would have relished such a luxury but have had to rely on the use of memory, mnemonics and printed checklists to avoid an occurrence during take-off as a result of an incorrectly set control.

One operator based at Mount Hagen in Papua New Guinea has progressed a long way towards overcoming the problem and has developed an electronic checklist, now fitted to most of his fleet of GA aircraft. Missionary Aviation Fellowship operates 18 aircraft, mostly Cessna 185 and 205 models, and has been progressively equipping them since 1976. This checklist is not limited to only the pre-take-off checks, but also operates for pre-landing and after-landing checks, including SARWATCH cancellation. As evidence of the usefulness of the checklist, not one of the aircraft so fitted has been involved in a 'failure to cancel SARWATCH' incident in approximately 12 000 landings at non-controlled aerodromes — an enviable record.

The checklist consists of a row of 10 toggle switches appropriately labelled, three lights coloured red, amber and green, and a transistorised logic circuit. The switches are progressively turned up to complete the pre-take-off check and then turned down to complete the pre-landing and after-landing checks. The equipment is very reliable because its electronics have been kept simple and there is no complicated logic interface with the aircraft's system to malfunction.

Operation of the checklist

Pre-take-off check

As soon as the pre-take-off checks are started, the green light goes out and the red light comes on and remains on until all checks are completed, whereupon it extinguishes and the green comes on indicating that all pre-take-off checks are complete and the take-off may begin.

Pre-landing check

As soon as the pilot starts his pre-landing checks, the green light goes out, the red comes on and stays on until all checks are done (with the possible exception of 'cancel SARWATCH') at which stage the red light goes out and the green and amber lights come on; the green indicates that the pilot may proceed to land but the amber indicates that post-landing checks still need to be done.

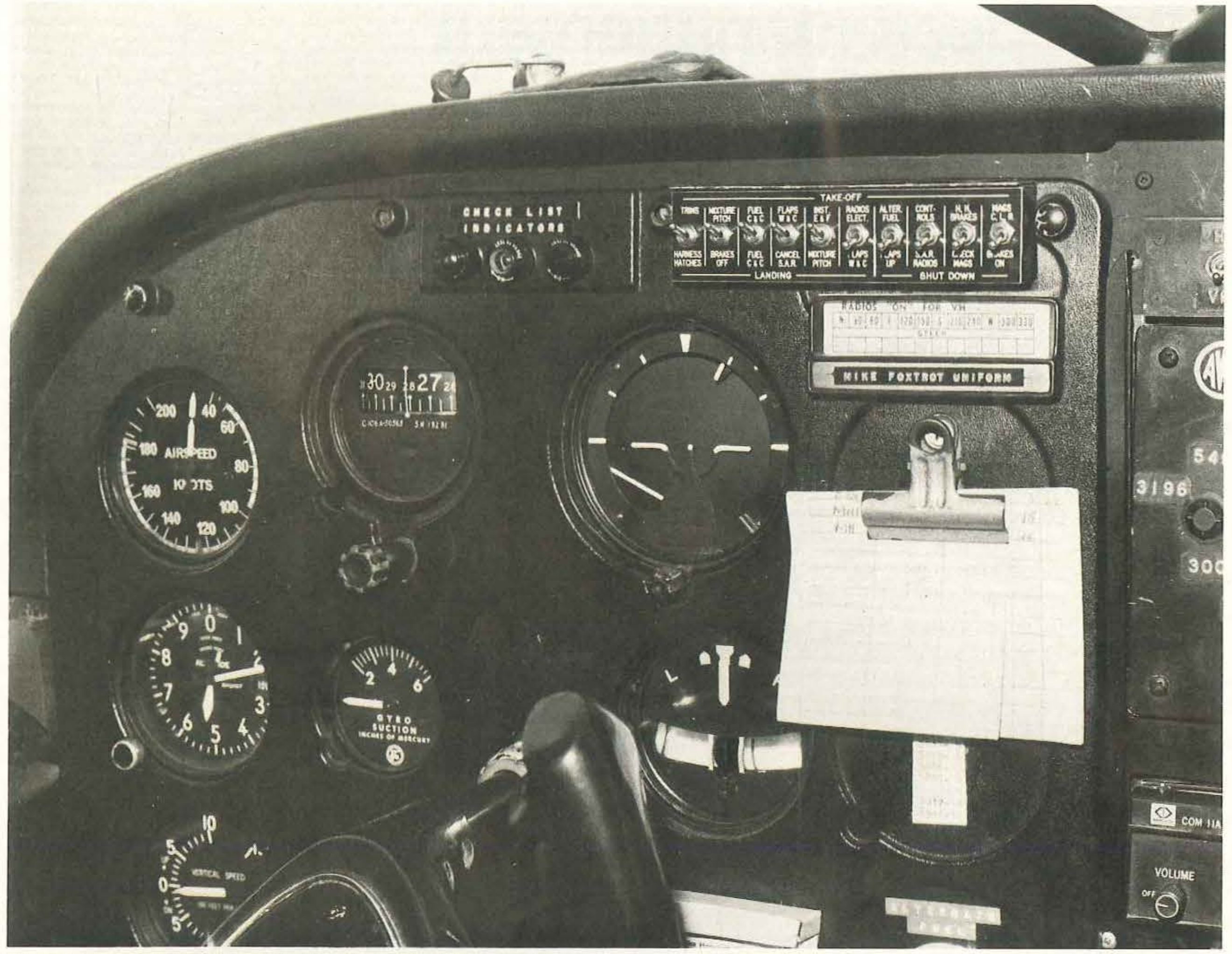
After-landing check

When these checks have been done the amber light extinguishes leaving only the green light on to indicate to the pilot that he is clear to shut down the engine.

The pre-landing logic circuits are so arranged that should the pilot elect to cancel SARWATCH after landing, he will still get the green and amber lights for landing, but the amber remains on at the completion of his after-landing checks to remind him to cancel SARWATCH by radio and then operate the appropriate switch in the pre-landing section. This will then extinguish the amber light, indicating that the checklist is complete.

Pilots using the equipment have found the checklists especially helpful when doing many consecutive short flights where it is comparatively easy to forget to complete a check.

As previously stated, this electronic checklist has overcome a lot of problems associated with incompleted checks. However, unlike the fully automatic systems in large, transport aircraft, the system is still fallible in that the pilot must carry out the particular check or make the necessary control selection before operating the appropriate checklist switch, otherwise the system becomes meaningless. It is still possible with this system to complete the checklist even though the check was not physically conducted. Obviously the checklist is only an aid to the pilot and is very useful to someone who wants to operate professionally; there is, however, a limit to what can be done to make a pilot complete his checks if he is not really interested.



Above: A typical installation of the electronic checklist on the instrument panel of a MAF-AIR Cessna.

Consideration was given during the design stages, to the many possible ways to 'pilot proof' the checklist and prevent the problem mentioned above. The present design is the final outcome and is considered to be the break-even point in terms of cost and reliability versus 'pilot proofness'.

This check-list system has the advantage over some other memory aids that, should the check sequence be temporarily interrupted, the position of the switches shows the pilot what point he had reached in his checks and he may carry on from there. If there is a major interruption, such as the necessity to shut down the engine, the switches should be re-positioned and the checks started again.

Another advantage with this system is that, should a particular set of circumstances necessitate a departure from the placarded sequence, checks can be done in any sequence and the switch position shows the pilot which checks have not been completed. The sequence used by Missionary Aviation Fellowship has been developed to suit their particular operations.

Future modifications under consideration include the fitment to retractable landing gear aircraft. It is proposed that the circuitry would be designed so that the pre-landing (checklist) green light could not illuminate until the landing gear down warning light had illuminated.

If any of our readers are interested in further details about the electronic checklist they should write to:

The Manager,
MAF-AIR Services Pty. Ltd.,
Airport,
Ballarat, VIC 3350.

The manager will be able to supply circuit and construction details, approved drawings and further information as required. The company does not intend to patent or commercially manufacture the equipment so there are no restrictions on its construction by interested parties. Requests to purchase the completed checklist, ready for installation, will be considered.

Before fitting this or similar equipment to your aircraft you are advised to contact the Airworthiness Branch of your nearest Department of Transport Regional Office to ensure compliance with all requirements ●

Flight deck management

Following an accident involving a Douglas DC-8 jetliner near the Portland International Airport, Oregon, USA, the National Transportation Safety Board linked a common element with several other air carrier accidents of recent years. They subsequently recommended better flight crew indoctrination in the principles of flight deck management.

The DC-8, carrying 181 passengers and a crew of eight crashed 10 km south-east of the airport while attempting a landing in December, 1978.

The Board concluded that the probable cause of the accident was 'the failure of the captain to properly monitor the aircraft's fuel state and to properly respond to the low fuel state and the crew members advisories regarding the fuel state. This resulted in fuel exhaustion to all engines. His inattention resulted from preoccupation with a landing gear malfunction and preparations for a possible landing emergency.

'Contributing to the accident was the failure of the other two flight crew members either to fully comprehend the criticality of the fuel state or to successfully communicate their concern to the captain.'

The sequence of events that led to the crash began when the landing gear was lowered for the landing approach, triggering unusual sounds and jolting the aircraft. In the cockpit, a green light indicated the nose wheel was down but there was no green light indication on the main landing gear. Despite the lack of a green light, other visual indicators on the wing surfaces signalled the main gear was down and locked.

Although procedures for checking an irregular gear problem are brief, the crew waited 28 minutes before it contacted maintenance staff by radio to ask for guidance. The crew was then told that it appeared that they had done everything to assure the integrity of the landing gear.

The Board said it felt that at that time — 30 minutes before the crash — the captain could have made a landing attempt. However, the flight continued its holding pattern and the flight attendants continued briefing the passengers on a possible abnormal landing. In total, the aircraft remained in a holding pattern for more than one hour from the time it reported a landing gear problem.

'During this period, the captain failed to relate time, distance from the airport and the aircraft's fuel state as his attention was directed completely toward the diagnosis of the gear problem and preparation of the passengers for an emergency landing. The gear problem had a disorganizing effect on the captain's performance,' the Board said. 'As for the first officer and the flight engineer, neither conveyed any concern about fuel exhaustion to the captain until the accident was inevitable.'

However, after it became apparent to the crew that engine flame-out was imminent, the cockpit conversation indicated that the captain may have been confused as to the amount of fuel which actually remained. About six minutes before all the engines stopped, the captain stated that there was 1000 pounds of fuel in the no. 1 tank, and the second officer agreed with him.

Additional remarks were made at this time by the captain describing the fuel gauge indication as changing from 1000 pounds to zero pounds. Since this gauge does not change its indication from 1000 pounds to zero directly, but decreases in increments of 100 pounds, the captain must have read the gauge incorrectly. Actually, the indication that he described is that of a gauge change from 100 pounds to zero pounds.

In addition, the Safety Board learned that the operator had recently changed the fuel quantity gauges on this aircraft from a direct reading digital-type to a three-figure indicator that must be multiplied by a factor of 100 to get the actual fuel tank values. The new total fuel gauge, with an identical display of the same three-figure presentation as the individual tank gauges, must be multiplied by a factor of 1000 to get the actual total fuel value.

The Safety Board believes that the design can cause confusion and as a part of its recommendations resulting from the accident urged the Federal Aviation Administration to ensure that the difference in fuel-quantity measuring instruments is stressed during flight crew training and that the crews using the new system are made aware of the possibility of misinterpreting the gauge readings.

This accident is similar in some respects to several other previous air carrier accidents investigated by the Safety Board. Although the circumstances surrounding these accidents were different, they have one element in common. In each case the crew concept failed as the entire flight crew either fixated to a degree on the problem at hand and thereby failed to monitor the flight's progress properly, or the first officer's or second officer's inputs on the flight deck were not adequately communicated to or received by the captain.

The Safety Board has learned informally that several air carrier operators have recognized a need for greater emphasis on flight crew management in their flight operations and have undertaken the development of some form of command training program. Generally, these efforts apparently include principles of leadership, management skills, human relations and problem-solving in the operational environment.

Additionally, the National Aeronautics and Space Administration, in the course of its ongoing research program on human factors and aviation safety, has recognized the importance of flight deck resource management in air carrier flight operations, and is currently working closely with industry representatives to encourage the development of training programs which address this subject.

The complexity of current air carrier flight operations imposes considerable demands upon flight crew members, particularly under high workload conditions. Moreover, accident investigation experience, as mentioned above, indicates that captains have failed, sometimes at critical points in a flight, to take advantage of important resources that are available to them. These resources have included not only available equipment and supporting services, but also the assistance of a co-ordinated crew; first and second officers have not, in some cases, adequately monitored flight progress, positively communicated their observations or actively assisted the captain in his management of the flight. Therefore, the Safety Board believes that present efforts to foster improved flight deck management should be expanded to include all air carrier operators. Accordingly, the National Transportation Safety Board recommended that the Federal Aviation Administration urge operators to ensure that their flight crews are indoctrinated in principles of flight deck resource management, with particular emphasis on the merits of participative management for captains and assertiveness training for other cockpit crew members.

