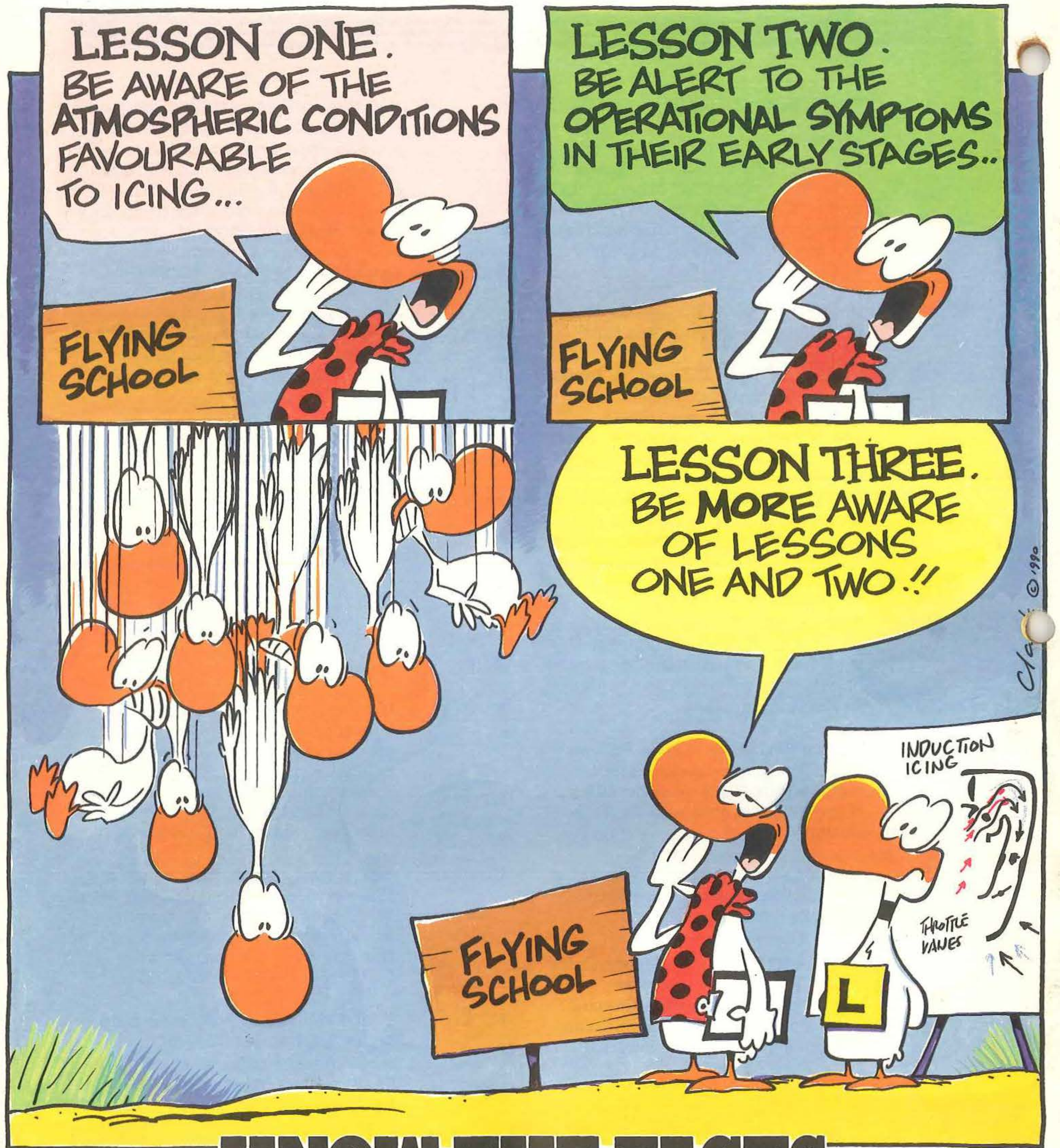
# CARBURETTOR ICING




# KNOW THE FACTS

- KNOW THE FUEL SYSTEM.
- KNOW YOUR MET.
- KNOW HOW TO RELATE IN-FLIGHT CONDITIONS TO ENGINE CHARACTERISTICS.
- KNOW THE PROCEDURES FOR YOUR AIRCRAFT.
- USE HEAT FOR PREVENTION — IT MAY NOT BE AVAILABLE FOR CURE . . .