The bitter experience of this accident has lessons for reflection by all crew members. The points made by the NTSB deserve special consideration for the reason that they highlight problems that have been observed in other accidents ●

Propeller feathering on light twin-engine aircraft

The following article was produced as *Aeronautical Information Circular 9/1979* by the Civil Aviation Authority, United Kingdom. It concerns the possibility of feathering difficulties with propellers fitted to light twin-engined aircraft. The message it contains is applicable anywhere in the aviation world.

Most feathering propellers (hydraulically actuated, constant speed, such as some Hartzell and McCauley types) fitted to twin piston-engine light aircraft are designed in such a way that it is not possible to feather the blades below a certain low rpm (typically 700–1000 rpm).

This is because at these low rpm centrifugal latches operate to hold the blades in fine pitch to ensure that when the engine is shut down on the ground, the subsequent restart is not made with the propellers feathered.

In cases where the normal windmilling rpm at low airspeed may fall low enough to prevent feathering, the Flight Manual, Owner's Handbook, or Pilot's Operating Handbook warns the pilot that feathering cannot be accomplished below a certain rpm. However the full implications of the situation may not always be clear, and other factors of which a pilot should be aware are:

(a) In the event of an engine failure caused by a major mechanical fault (e.g. seizing bearings due to loss of oil), the rate of deceleration of the engine can be rapid and it is thus imperative that the pilot take immediate action to feather the propeller, before the rpm falls to the 1000 rpm region.

(b) On most twins the usual procedure when shutting down an engine which has failed is initially to close the throttle of the inoperative engine. This serves to confirm which engine has failed before commencing the feathering actions. However, if the windmilling rpm has reduced towards the critical region where feathering may not be successful, then re-opening the throttle will usually increase the rpm slightly and improve the probability of being able to feather.

(c) In the event of an engine failure, it is important not to let the airspeed reduce below the scheduled engine-out climb speed. This will help to ensure that the propeller continues to windmill at sufficiently high rpm for feathering to be successful. If optimum performance is required it is vital to achieve and maintain this best engine-out climb speed.

(d) The loss of performance associated with a stopped propeller in fine pitch or more importantly with a windmilling propeller is potentially serious. The additional drag will considerably reduce the single-engine climb performance from that available with a fully feathered propeller. The directional control-liability will also be reduced, though adequate control should still be available down to the minimum control speed (Vmca), as Vmca is determined with the propeller in the condition existing prior to feathering action by the pilot (i.e. normally with a windmilling propeller). It will probably not be possible to trim the aircraft on the rudder trim at the best rate-of-climb speed and a considerable foot force may have to be held to maintain heading. However, it cannot be over-emphasised that, if it is necessary to gain or conserve altitude, the best available performance is essential and for this the best engine-out rate of climb must be maintained ●

Low level turbulence

Turbulence can be classed as second only to wire strikes in the order of hazards facing the agricultural pilot. Although directed towards this specialised kind of flying the following article is of value to all general aviation pilots in respect of take-offs and landings.

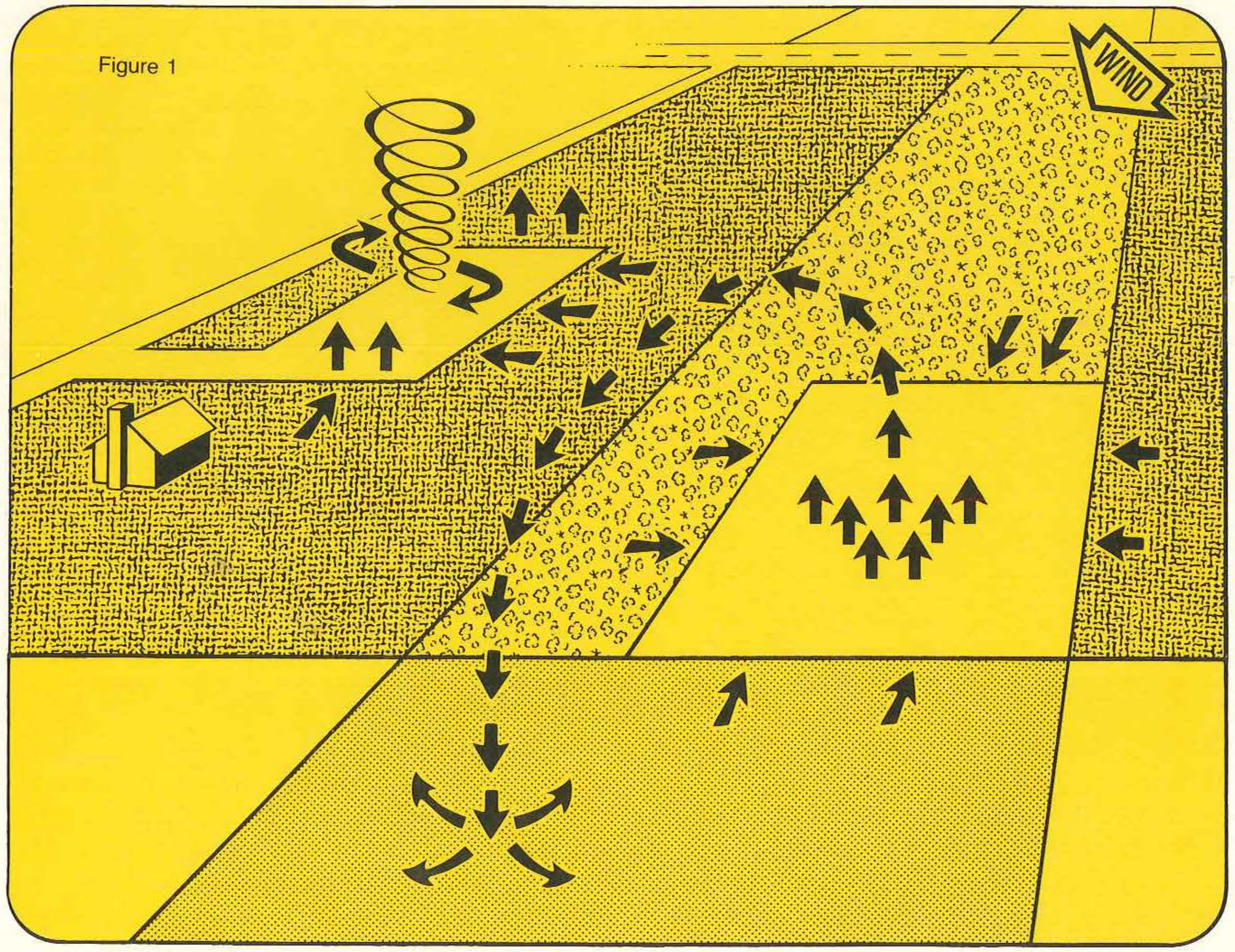
When looked at practically and analytically the problem of low level turbulence is not insurmountable. The two main causes of turbulence at low level (up to 1000 feet AGL) are:
— Thermal movement of air
— Mechanical disturbance of an airflow

Thermal movement of air
Rising parcels of air (thermals) are caused by air being warmed to different temperatures over different surfaces. For example, on a sunny day, a newly worked-up paddock in sandy country, surrounded by fully stooled crops which cover the ground with a thick green canopy, will have a much higher surface temperature. The bare ground will supply much more heat to the air than will the surrounding crops. This hotter air will rise by convection and an aircraft flying over the crops, then the bare paddock, will be carried upwards by the rising air when it comes to it (Figure 1). The upward motion will cease as the aircraft flies out of the rising air.

Of course some air has to replace the rising air over the bare paddock. Cooling parcels of air descend in other places and move in to replace the rising air. Both are happening at the same time and this raises and lowers aircraft flying through the various parcels of rising and descending air (Figure 1). Aircraft operating in close proximity to the ground are most obviously affected.

Moving air always has a small rotation and this becomes concentrated as the air moves towards the centre of the low density area. If the heating is quick and the contrast in temperatures is high this will result in a more violent rising of the heated air; the inflowing cooler surface air will move in rapidly with a twisting movement and give birth to a vertical vortex — the 'willy-willy' (Figure 1). Aircraft operating at low level and passing through this air will indubitably be affected, perhaps with critical results.

Figure 1



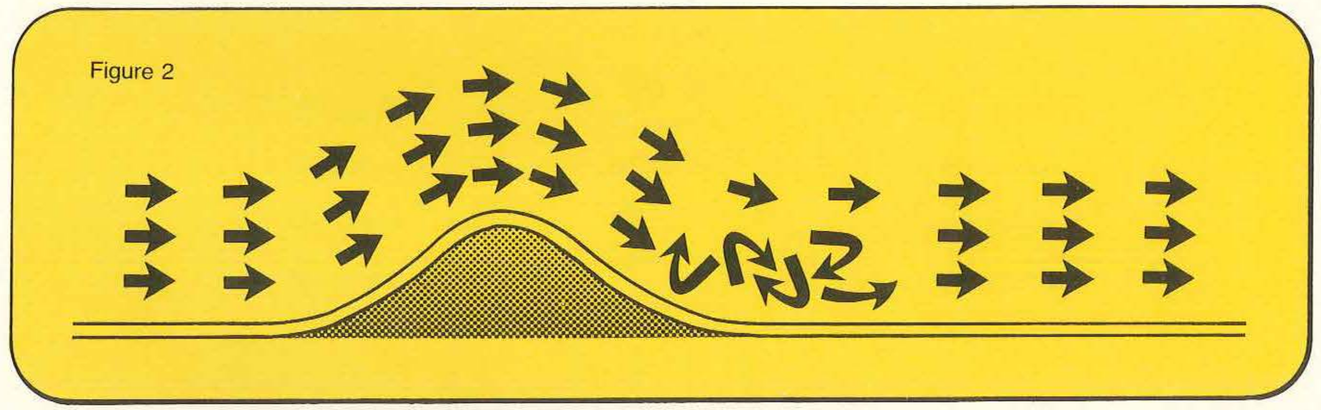
Mechanical disturbance of an airflow
Air flowing across terrain of varying height during the day will tend to follow the line of the terrain. This brings about a number of effects. Firstly, the air on the upwind side of an undulation will rise and on the downwind side of an undulation will descend (Figure 2). An aircraft operating on the windward side will also rise (updraft) and on the leeward side will descend (downdraft).

Secondly, the air flowing close to the crest of the undulation will have a higher relative speed and the local effect upon an aircraft flying from windward to leeward will be a reduction in airspeed due to its inertia and this results in a loss of lift. The reverse is the case when flying from leeward to windward.

Thirdly, the airflow on the windward side will tend to be streamlined, whereas on the leeward side the air will tend to break away, resulting in eddies and swirls instead of the streamlined flow.

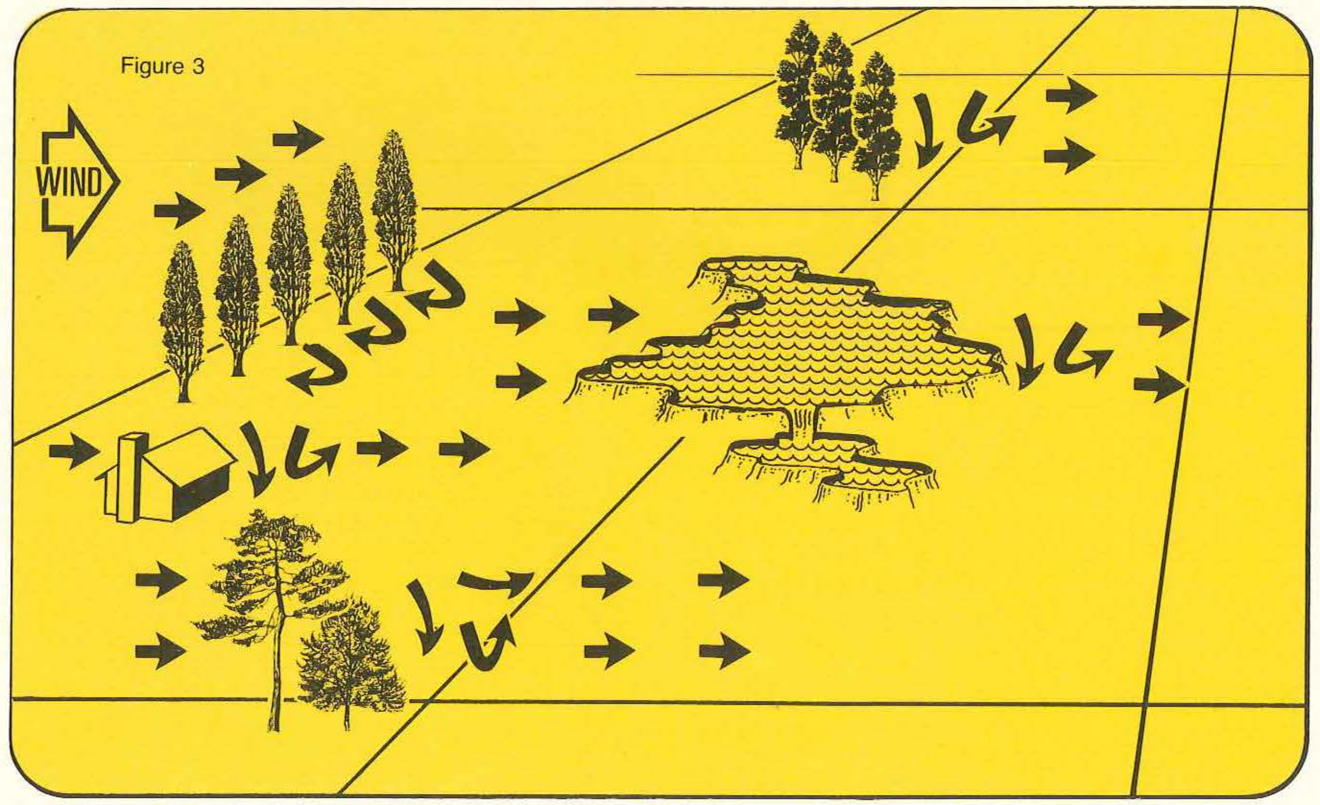
To illustrate the effect of these three factors, imagine an aircraft flying downwind across a ridge in undulating terrain. As the aircraft approaches the windward side of the ridge the air rises and so does the aircraft; the air accelerates towards the crest resulting in loss of airspeed and lift; as the aircraft passes the crest it is subject to downdrafts, and eddies and swirls in the air. An aircraft approaching from the other direction will find the eddies and swirls first, together with the downward movement of the air; as it passes towards the crest, there is an increase in airspeed and lift followed by updraft lift on the windward side — classic mechanical turbulence.

Figure 2



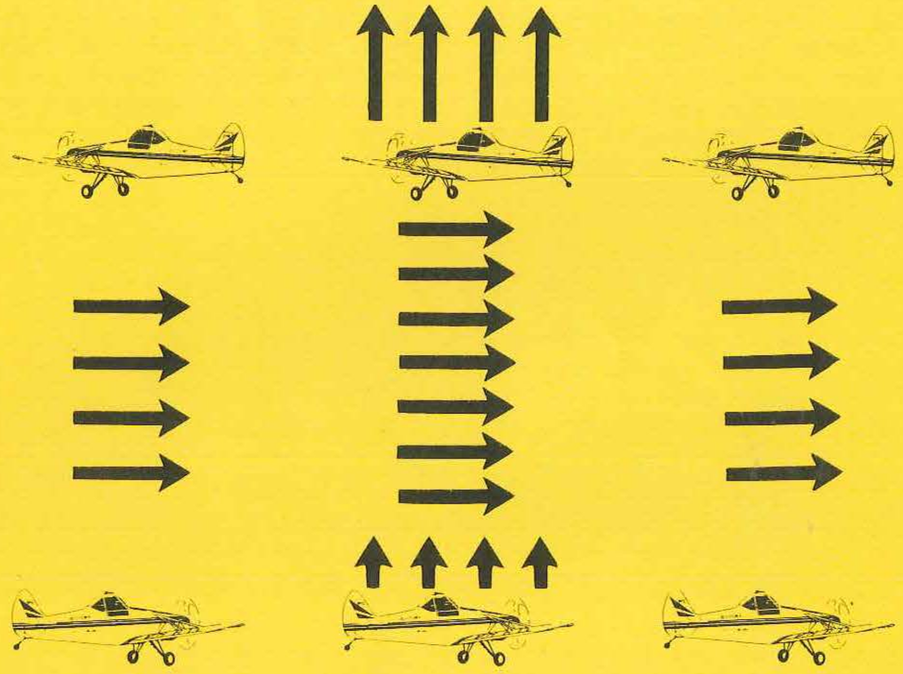
Air flowing over obstructions (trees, houses, bridges, etc.) will have very little streamline flow and will quickly break into a turbulent flow close to the obstruction (Figure 3). On the upwind side there is virtually no effect, but downwind, the stronger the airflow, the more pronounced the turbulent flow. Where the obstruction is continuous and relatively uniform, i.e. a forest or a belt of scrub, the turbulent flow will be continuous and strongest close to the trees. The same factors apply in a lesser way with airflow across the surface of a crop. Turbulent flow will result and its effect will vary with the nature of the crop. For example, vines and cotton will generate more turbulent flow than a cereal crop like wheat.

Figure 3



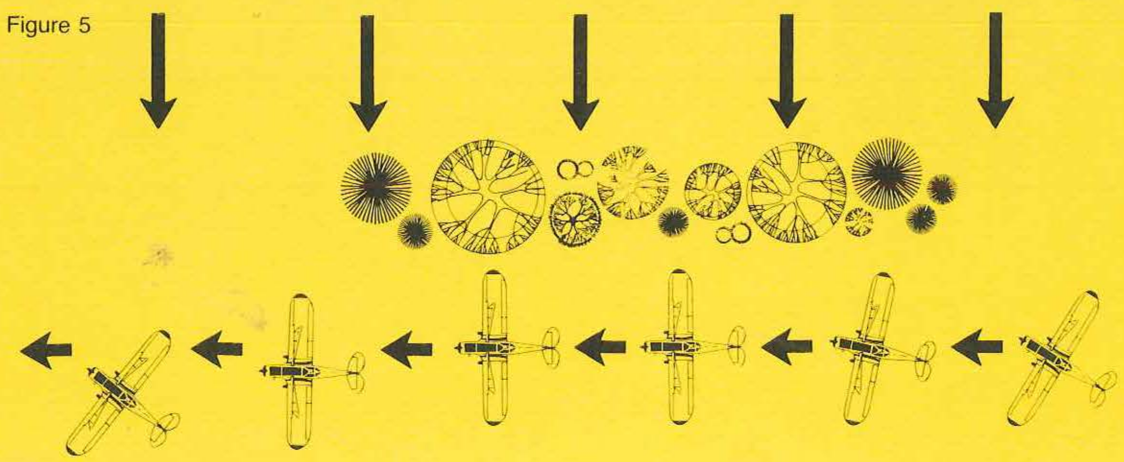
One of the products of the eddies and swirls resulting from the above is the interruption and resumption of the normal flow. We know these variations as gusts and they are more pronounced as the airflow increases. An aircraft passing through a horizontal gust from the rear suffers a loss of airspeed and lift due to its inertia, followed by a return to its previous airspeed and lift as it flies out of the gust. Approaching from the front of the gust results in an increase in airspeed and lift whilst entering, and return to previous conditions when through (Figure 4). The result is a bumpy ride. A side gust simply drifts the aircraft violently downwind with the drift ceasing just as violently when out of the gust.

Figure 4



One example that is similar to gusts, but belongs in the area covered by Figure 3, is when an aircraft flies crosswind in uninterrupted air flow and passes on the leeward side of a line of scrub or trees. The aircraft already has its drift laid off so that when the crosswind suddenly ceases, the aircraft moves towards the line of scrub and if it is on a spray run close to the trees, this can be quite awkward. The pilot corrects and flies with no drift laid off whereupon the aircraft emerges from behind the scrub and is subject to immediate drift which moves it downwind until the drift is laid off again (Figure 5).

Figure 5



Methods to counteract and avoid the problem
Use a combination of common sense and anticipation. A strong wind blowing over a patch of trees is obviously going to generate turbulence. Anticipate it and be ready for it.

An area of cotton or vines with a sealed road and parking area adjacent is going to create sharp differences in temperature close to the ground. One can anticipate, at the least, rising and descending air, or at the most, strong 'willy-willys', so be ready.

To help you anticipate and be ready, use common sense in looking for signs of turbulence, both thermal and mechanical.

- Look ahead of the crop you are treating. Gusts quite often show up well, particularly over cereal crops. So do 'willy-willys' which may move crosswind, across your path.
- Look ahead in your procedure turn. Gusts will show up on the ground particularly in the crop. The relative movement of trees will show acceleration and deceleration of air movement. Study the path your turn will take.
- Watch for dust rising; it is always a good sign of a relative change in air movement, both thermal and mechanical.
- Anticipate changes in airspeed and drift caused by gusts and the blanking of wind movement. This will result in the aircraft being less prone to rise and fall in gusts. It will also enable you to track straight when passing in and out of a blanked area on the downwind side of an obstruction.
- Watch for visible meteorological signs — movement of low cloud showing wind speed and turbulence, breakup of fog or mist suggesting an imminent change in surface temperature, condensation or dissipation of cloud on upslopes or downslopes of hills which show topographical uplift or downflow.

You cannot prevent or stop low level turbulence, but through common sense and anticipation you can make it a lot easier to live with — and *live* is the operative word ●

Unpredictable birds

A large flock of seagulls had been seen in the vicinity of Runway 14 at Mackay shortly before 0700. The fire service vehicles on runway inspection had attempted to disperse the birds, but the flock was persistent and continued to circle and land as the fire vehicles passed.

A DC9 was due for departure at 0710 and, by the time the aircraft had lined up on Runway 14, the birds had settled on the runway from the intersection south for about 200 metres. The pilot was advised of the hazard but he replied that the birds would probably move and continued the take-off.

Rotation was at the intersection and the aircraft was just airborne when the birds rose from the runway. The aircraft passed through the flock, killing more than fifty seagulls. The only damage sustained by the aircraft was loss of a static discharge spike.

The passengers and crew of this aircraft were extremely lucky that no critical engine components were damaged by birdstrike. The result could have been catastrophic if, for example, the gulls had been ingested into the aircraft engines. Consider a parallel occurrence to a Falcon 20 out of Florida USA:

'Before the accident, airport employees had dispersed a flock of gulls from the runway. Most of the gulls departed but about 30 returned. The radio normally carried by the bird scaring team was unserviceable. By this time (0855 hours local time) the aircraft had started its take-off run. Shortly after becoming airborne it passed through the flock. Both engines failed and the aircraft crashed. The fuselage was severely damaged, a wing separated and all eleven occupants were seriously injured'.

The hazards associated with birds on or near a runway should be obvious. Who then has the responsibility to advise of bird hazards and decide whether or not take-off should be attempted? Should the tower controller prohibit take-off on the grounds that a hazard exists, or does the onus rest with the pilot in command? Reference to AIPs answers our questions: For take-off or landing ATC will advise of the presence of birds on the runway or strip when in numbers or of a size likely to be hazardous. However, the decision to proceed with a take-off when the presence of birds has been advised rests solely with the pilot in command.

An interesting sidelight of the DC9 incident is that the pilot expected the birds to disperse as the aircraft approached. This had been his experience in the past. However, in this case the flock was large and concentrated, and therefore the birds in the centre may have been restricted in their escape path, being forced to rise, rather than clear to the side of the oncoming aircraft. Apparently the only predictable thing about the behaviour of birds is their unpredictability ●

Air safety incident reporting — the Australian system

From the beginning of aviation history it was recognised that thorough investigation of aircraft accidents was essential to promote safety and public confidence in air transport. The incident reporting system is simply an extension of that concept and provides the opportunity to explore a greater range of aviation activities than those examined during accident investigations. In the Australian system, which has been operating for over 30 years, the results obtained from investigations of all reported occurrences affecting air safety are combined into a total system. Accidents can be reviewed in conjunction with incidents which occurred under similar circumstances.

The objective of air safety investigation is to promote aviation safety, **not to apportion blame or liability**. The system aims to determine all the factors that are relevant and to use them as a basis for enhancing the safety of aviation in Australia.

What is an incident?

The legal definition of an incident and the statutory reporting requirements are contained in the Air Navigation Regulations. For practical purposes an incident is any occurrence in which the safety of an aircraft or persons has been jeopardised or which the reporter believes to be hazardous. Any report related to aviation safety will be investigated to establish the facts.

Who reports incidents?

Pilots, owners, operators and Departmental officers all have obligations to report incidents. In practice, any person who becomes aware of an occurrence which jeopardises aircraft safety, or which could have done so in combination with other circumstances, is invited to utilise the incident reporting system to bring the matter to the notice of the Department.

How do you notify incidents?

The reporting of incidents is the key to the whole system. The most convenient and commonly used notification method is the well known yellow '225' form which has been around the industry, deliberately without substantial changes, for over 20 years. The convenience of this form is that it simplifies compilation of the report. If '225' forms are unavailable, reports may be made in any written form, or verbally by telephone or radio.

Written reports, including the '225' form, can be lodged at any Airways Operations unit, with officers in charge at government aerodromes, or posted direct to any Regional Office of the Department. Verbal reports may be made in flight (by radio to any ATC or FS unit) or after landing (by telephone to any officer of the Department).

Serious incidents which involve significant safety aspects can be initially reported by radio or telephone and will be passed immediately through the system to an air safety investigator. In all Regions there are investigators available 24 hours a day — seven days a week. A message passed to any Airways Operations unit will be relayed to the duty investigator. He in turn, if necessary, will telephone the originator of the report at any nominated number. Where the incident involves a complex situation, the investigator may request the originator to provide a written report or alternatively arrange a meeting to discuss and clarify the circumstances.

Investigation of incident reports

Departmental procedures provide for rapid movement of incident reports to Regional Offices where they are examined by specialist investigators who are employed totally on air safety investigation work. These officers are quite separate from, and have no responsibility for, the regulatory and surveillance functions of the Department.

Each incident report is investigated to establish the facts and circumstances involved — what happened and why it happened. The depth of investigation required depends upon the nature of the incident. It may vary from simply ensuring that the report is sufficiently detailed for coding and entry into the computer-based data system, to the other extreme of a very comprehensive investigation process necessitating discussion with the originator, obtaining reports from other persons directly involved, co-ordinating enquiries with other government authorities, analysing flight plans, transcribing air–ground voice recordings and, where available, examining flight data recordings. The investigator gathers and considers all the relevant evidence and may also need to consult experts in particular fields. His primary task is to establish all the factors involved and prepare an impartial report on the incident investigation.

The investigator's report is referred to Regional Departmental officers having responsibility for matters revealed during the investigation. In most cases, and particularly in areas which involve Departmental functions and facilities, immediate action is taken at the Regional level to rectify any facility faults or revise local procedures.

The broad details of all significant incidents are telexed or telephoned to Central Office immediately they become known. Central Office investigators correlate the known details with similar incidents that may have occurred in other Regions, or search computer or other records for relevant information. Close liaison is maintained between Central Office and Regions to ensure that the maximum benefit is derived from the total investigation system.

Concurrently with any remedial action that may be proceeding at Regional level, each incident report, with the investigator's report, is forwarded to Central Office. The reports are reviewed by other investigators as part of a quality control system and, where applicable, referred to functional Divisions within Central Office with recommendations or suggestions as to areas warranting attention. The action taken at Regional level may then be introduced nationally, or perhaps modified in the light of similar occurrences in other Regions.

Storage of information

On completion of the review and any action arising, the incident report is coded and entered in the computer-based data storage system.

The Australian data storage system is closely compatible with that used by the National Transportation Safety Board, U.S.A. This compatibility has enabled the annual exchange of computer tapes of aircraft accident data, giving immediate access to information about thousands of accidents involving almost all types of aircraft. A similar exchange arrangement has also been established with the Federal Republic of Germany. Additionally, New Zealand and Papua New Guinea forward their accident investigation records to Australia for inclusion in our computer system and share in retrieval from the total records available. In 1976, ICAO introduced an accident/incident reporting system which is also similar to the Australian and USA systems.

Use of stored information

The most valuable contributions to safety already achieved by the system are the opportunities provided for monitoring the performance of Departmental services and facilities, examining the supervision standards exercised by operators, reviewing the efficiency of civil/military traffic co-ordination, gauging the standards of maintenance and servicing, and generating safety awareness in personnel with operational responsibilities. In the 30 years the system has been operating, the collective examination of facts revealed in incident investigation has led to the origination or amendment of nearly all operational standards and procedures.

Another developing source of accident prevention information is available from statistical analysis of recorded accident/incident data. Prior to the availability of computers, the retrieval and analysis of such data was very time-consuming and this imposed severe limitations on the number and scope of such studies. Computer processes have been used in Australia since 1969 to record a wide range of accident and incident data, and there now exists a substantial data base, readily accessible for analytical purposes, against which trends can be adequately measured and which provides a sound basis for accident prevention studies.

Data studies have been conducted during the past few years on a range of accident prevention subjects and, as analytical experience is gained and computer programs are further developed, more complex studies are being undertaken. The information gained through these studies often forms the basis of articles in the *Aviation Safety Digest*, *Airworthiness Advisory Circulars* and other Departmental publications aimed at improving aviation safety.

What of the future?

For many years, worldwide accident prevention efforts were concentrated on improving the aircraft, its support facilities and operational procedures. The success of these efforts is reflected in the improvements achieved in the technical reliability of modern aircraft and the sophistication of the airways operations system for handling increased movements. It has been recognised for some time that further significant progress in accident prevention may be achievable only by reducing the contribution made by human factors in the circumstances leading to accidents. Isolating the circumstances that lead to human error and eliminating these factors, or at least minimising their effect, may produce the same improved safety level as already achieved in the technical and procedural areas.

Accidents rarely escape notice and the investigation of over 250 each year reveals the human factor contribution. On the other hand, most incidents, which are rich in human factors, become known only when reported by the personnel directly concerned. Our accident statistics show a human factor involvement of over 70 per cent but corresponding incident statistics show only 15 per cent. Obviously there are many human factor incidents known only to the pilots and other personnel who experienced them.

Investigation into human factor involvement in incidents confronts a fundamental human characteristic — live human beings, our vital witnesses, are reluctant to reveal occurrences which reflect upon their ability and knowledge. Some of this reluctance arises from misunderstanding the purpose of incident reports. They are not black marks against a person's record — they never have been and never will be. Another reason sometimes given as to why incidents are not reported is that people do not have faith in the system and are concerned about possible punitive action. To dispel this concern we refer readers to the immunity provisions restated by the Secretary in *Aviation Safety Digest 100*.

The output of the incident reporting system is directly proportional to the input. If you wish to obtain the maximum benefit from the system it is necessary for you to report any occurrence which endangers the safety of an aircraft and its occupants. Air safety incident reports form a vital component of our aviation safety monitoring system and by making full use of the incident reporting procedure you will be playing an important role in the improvement of safety in the air ●

An unreported incident

The following contribution was received from an unknown pilot in NSW. Anonymous letters are not usually printed in the *Aviation Safety Digest* because their contents cannot be checked for authenticity or accuracy. However, this example is a useful illustration of the importance of the incident reporting system. If the author had not taken *anonymous* pen to paper, the safety messages inherent in his experience would have been lost to fellow aviators.

DEPARTMENT OF TRANSPORT

AIR SAFETY INCIDENT REPORT

Folio No. ....
Station ....
No. ....
Reg. Off. No. ....
Central Off. No. ....

Normally this report should be mailed to the Director of the Region in which the incident occurred. If more convenient it may be lodged with the OIC of any Air Traffic Control or Flight Service Unit.

LOCATION OR ROUTE SECTION Tindal - Darwin Date ? Local Time ?

AIRCRAFT: Type and Marking CESSNA 172 ? PILOT: Name and Initials ?

OWNER/OPERATOR ? FLIGHT CATEGORY: (underline) VFR ? IFR

TYPE OF OPERATION (underline applicable type): ?
Regular Public Transport — Charter — Agriculture — Aerial Work
Private — Aircraft Test Flight — Training Dual — Training Solo

FLIGHT: Last departure point Tindal First point of intended landing Darwin Flt. No. –

When this report is submitted by a Departmental officer, enter Fault Report No. (if applicable) –

DESCRIBE INCIDENT AND RELEVANT CIRCUMSTANCES, with comment and suggestions:

'I was on a safari trip around Australia in a Cessna 172 when I stopped at Tindal for a couple of days. I filled the tanks of my plane and, after unloading, I tied it down in the parking area and departed for a very enjoyable visit to the famous Katherine Gorge.

'Two days later, I submitted a flight plan for a trip to the Alligator River area so that we could see this interesting country from the air and then, without landing, continue on to Darwin.

'Having loaded the plane, I did a quick pre-flight daily inspection and to speed things along I had one of my passengers check the fuel tanks which I knew were full because I had filled them myself. He informed me that one tank was full to the top and the other one was "down a little bit".

'During the pre-take-off check I found that one tank gauge showed less than half full, but as I had filled both tanks myself and from what my passenger had told me after his visual check, I was inclined to suspect the accuracy of the gauge. In addition, another aircraft was waiting to take off behind me so I dismissed the matter and took off.

'We flew over the Katherine Gorge then continued towards the Alligator River area. Near Cooinda I noticed that both fuel gauges were showing less than I expected so I immediately headed for Darwin and, as I approached the airport, I could see that the fuel contents were dangerously low.

'After landing, I checked the tanks to find that I had far less than my required 45 minutes of reserve fuel.

'I am now of the opinion that my trouble started when I parked the plane on uneven, sloping ground with one wing low and the fuel cock left in the "both" tanks position. Fuel drained from one tank to the other and out the overflow during the two day period that I was at Katherine Gorge. The lost fuel had no doubt soaked into the dry earth or had evaporated and was not noticed when I returned to the plane. My next mistake was to have a passenger make the visual check of the tanks. Had I done so myself I would have realised that more than half the contents of one tank had drained away. A few inches of air space to my passenger simply meant that the fuel was "down a little bit" in the tank.

'My next mistake was in suspecting the accuracy of my fuel gauge when making my pre-take-off check and, in addition, I should not have been "hurried" by the knowledge that someone else was waiting behind me to take off.

'The flight ended without mishap, but had I continued to fly over the Alligator River area as planned, it might have been a different story in the *Digest*' ●

Selected incidents

While on a private VFR flight to an aerodrome inside a control zone, a Piper Aztec was reported to be in controlled airspace without an airways clearance. When its position could not be positively established, an Uncertainty SAR phase was declared. The pilot had advised Flight Service that the aircraft was at 10 000 feet above eight oktas of cloud and estimated overhead the destination aerodrome five minutes later. However, the position and estimated time of arrival given by the pilot were inaccurate and, because there were very few breaks in the cloud, it was almost an hour before the aircraft was established below cloud in a known position. Eight other aircraft had their operations delayed or restricted for periods of up to 50 minutes.

The pilot, who held a private licence and a Class 4 instrument rating, had a total flying experience of about 700 hours. Arriving at an uncontrolled aerodrome the previous evening, he found there was no overnight accommodation available in the nearby town so he and his passenger were forced to spend the night in the aircraft. Next morning they did not have any breakfast and there was only water to drink.

Intending to leave early, the pilot telephoned Flight Service at 0618 hours and lodged a flight plan. He indicated he would be flying below 5000 feet and that he planned to enter controlled airspace at the control zone boundary. The briefing officer advised the pilot of the wind direction and speed at 3000 and 5000 feet and was about to give him the wind at 7000 feet when the pilot interrupted and said he had sufficient information. The briefing officer then gave the pilot the terminal forecast for the destination aerodrome, which predicted visibility greater than 10 kilometres, rain, two oktas of stratus cloud at 1500 feet and five oktas of strato-cumulus cloud at 3500 feet. The section of the area forecast which the pilot said he did not require predicted that en route there would be scattered and broken cloud in layers from 1000 to 14 000 feet with some rain showers.

At 0652 hours, the pilot gave a departure report. Six minutes later he called again and advised he was climbing to 10 000 feet. The cloud beneath the aircraft increased until, at 0745 hours, the pilot reported that the aircraft was above eight oktas and enquired if there was still clear sky over the destination aerodrome. The pilot was given the most recent meteorological report for his destination, which included one okta of cloud at 700 feet and five oktas at 1100 feet and this was upgraded a few minutes later to six oktas at 2500 feet with lower patches. Shortly afterwards, in response to another query by the pilot, Flight Service advised that south of the destination aerodrome there were seven oktas of cloud from 7000 to 10 000 feet and that an aircraft 75 km south had reported eight oktas cloud cover.

The pilot reported that the cloud behind him had risen to such a height that he could not now return to the aerodrome from which he had departed. Adding that he had adequate fuel reserves, he then asked if there were any gaps in the cloud through which he could descend. He said the aircraft would be over the tower in about five minutes and that he thought he had received a clearance to overfly the airport. Knowing this was not the case, the Flight Service officer notified ATC of the aircraft's reported position and at 0809 hours the aircraft was transferred to the tower frequency.

The aircraft was about 75 km further away from the aerodrome than the pilot had reported and, although attempts were made to establish its position using ADF bearings and aircraft headings, lack of DME equipment made it difficult to locate the aircraft accurately. Because of this, ATC was forced to restrict the operations of other aircraft in the area.

The first time the pilot made an attempt to descend through a hole in the cloud he was unsuccessful and it was not until 0845 hours that the aircraft was able to descend below cloud and remain in VMC. At 0906 hours the position of the Aztec was positively established 35 km from the aerodrome and the aircraft eventually landed 12 minutes later.

Although there was no urgent reason for the pilot to get to his destination, it is understandable that after spending the night in the aircraft, and with breakfast probably unobtainable for some two hours, he should want to reach the destination aerodrome, only one hour and 45 minutes flying time away, as soon as possible.

Lack of proper rest and breakfast, the time of day and the desire to get going early seem to have affected the pilot's attitude to the flight briefing. At no time during the previous day and night, or before this take-off, had the pilot or his passenger seen any significant cloud. The pilot showed scant interest in the weather briefing and it would appear that, because there had been little or no cloud the previous day or night, he did not expect to encounter such heavy cloud this day. If he had received the full area forecast he might have considered delaying the flight or providing for a diversion; however, in consideration of his subsequent actions, there must be some doubt about this.

The aircraft encountered low cloud only six minutes after departure. It seems the pilot accepted this without question and made no effort to obtain any more meteorological information until he was almost half-way to his destination. He displayed a poor knowledge of weather situations and apparently lacked the ability to properly interpret the information passed to him en route by Flight Service. He delayed making any operational decisions until it was too late to return to the aerodrome of departure and pinned his hopes on the chance that, near his destination, there would be breaks in the cloud through which the aircraft could descend. But such hopes were ill-founded and the subsequent chain of events was virtually a foregone conclusion. Fortunately, the aircraft was finally able to descend through the cloud before a catastrophic conclusion was reached.

Over an hour elapsed from the time the pilot advised he would be overhead the destination aerodrome in five minutes, to the time the aircraft finally landed. It was inevitable that such a long delay at a controlled aerodrome would disrupt other traffic and, as it happened, the departure of an airline jet was delayed 50 minutes, five charter aircraft were delayed on the ground, another light aircraft was held outside the control zone and the operation of another was restricted in respect of levels.

The extent to which a night of discomfort, inadequate rest, and lack of food may have affected the pilot's preparation for the flight and his subsequent performance must remain a matter of conjecture; the fact remains that he did not exercise a reasonable level of judgement and airmanship, resulting in not only inconvenience to other airspace users but in the exposure of both himself and his passenger to a potentially disastrous situation ●

By their very nature, aircraft incident files can give a negative slant to aircraft operations. Invariably they deal with what went *wrong* — technical faults, human errors, system deficiencies, etcetera. This incident is no exception, but the way the pilot applied his knowledge and common sense to handle an equipment failure shows a positive aspect that is most gratifying.

The pilot was on a private flight in a Piper Cherokee inbound to Darwin from the north east. Initially he was working Darwin on HF but when requested to call on VHF, he could not establish contact. Some swift troubleshooting revealed that the fuse for the VHF radio had blown. The pilot replaced the fuse and attempted radio contact, but once again the attempts were unsuccessful. Shortly afterwards he noticed acrid fumes in the cockpit. The VHF radio was switched off and the fumes disappeared. However, VHF was not the only communication problem. To complicate matters the pilot found the HF reception was very poor and contact with Darwin had been lost.

As clearance into the Darwin CTR had not been obtained, the pilot elected to remain OCTA and divert to an ALA near Darwin. He broadcast these intentions 'in the blind' and advised that he was listening out on the Darwin NDB. Through the ATIS facility, ATC was able to pass an airways clearance to the aircraft to track to Darwin. The pilot followed the instructions and arrived in the circuit area some two minutes earlier than he had previously advised. He kept a lookout for a 'steady green' from tower and asked his passengers to do the same, however, when no green light was observed and after assessing that no conflict existed the pilot carried out an orbit. This time, the clearance to land was sighted.

During the incident the private licensed pilot acted in a very professional manner. Firstly, he reacted correctly when a fault occurred within the aircraft radio installation. Secondly, although HF contact was lost, he nevertheless transmitted his intention. Thirdly, he was aware that ATIS could be used to broadcast ATC instructions.

Communications failure procedures are laid down in the AIP En Route Supplement, Emergency Procedures Section. By reference to the correct procedure, this pilot was able to safely complete his flight even though communication had been seriously hampered ●

A letter received from an irate citizen provides a novel twist to an old problem. The letter reads:

'Dear Sir,

The package I have forwarded to you contains a fuel tank cap. I was standing in my back garden last Saturday morning and at approximately 1115 local time an aircraft passed overhead and this cap landed a short distance from me.

I am sure you will agree with me that I was very lucky not to be injured, maybe fatally, or have part of my house damaged. I did not take any notice of the aircraft as it passed over, so I cannot give you a description of it. Aircraft pass over this area frequently.

I request that you look into this matter and ensure that it is brought to the notice of the people responsible and that a tighter control is maintained on some of these aircraft.'

Investigation of the incident revealed that the aircraft, a Cessna 185, had been refuelled at the nearby aerodrome. The pilot admitted that he had experienced difficulty in replacing one tank cap. It was a little awkward as he was on a ladder with the fuel hose in one hand and he could not use both hands on the cap. He left the cap loose, intending to replace it after he had finished refuelling the other tank. Inevitably he forgot to do so.

The tank cap managed to stay in place during take-off and for the short time till the aircraft passed over the house, about two kilometres from the aerodrome. The pilot completed the planned 15 minute flight and, after landing, established that about 70 litres of fuel had been lost from the open tank.

Apart from the loss of that precious and scarce liquid, Avgas, the pilot also faced possible litigation and payment of damages if the tank cap had injured a person or caused damage to property.

Need we say more?

Pilot contribution

With the recent introduction of the new flight planning requirements above 5000 feet and over 120 nautical miles, I would like to comment on flight planning outside controlled airspace.

Firstly, we know the obvious reasons for submitting flight plans to the Airways Operations organisation: SAR requirements, traffic separation, Operational Control and so on. However, apart from that, I believe a properly prepared plan is an obvious advantage to the pilot.

As we all know there is no requirement to lodge a flight plan for a private VFR flight B050 OCTA, with the destination less than 120 nautical miles. But before jumping into our aeroplane, let us answer a few questions:

- Have I studied the map thoroughly?
- Is there any chance of diversion from my track?
- What if the weather forecast turns out to be wrong and for the worse?
- There's 180 minutes of fuel in the tanks. Is that *really* enough?
- Briefing told me of an active LJR crossing my track. What's my plan of action if I have to descend to 500 feet AGL for any reason? And the list can go on.

There is one way to ensure all these questions are answered. Complete a flight plan, even if you do not lodge it.

Why bother? Well at one glance during the flight your tracks, headings and distances are readily available. And updating and revising the plan in the air can only be an ace up your sleeve if things get a little tight.

I am a rather new commercial pilot with about 630 hours and like the rest of you have been taught to be prepared for the unexpected ever since my log book read 'zilch'. I am not saying that flight planning is the be-all and end-all of being prepared — the pilot-in-command is responsible for that. I am just suggesting that a flight plan can make pleasure out of worry. Here is an example:

Last year I conducted a private VFR flight from Bendigo to Bacchus Marsh, a distance of just over 60 nautical miles. I knew the country quite well. I rang Flight Service for the weather and was given 'broken strato-cu, base 4500 with winds averaging light and variable'. Following the briefing I checked the maps and fuel were on board, then departed.

Shortly after reaching my cruise altitude of 3000 feet I saw isolated rain showers and the cloud base at about 2500 feet in front of me. It was still VFR below this cloud as I descended. After about 10 minutes, further descent was required to 500 feet AGL (I had not done that for a long time) to remain VFR and I had to divert to avoid a rain shower.

'Is that the town I flew over once before at 3000 feet? Sure looks different down here! What was my planned track? I wrote it on a scrap of paper here somewhere. Oh yes, 150 degrees. I diverted left about 60 degrees, so my DG's 099 degrees. For how long? Three minutes I think. Okay, I'll turn on to 219 degrees for three minutes . . . good, I should be on track. Or am I? I thought that road should be in sight now. There's another town. Looks like . . . nope, it isn't. I know that hill next to it. So I'm 10 miles port of track! Feels like a south easterly wind at about 30 knots. Sure isn't easy navigating at 500 feet!

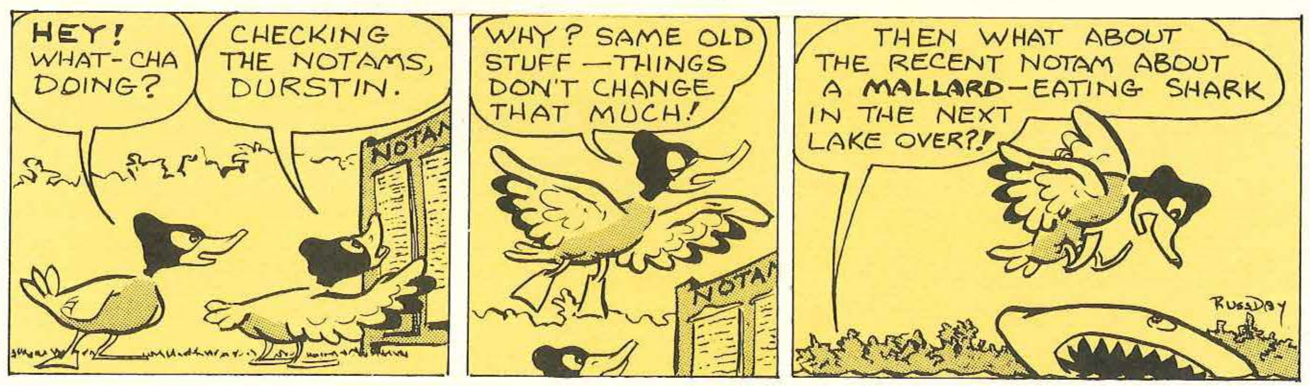
'What's my heading? 159 degrees. No, it shouldn't be. Make allowance for drift. Wait a minute. I know my position, so I'll make a one-in-60 correction. How can I? I haven't held a constant heading! What is my heading? 159 degrees. No, it isn't. Heck, another shower!'

I eventually 'track-crawled' home and the weather improved along the way. But on arrival at Bacchus I felt quite dissatisfied with regard to my navigational conduct, needless to say, even though I was in familiar territory. The advantage of having a flight plan with headings, tracks etc., plus a continual update of the same is exceedingly obvious.

I know that completing a flight plan can sometimes be a nuisance. But for about half an hour of paperwork, it could be the most priceless piece of paper in the cockpit when things do not turn out as expected.

Remember that most of us fly because we enjoy it. Let us keep it enjoyable, irrespective of whether we are private or commercial pilots ●

DURSTIN by Russ Day (courtesy of *Flight Crew* magazine Fall 1979)



Corrosion prevention for piston engines

Engines in aircraft that are flown only occasionally may not achieve normal service life because of internal corrosion. This article gives guidelines on suitable procedures to prevent internal corrosion of inactive engines. As there are slight differences in the inhibiting methods recommended by different engine manufacturers, the method specified in the relevant engine maintenance manual should be followed.

A visit to any secondary aerodrome around Australia's capital cities will reveal large numbers of idle aircraft in the parking areas. The grass is often cut up to the aircraft but not under the wings or fuselage; its length being indicative of the time the aircraft has occupied that space.

There are many aircraft awaiting sale in the hands of brokerage companies that have no operational or engineering organisation supporting their sales departments. In addition, there are many owners and operators not using their aircraft as frequently as in the past because of increasing operating costs and shortage of fuel. Under these circumstances an aircraft with a maintenance release valid for 12 months or 100 hours may only fly for a few hours during that period.

The Airworthiness Branch of the Department of Transport has noticed that a number of defects are beginning to appear which are directly attributable to a lack of engine operation. These defects show up as 'blow by' and loss of compression, resulting in the need to replace cylinders because of internal corrosion. Even though the aircraft has been properly maintained and certified in the past, the problems arise because the engine has remained idle for excessive periods without the correct precautions.

Unlike the military situation, there are no mandatory civilian requirements to inhibit or run engines which are likely to be out of service for a month or more. Consequently, a prospective buyer, or an owner whose aircraft has been flown infrequently, could be faced with a loss of engine power and costly repair bills because of internal corrosion of the engine.

The type of protection necessary for the prevention of internal corrosion depends on the length of time the engine is expected to be out of service, on climatic conditions, whether the engine is installed in an aircraft and whether or not the aircraft is stored in a hangar.

On flyable aircraft and under favourable atmospheric conditions, an engine which is operated only at irregular intervals can be adequately protected from corrosion for a period of up to one month by periodically using the propeller to turn the engine through five or six revolutions. This will disperse beads of moisture that may have accumulated and will spread the lubricating oil around the cylinder walls. Unless the aircraft is flown, repeat this procedure every five days or so. After one month, the aircraft should be flown, or at least ground run for 30 minutes, maintaining the oil temperature within the normal operating limits. This procedure will evaporate any moisture which may be present in the lubricating oil. The run should be carried out at low engine speed (1200-1500 RPM) while exercising the propeller controls to ensure complete oil circulation. Avoid excessive ground running and observe the maximum cylinder head temperature limits.

Ground running the engine for *brief* periods of time is not a substitute for turning the engine over by hand. In fact the practice of brief running will tend to aggravate rather than minimise corrosion formation. This is because a brief ground run does not evaporate the moisture from the oil and encourages further condensation to take place.

If it is known that an aircraft is to remain inactive for 30 days or more, more comprehensive procedures should be carried out, especially if the aircraft is located near salt water or in a humid area. Inhibiting techniques of this nature need to be performed by an approved maintenance organisation in accordance with carefully controlled procedures, and broadly involve the following steps:

- Draining the normal engine oil and replacing with a specially formulated preservative oil mixture
- Operating the engine for a short time
- Draining the preservative oil mixture
- Spraying the interior of each cylinder with preservative
- Installing dessicant bags and sealing all openings
- Installing cylinder dehydrator plugs in place of the normal spark plugs if the aircraft is to be stored in a humid region or near the coast.
- Tagging the propeller 'Engine inhibited — do not turn propeller' and attaching red cloth streamers to each dessicant bag to ensure they are not overlooked when the engine is eventually made ready for flight.

Preparation of the aircraft for its return to service will involve the following steps:

- Removal of dessicant bags, seals, dehydrator plugs, etc.
- Replacement of spark plugs and any accessories which may have been removed during storage
- Draining of any accumulated preservative oil and refilling of the engine with normal oil
- A thorough cleaning of the aircraft, followed by a pre-flight, then a normal start-up and test flight.

If you ensure that the above procedures are complied with you could save a lot of maintenance costs and prevent an undesirable situation arising in flight due to reduced engine power resulting from corrosion ●

Unfamiliar navigation equipment

Most pilots, at some stage or other, have experienced the problems of flying unfamiliar aircraft for the first time: cockpit layouts, the operation of ancillary controls and the location and function of engine and electrical switches can all vary significantly, even between aircraft of the same basic model range.

But perhaps the area with the greatest potential for error is in the operation of increasingly sophisticated radio and navigation systems. In many cases, this equipment requires specialist operational knowledge which cannot be gained simply on a trial and error basis. There are numerous instances on record of pilots mismanaging radio and navigation equipment and yet another example of this occurred recently when a pilot decided to check the in-flight functioning of a new navigation system installed in a Piper Cheyenne. So far as is known, the aircraft was the first to be brought into Australia with this equipment fitted.

The pilot, who held a Senior Commercial licence and a Class 1 instrument rating, had considerable aeronautical experience but had received no formal training in the use of this system. Not having the benefit of any other pilot's advice in operating the system, he had studied the manufacturer's handbook in an effort to acquire the necessary knowledge.

The route the pilot had planned for his familiarisation exercise was from Bankstown to Katoomba, Bindook and back to Bankstown. He departed Bankstown on an IFR clearance, climbing to flight level 200 and tracking direct to Katoomba, his first way point.

Ten minutes after the Cheyenne departed, a Boeing 747 on a scheduled service to Singapore departed from Sydney Airport with a clearance to climb to flight level 330 and track via the 275 radial of the Sydney VOR. To provide separation from the Cheyenne, the 747 was radar vectored about five miles north of the Sydney-Katoomba track.

Shortly after the 747 reported climbing through flight level 165, the Cheyenne reached Katoomba. Although the pilot could not subsequently recall his precise actions at this point he intended that the system, which had the Bindook VOR programmed as the next way point, would be selected under auto-pilot control to bank the aircraft into a left turn over Katoomba to intercept the track to Bindook. Instead the aircraft banked to the right and by the time the pilot had disengaged the auto-pilot and resumed manual control, the aircraft had turned through about 90 degrees and was heading into the path of the approaching Boeing 747. Unaware at first of the potential confliction, the pilot continued the right turn through 270 degrees to take up the heading for Bindook and, during the latter part of the turn, he saw the 747 below him.

Obviously, there was room for improvement in the manner in which this familiarisation exercise was conducted. The possibility of something unexpected happening in such circumstances must always be kept in mind. In this case it was fortuitous that vertical separation was maintained from the 747.

The airspace in the immediate vicinity of a capital city primary airport is not the place for experimentation. Pilots wishing to familiarise themselves with new or sophisticated equipment should observe the following basic precautions:

- Climb to a safe height
- Remain in VMC
- Stay well clear of controlled airspace while becoming familiar with the various modes of operation.

As an added precaution, pilots should carry a map showing the aircraft's track via the planned way points and which clearly shows the direction of each turn ●

Servicing older helicopters

A Bell 47 helicopter was engaged in cattle mustering operations on a station in the Northern Territory. At about 1300 hours local time the pilot was herding cattle into wind towards a yard. He noticed that three bulls, standing under some bushes near a billabong, were not moving and the normal driving passes at 35–40 knots were unsuccessful in shifting these beasts.

In an attempt to move them the pilot made a precision approach towards them, as if for a spot landing, but keeping the speed at about 30 knots, which was above the translational lift speed. The aim of this technique was to ensure that the animals could see the aircraft for an extended period of time.

The helicopter was still descending when the bulls ran out from the bushes and the pilot applied power and started climbing out. When the machine was about 50 feet above the bushes, the pilot suddenly heard a very loud 'crack' and the helicopter began rotating to the right. The pilot rapidly closed the throttle and lowered the collective pitch to stop the rotation but the aircraft turned 2.5 or 3.5 revolutions before this happened.

When the rotation stopped the helicopter was about 65 feet above the ground, facing downwind, with no groundspeed. It began descending 'like a rock' and as it neared the surface the pilot pulled up on the collective pitch to stop the descent. The machine landed in some light timber and slid into the billabong. The uninjured pilot was able to evacuate from the aircraft through the right hand cabin door.

Specialist examination of the wreckage revealed that one tail rotor blade had separated due to a fatigue failure of the blade grip. The fatigue process had been accelerated by failure of the tail rotor thrust bearing which had been inadequately lubricated and was contaminated by dust and grit.

Another Bell 47 helicopter was operating from Darwin on a flight to check water level recorders and automatic rain gauges at various locations in Arnhem Land. On board were the pilot and a hydrographer. The total operation was to take four days and on the first day 11 stops were planned.

After departing Darwin at about 0800 hours local time the helicopter successfully completed six of the stops, including a refuelling at the fourth location. It landed at the seventh location at 1237 hours and, about 15 minutes later, after the hydrographer had completed his checks, the pilot restarted the engine. The run-up and initial take-off were normal but when the aircraft was about 25 feet above the treetops it suddenly yawed to the left. The pilot applied right rudder but the yaw continued to develop and the pilot was unable to control it.

Believing that the helicopter had suffered a tail rotor strike, the pilot reduced the collective pitch and attempted to steer the aircraft to a forced landing area using only the cyclic pitch control. The helicopter struck trees at a very low forward speed and crashed heavily to the ground. It was severely damaged but neither occupant was injured. The pilot reported the accident to Darwin by HF radio and some hours later the two men were rescued by another helicopter.

Examination of the wreckage during the accident investigation revealed that the left hand control cable to the tail rotor had broken. It was concluded that the cable had failed because of excessive wear at a position where it passed beneath a pulley. The multi-strand cable was heavily impregnated with a mixture of oil and dust which had accelerated the wear.

Excessive cable wear at this location was a known problem and should have been detected during regular maintenance.

The various models of Bell 47 helicopters have been with us for around 30 years, and have an excellent reputation for reliability and safe operation. This reputation has not just happened, but is due, to a large extent, to the cautious attitude of the earlier helicopter operators, and the thorough maintenance given to the helicopters by field engineers and overhaul shop personnel.

The Bell 47 is a first generation helicopter and, together with others of its era, features relatively complicated control and drive systems, many sections of which are exposed to the elements. Large numbers of unprotected bearings and bushings are used and these require an almost constant supply of clean lubricant.

Maintenance engineers, trained on these first generation helicopters in the 1950s and 60s, accepted this need for constant attention as normal and, almost without exception, the helicopters in Australia were carefully and conscientiously maintained. It could be said that the degree of maintenance given to helicopters such as the Bell 47 and Hughes 300 was directly proportional to the amount of grease they would fling at any given engine start.

With the passage of time, many of the engineers experienced in the ways of the Bell 47 have moved on and their places have been taken by others who, although competent with the more modern helicopters, may not fully appreciate the needs of the older machines.

Most of the Bell 47s have now moved from the major helicopter charter companies to smaller operators and pastoral groups who, in many cases, do not realise the maintenance back-up that a '47' needs. This, unfortunately, is being reflected in our accident files with a definite increase in accidents which are directly or indirectly attributable to faulty maintenance.

A helicopter is not just a fixed-wing aircraft with its propeller pointing upwards. It is a lightweight, performance machine, with many finely engineered components operating continually at high tension and torsion loads, and exposed to an environment of heat, dust and water. The whole airframe is continually subjected to a multitude of vibrations, some of large magnitude, generated by the main and tail rotor drive systems and the engine.

When one considers that most helicopter components are either primary load-carrying members without any fail-safe facility, or form parts of a primary control system on an aircraft that is inherently unstable, and that the loss of any rotating component of reasonable mass will produce out of balance forces more than adequate to instantly destroy the machine, some appreciation may be gained of the need to keep a helicopter maintained in top condition.

Good maintenance is not cheap, as the larger helicopter operators know only too well, but there can be no compromise. Large operator or small, without this philosophy the continuing airworthiness of your helicopter cannot be assured ●

Polarised instrument glass

A radio technician was occupying the right hand seat of a Partenavia P68B to check the operation of a Bendix 2000 navigation unit. The original unit was undergoing repair and a replacement unit on loan was installed in the aircraft. During the flight test he leaned across the cockpit to check the frequency selections and they appeared to 'drop out'.

He later experimented with the original unit and obtained the same results. All frequency indications, the ILS/VOR presentation and the RMI appeared to go blank when he tilted his head. It transpired that he was wearing a polarised shield over his normal spectacles and when he tilted his head about 15 degrees, the planes of polarisation of the spectacle shield and the polarised instrument glass became sufficiently out of alignment that light was not transmitted.

It has not been possible to establish how many different aircraft instruments and cockpit displays are fitted with polarised glass. A check with the Bendix design engineers revealed that the polarised glass was fitted 'to improve display readability in conditions of high ambient light'. In consideration of the advantages to be obtained from the use of polarised instrument glass and the wearing of polarised sunglasses it is unlikely that these practices will be discontinued because of incidents such as this.

We recommend that if you do wear polarised sunglasses, check out the possible effect on any aircraft indication *before take-off* so that you will not be caught out by this phenomenon at a critical phase of your flight ●

Some thoughts from a Met. man

A Meteorological briefing officer presents some suggestions to improve the service available to pilots.

As general aviation grows in Australia, Meteorological briefing officers are coming under more and more pressure in providing the services required. Usually there is only one officer on duty to answer all the enquiries addressed to him by pilots, both on the telephone and by personal attendance at the briefing office. The Met. man can very rapidly become saturated by unnecessary and sometimes ill-directed enquiries, especially on days of marginal VMC. To alleviate the problem I would like to make the following suggestions, which, if adopted by pilots, could help to improve the service they receive.

Learn the standard abbreviations used in forecasts

When getting weather by telephone it is much easier and quicker to write "SCT CU 2000 COT 5000 MON TOPS 10 000" than "scattered cumulus base 2000 feet at the coast, 5000 feet above mountains tops to 10 000 feet".

Learn the format of Area Forecasts

Apart from some central Australian areas, winds are always given at the levels 2000 ft, 5000 ft, 7000 ft, 10 000 ft, 14 000 ft and 18 500 ft. Central areas give a 3000 ft wind instead of the 2000 ft wind. Winds are followed by cloud, visibility, weather, freezing level, icing and turbulence. If these headings are written down before ringing the Met. man, time is saved and there is less chance of confusion.

Attend the briefing office

If you are departing from an airport where there is a Met. office, please do not ring the Met. man and ask him to read out area forecasts over the telephone. Probably 50 per cent of any Met. man's time is taken reading forecasts to people who could attend the office to obtain their forecast documentation. By all means ring earlier to check if VMC exists, and if not, to get an opinion of when your flight could be possible, but do not expect the Met. officer to read the forecasts word for word.

Give details when requesting a forecast

When calling the office for a forecast, do not just say, "May I have an Area 21 please". Give some details. Tell the officer (a) your point of departure, (b) your destination, (c) any planned departure from the direct route, (d) your intended altitude, (e) whether you are flying IFR or VFR and (f) estimated time of departure. This gives the Met. man a full picture of your plans and your requirements and he can immediately give you the most important details first, e.g. SIGMETS, reports of non VMC etc. It also allows him to precis the forecast by omitting information not relevant to your flight.

Read the forecasts, then discuss them

On arrival at the office, pick up the forecasts, read them and then ask the Met. man about any problems or clarification. If you are told that your planned flight is unlikely to succeed due to non VMC conditions, you will also be advised of the time when VMC is likely to exist. Check again with Met. about this time, not every 15 minutes until he is ready to throw something at you.

Order flight forecasts

If you are planning a flight covering more than four areas or which has a stage covering more than two areas or the duration of which exceeds the validity of the Area Forecasts, you are entitled to a flight forecast. Ring any Met. or Flight Service office at least three hours before you require the forecast and order it. Three hours notice should also be given if you require Terminal Forecasts which are not issued routinely. If the flight will cover more than two FIRs or is of more than six hours duration, at least eight hours notice should be given.

At the same time as you order the forecast, you can check the general situation and maybe change your plans accordingly. If you do not order the forecast, you could be delayed considerably while the Met. officer sends messages here, there and everywhere for forecasts that are not available routinely at the briefing office. If you are going to ring the office for a forecast just consider this example — a flight forecast from Taree to Adelaide is much easier to write down, and less time consuming, than getting areas 20, 21, 22, 30, 50 and the TAFORS read over the phone.

Send AIREPS

AIREPS are one of the most useful aids there is for a briefing officer. Everybody asks for them but nobody gives them, and the importance of a report on cloud, weather, visibility and turbulence cannot be stressed enough. Just think for a minute. When was the last time you sent one, and when was the last time you asked for actual conditions? The AIREP you send today could encourage someone else to send one in your hour of need.

A little thought by pilots would enable us to give you a better service. Met. men, like pilots, make more mistakes when under pressure. Reduce the pressure and you should get more accurate and up to date information, in turn leading to a safer flight ●

Fuel ice

A recent case of fluctuating fuel flow, low cylinder head temperature and rough running made it necessary for the pilot of a light twin to stop one engine and return to his departure point.

On reaching flight level 230 after a normal climb the pilot leaned the mixture for cruise power and noted that the indicated outside air temperature was minus 28 degrees Celsius. Even though full cabin heat was applied, ice formed on the inside of the cockpit and cabin windows.

The aircraft had been cruising for about 10 minutes when the left engine began to run roughly and misfire. The pilot carried out all the appropriate trouble checks but found nothing wrong. He elected to return and notified ATC accordingly. Engine instrument indications were normal apart from low cylinder head temperatures which nevertheless were still within the normal operating range. The left fuel flow was fluctuating as the engine misfired.

During descent to flight level 120 the pilot shutdown the left engine and feathered the propeller. ATC declared an Alert phase of emergency on the aircraft and a few minutes later, after the pilot reported that the right engine had begun to run roughly, this was upgraded to the Distress phase.

The aircraft maintained flight level 120 for a short time before continuing descent to 8000 feet. During this further descent the right engine operation improved and shortly afterwards the left engine was re-started. The SAR phase was downgraded and the aircraft landed safely about 50 minutes after the initial problem.

Subsequent inspection of both engines did not reveal any positive indication of mechanical problems and attention was then turned to the possibility of fuel ice being the cause of the rough running engines. All aviation fuel contains some water in a dissolved form, i.e. in solution, and the fuel is also likely to contain water in a liquid form, i.e. in suspension. Pre-flight draining should remove the free water accumulation from the tank sumps but small amounts will still remain in solution in the fuel. This water will normally be consumed without affecting the smooth operation of the engine.

However, additional water may be absorbed into the fuel on very humid days and this water will precipitate out of the fuel at very low outside air temperatures. This is precisely what happens at high altitudes, i.e. above 20 000 feet. The small amount of water that has been held in solution in the fuel will precipitate out and freeze in sufficient quantities to cause partial icing in the fuel system. This condition can readily occur, since the International Standard Atmosphere temperature at 20 000 feet is minus 24.6 degrees Celsius. At 23 000 feet, which was the cruising altitude of the aircraft mentioned earlier, the ISA temperature is minus 30.5 degrees.

What can be done to alleviate the possibility of fuel ice?

The addition of isopropyl alcohol to the fuel in correctly measured proportions will help by depressing the freezing point and by keeping the dissolved water in solution. Alternatively, the addition of ethylene glycol monomethyl ether to MIL-I-127686E specification will give similar protection.

However, a word of warning! Either of these compounds must be blended with fuel in exact proportions and their usage must be approved by BOTH the engine AND the airframe manufacturers. This is to ensure that no harm will be done to the various seals, hoses etc., of the complete fuel system.

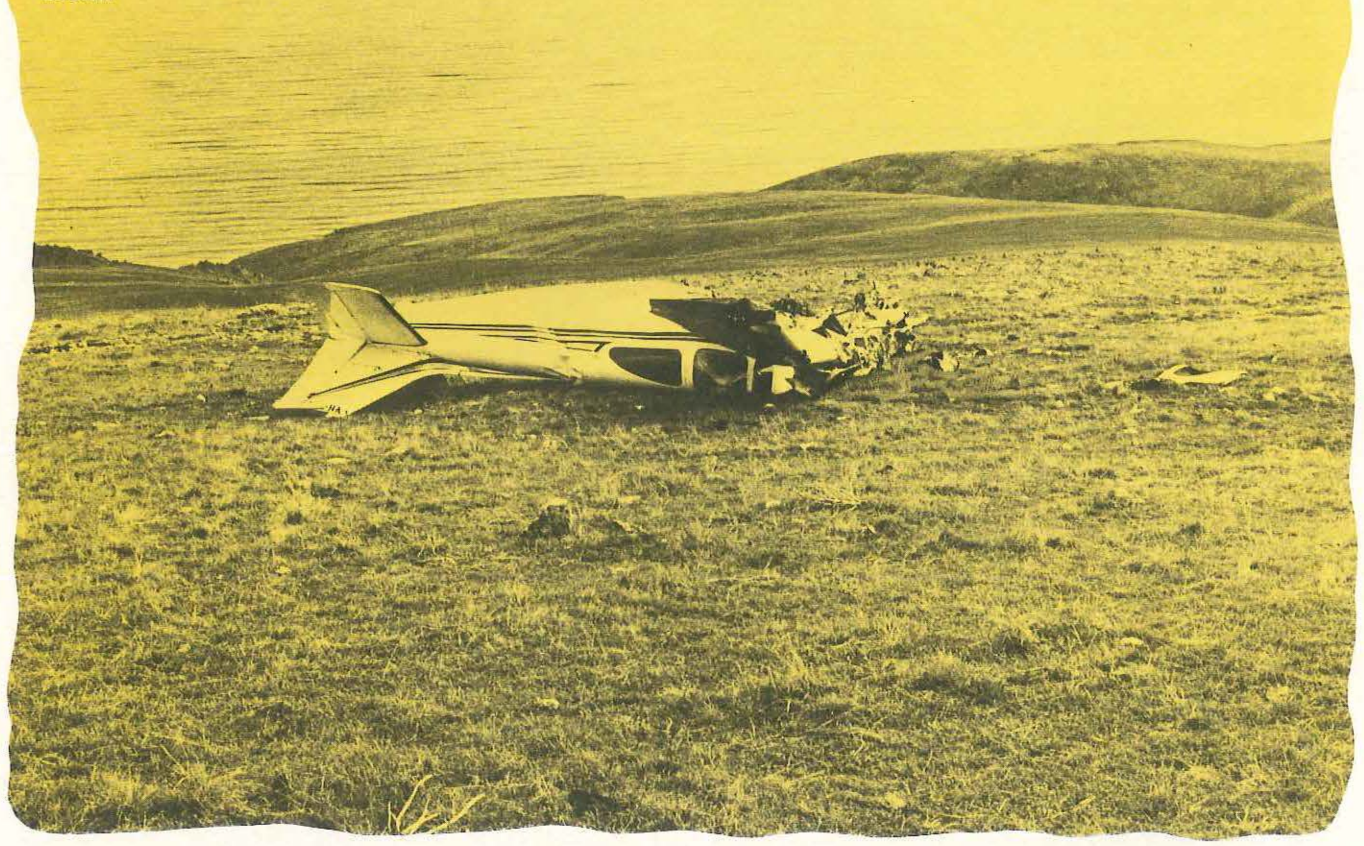
The permission to use these anti-freeze additives and instructions on how to blend them are given in the various manufacturers' bulletins and in the current flight manuals. Some of these publications are:

- Teledyne-Continental Service Bulletin No. 79-5,
- Rolls Royce Light Aircraft Service Bulletin No. T-240/8,
- Lycoming Service Letter No. L-172A,
- Cessna Service Information Letter No. ME79-2 and Cessna Customer Care Owner Advisory No. ME79-2A.
- Also the various flight manuals, such as the Cessna 414A "Information Manual"

As can be seen from the preceding paragraphs, information about fuel icing is readily available to owners and operators and it must be taken into account when planning flights at high altitude ●

The man on the other side

During the final stage of a VFR flight from Moorabbin, Victoria to Adelaide, South Australia, and while descending towards St. Vincent's Gulf preparatory to a visual entry to the Adelaide Control Zone at Port Noarlunga, a Beech Debonair struck the top of a ridge 680 feet above sea level, about 40 km south of Adelaide. The pilot and all three passengers were killed instantly. At the time of the accident, fog and low stratus cloud covered the hills south of Adelaide and there was extensive cloud above them.



The report of the accident described and illustrated above appeared in a past Aviation Safety Digest. It is a familiar story. But how does an Airways Operations officer, either ATC or Flight Service, feel when he loses radio contact with an aircraft?

Some years after the accident, an FSO who was on duty at Adelaide Airport and monitored the aircraft in the last stage of the flight, has chosen to reveal his sentiments towards the pilot, the accident and the subsequent investigation:

'Flight Service Officers are continually encountering the problem of aircraft entering non VMC weather and this has probably accounted for more ulcers than any other related problem. I thought an article explaining one of these accidents from our viewpoint might give a new dimension to an old problem.

'On the day of the accident I arrived on watch at 0600 and commenced to work the air–ground circuit covering eastern South Australia. It looked like being a quiet day owing to poor weather. In fact the only aircraft flying and scheduled to operate were IFR aircraft, on charter or RPT plans, plus one Sartime Beechcraft, VFR from Moorabbin to Adelaide.

'Throughout the morning the terminal and area forecasts were continually being amended and we were busy distributing the relevant amendments to aircraft concerned. Broadcasts were periodically made to the Sartime aircraft but at this stage no radio contact had been established with it.

'Midway through the morning contact was established with the Beechcraft. The pilot sounded in good spirits and passed a full position report at Bordertown with an estimate for Tailem Bend. He was given the amended area and Adelaide terminal forecasts and a short while later reported that he was diverting from his flight plan and would be tracking from Tailem Bend to Port Noarlunga, not directly to Adelaide. He notified his intention to descend outside controlled airspace and requested an airways clearance to enter the Adelaide control zone at Port Noarlunga. An amended Sartime was also given.

'Because of the confident way in which the pilot had handled this diversion, I found myself thinking, "This bloke's got his head screwed on."

'I co-ordinated the aircraft's position and diversion with the Approach Controller. After passing Tailem Bend the pilot requested his airways clearance and was advised that the clearance would be available when the aircraft was approaching Port Noarlunga.

'About 20 minutes later Adelaide Tower issued a clearance for the aircraft to enter the Adelaide Control Zone at Port Noarlunga and to cruise at 500 feet coastal to Adelaide. I passed the clearance to the aircraft and it was acknowledged.

'Some short time later Approach (Radar) requested the aircraft's position. When I queried the pilot he reported that he was crossing the "one eight zero radial". After transferring the aircraft to the Approach frequency I sat back to enjoy a cuppa thinking, with reference to the *Digest* and its saga of weather-related crashes, that at least some pilots were approaching poor weather prepared for possible diversions.

'Ding! The Approach Controller's co-ordination alarm bell! I answer Approach. He advises that he has no contact with the Beechcraft. I call the aircraft. No contact, then Approach advise that they have lost the aircraft on radar. Silence. Distress phase declared. Other aircraft are instructed to call the missing aircraft. No contact. The Department's SAR organisation gears up for a possible search.

'Suddenly it's 1300 and my shift has ended. I hand over to my relief and advise him of the situation. "Perhaps he has landed without advising, could have been too low and out of VHF range". As I leave the Flight Service centre I meet a couple of general aviation pilots just back from Kangaroo Island. We decide to drop in for an ale on the way home. We chat about the missing aircraft and my companions advise me that the weather they encountered was pretty rough. They are not very encouraging. Time to go. During the drive home I am continually going over the morning's happenings. Did I give him the amended forecast? Yes, sure I did. Did he have any doubts or sound uncertain? No, very sure of himself, gave confident answers to all the questions and gave full revised details. Where the hell is he?

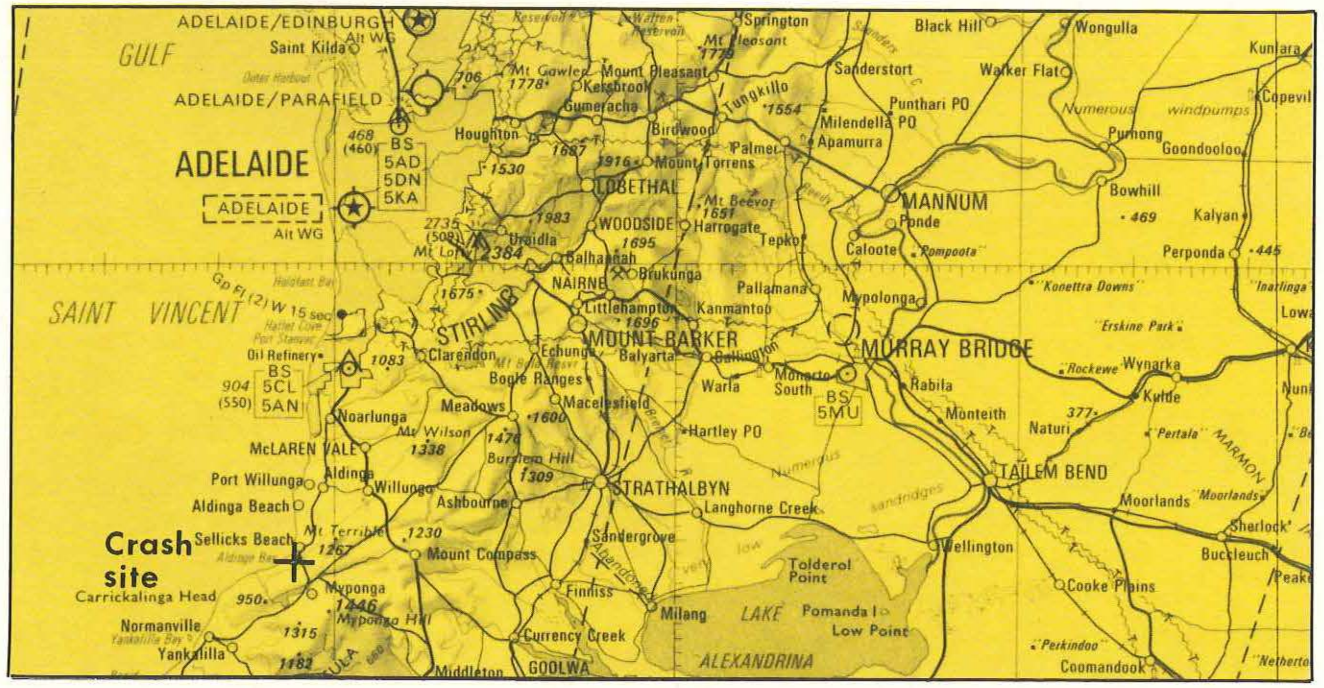
'That afternoon the news breaks. The weather had been extremely rough but it lifted and the wreckage of the Beechcraft was sighted. No survivors.

'Next morning, time to head off to work. I am rostered on at 0700. On arrival the atmosphere in the centre is quiet. No joking. No footy talk. I am informed that a car will pick me up for an interview with Air Safety in town at 1000.

'At the Regional Office I am introduced to the investigator. A short discussion about past days then down to business. I am given a transcript from the previous day's accident. It shows all air–ground conversations and my discussions and co-ordination with Air Traffic Control, including all the ers, ums and ahs. Quite a document. After very exact questioning on the text, the pilot's expressions and general attitude, and reasons why I did this and that, it was over. The investigator was satisfied that we had done all we could in the circumstances. Well, why did he crash? At that stage the investigator did not know.

'The details of the accident were eventually related in the Aviation Safety Digest as "another pilot operating in IMC when he was only rated for VFR." Apparently he had been in cloud prior to Tailem Bend, was rated for Night VMC and was using the navaids on board to navigate. Unfortunately, after passing the revised details he miscalculated the time he estimated crossing the coast and crashed when he thought he was just off the coast. How far inland was he? Just 400 metres.

'Whenever a pilot continues on into areas of marginal VMC the blokes on the ground, the Flight Service Officers and Air Traffic Controllers, start to get concerned. We can only try. It's up to the pilot to heed and divert. And if it's too late to divert tell us of your problem and we will try damned hard to help you out' ●



MD and the jet fuel

Remember Murphy's Law? 'Anything that can be done the wrong way, sooner or later will be . . .'. Once again the Man in the Dustcoat (MD) shows us how easily Murphy's Law can catch the unsuspecting.

It was tea time on a crisp, winter's morning and the staff of Murphy's Aeroplane Company decided to make the most of the fine weather. They were sitting around outside the hangar, enjoying their coffee and sandwiches when, without warning, a light twin passed low overhead on a high speed run. As it pulled up the sun reflected off its bright new paintwork. The aircraft turned and headed back along the strip on another pass.

Murphy came out from his office to see what was happening and as he and his employees watched, the twin broke on to downwind, the wheels dropped and the aircraft made a tight, low level circuit.

'That will be Fred' said Murphy to the group. 'Phoned me last night and said he would bring down his new plane to show us. Wants us to service it'.

The twin completed its landing and taxied to the front of the hangar. As the engines were cut, the warning siren for the end of 'smoko' sounded.

'Okay, you lot' exclaimed Murphy, 'back to work. I don't pay you to stand around gawking!' Murphy overheard a muttered 'slavedriver' as they headed into the hangar.

The cabin door of the aircraft opened and the pilot stepped out on to the wing-walk. 'Gidday Murph,' he said, 'how do you like my new toy? Ain't she a beaut!'

'Looks great, Fred,' responded Murphy to the enthusiastic pilot. 'Cost you a few bob I bet.'

'Sure did mate, but I'll be able to write most of it off against the business. I brought all the manuals with me so why don't we sit down and work out how much the servicings will cost.'

'Okay, Fred. I'll get us a cup of coffee.'

'Oh, listen Murph, could you have one of the boys fill it up with some hundred? Save me some time later.'

As they walked towards his office Murphy called out 'Hey, MD, how about getting us some coffee, then fill up Fred's plane.'

'Alright,' replied MD, and under his breath, 'nothing but a . . . tea lady.'

Murphy and Fred were mulling over the maintenance manual when MD arrived with the coffee. Not wishing to disturb them, he put it down without talking and went out to the new aircraft. As he walked around it admiring the smooth lines and colourful paint scheme his eyes caught the sign on the engine nacelle. 'Turbo-system' MD thought aloud, 'must have those small turbines driving the props. I guess it uses jet fuel. Should check Murphy but I'd better not disturb him while he's talking money. He'll do his block.'

MD went around the back of the hangar to the old fuel tanker that contained the jet fuel. The tanker had not been used for quite a while and after a lot of trouble MD got it started and drove it round to the plane. He had unrolled the fuel hose and was about to fill the tanks when Murphy stomped out of his office.

'What the blue blazes are you up to MD?' roared Murphy.

'I'm filling the tanks, like you said to, Boss' MD cowered before his enraged employer.

'But that's jet fuel you're using, blockhead, instead of hundred!'

'Gee, Boss, I saw the decal and thought it had turbines.'

Just then the owner joined the group. He had heard MD's last comment and without further ado turned to Murphy and said, 'Get out the spraygun and paint out those signs Murph. Just as well I didn't get airborne with jet fuel in the tanks. While the painter is at it he can repaint the fuel grade signs alongside the filler caps in larger letters. That should help stop this happening again. I guess we should have been a bit more careful when we asked for the fuel, eh, Murph. Not all MD's fault you know.'

When Fred's aircraft left Murphy's that afternoon the tanks were full of Avgas 100 and the nacelle signs had been removed. The experience had been another episode in MD's continuing education.

Cases of inadvertent use of jet fuel in aircraft fitted with reciprocating engines are becoming more widespread. Needless to say, the result can be a loss of engine power, sometimes followed by disastrous consequences.

Basically, two situations are arising regularly around the world. In the first instance, jet fuel is added to the aircraft tanks as a result of carelessness. The majority of general aviation aircraft are refuelled overwing irrespective of whether they are turbine or piston-engine. Nozzles fitted to fuelling hoses are common to all fuel types so that care must be taken by the person refuelling to ensure that the bowser or tanker they are using contains the correct type and grade of fuel for the aircraft being refuelled.

The other set of circumstances is depicted by our Man in the Dustcoat and is another example of Murphy's Law at work. Many aircraft now being produced are fitted with turbo-charged or turbo-compounded reciprocating engines. Unfortunately a large proportion of these are delivered from the manufacturers with decals on nacelles, tip tanks, etc., which easily mislead refuellers into believing that the aircraft are fitted with turbine engines. Consequently the aircraft tanks are filled with jet fuel. In addition, a number

of manufacturers are producing both piston and turbine-engine versions of similar aircraft. Typical examples are:

Piston-engine		*Turbine-engine*
Rockwell Strike Commander	*resembles*	Turbo Commander
Cessna 404 Titan	*resembles*	441 Conquest
Beech Queen Air	*resembles*	King Air
Piper Navajo Chieftain	*resembles*	Cheyenne

Cure for these problems

The ideal solution to the first problem would be to introduce a system of different fuel nozzle sizes for different grades of fuel. Aircraft overwing fuel orifices would also be sized to prevent the inadvertent delivery of jet fuel to piston-engine aircraft. This procedure was used successfully by the Royal Air Force in the United Kingdom by enlarging the outside diameter of nozzles supplying jet fuel and sleeving the refuelling orifices of all piston-engine aircraft. Such a modification to civilian aircraft is highly unlikely as it would require acceptance by aircraft manufacturers, operators and refuelling organisations as a mandatory modification. The cost and time involved would be prohibitive.

The obvious immediate solution is sufficient care on the part of the person refuelling an aircraft to ensure that the grade of fuel they are adding is correct. Before placing the nozzle in the fuel tank opening be sure that the marking shown on the tanker or bowser corresponds with the fuel grade marking on the aircraft.

The solution to the other problem is simply to remove or paint out misleading decals and, in the case of similar aircraft types, to ensure that the fuel being delivered is the same type and grade as that indicated on the aircraft.

Pilots and operators can prevent misunderstanding by being more specific when they order fuel for their aircraft. When placing the order, preferably in writing, state clearly the type and grade of fuel, the quantity to be added to each tank, or the total amount required at the end of refuelling if less than full tanks.

Operators and owners should also ensure that the fuel grade markings adjacent to fuel tank caps on aircraft are maintained in good condition ●

Learn to say 'No'

How often have we felt ill-equipped to carry out a flying task? Possibly we are weary, or pre-occupied with personal affairs, or just plain unfamiliar with the aircraft or its equipment. Perhaps we have been poorly briefed on the task or perhaps we have carried out a task so many times that we have become complacent or even bored. How often then, have we succumbed to various pressures (the BOSS, get-home-itis, saving face) and have become airborne only to regret our action later? Usually we kick ourselves and vow never to do the same thing again, but often we do and sometimes the results are rather more dramatic.

It was one of those days when paperwork kept piling up — all to be done yesterday. On top of this workload the pilot was asked to carry out a check flight on another pilot. He agreed to do so, but only if no one else was available. Predictably, this was the case.

The check pilot briefed that he would adjust the flaps for the pilot during touch and go landings. His normal procedure for doing this was to point to the flap handle, say 'Flaps identified' and then activate the handle. On the first touch and go, the check pilot inadvertently selected the gear handle up instead of the flap handle. The nose and main gear collapsed even though he re-selected the gear handle down almost immediately. The aircraft veered off the runway and stopped on the grass, substantially damaged. The check pilot recalled some time after the accident that when he selected the gear handle up he must have actually identified the handle because he remembered saying 'gear up'.

The check pilot was not mentally prepared for the flight due to workload, short notice for the flight and lack of current practice in check pilot/instructional flying. In addition to this, he had flown about 100 hours in the previous 12 months, divided between 19 different types of light twins and singles. Although many of the types were similar, the pilot had flown too few hours on too many types of aircraft to be properly proficient on any one of them.

The lesson to be learnt from this accident is clear: If you feel 'switched off' then keep the aircraft switches off — saying 'no can do' can avoid much embarrassment ●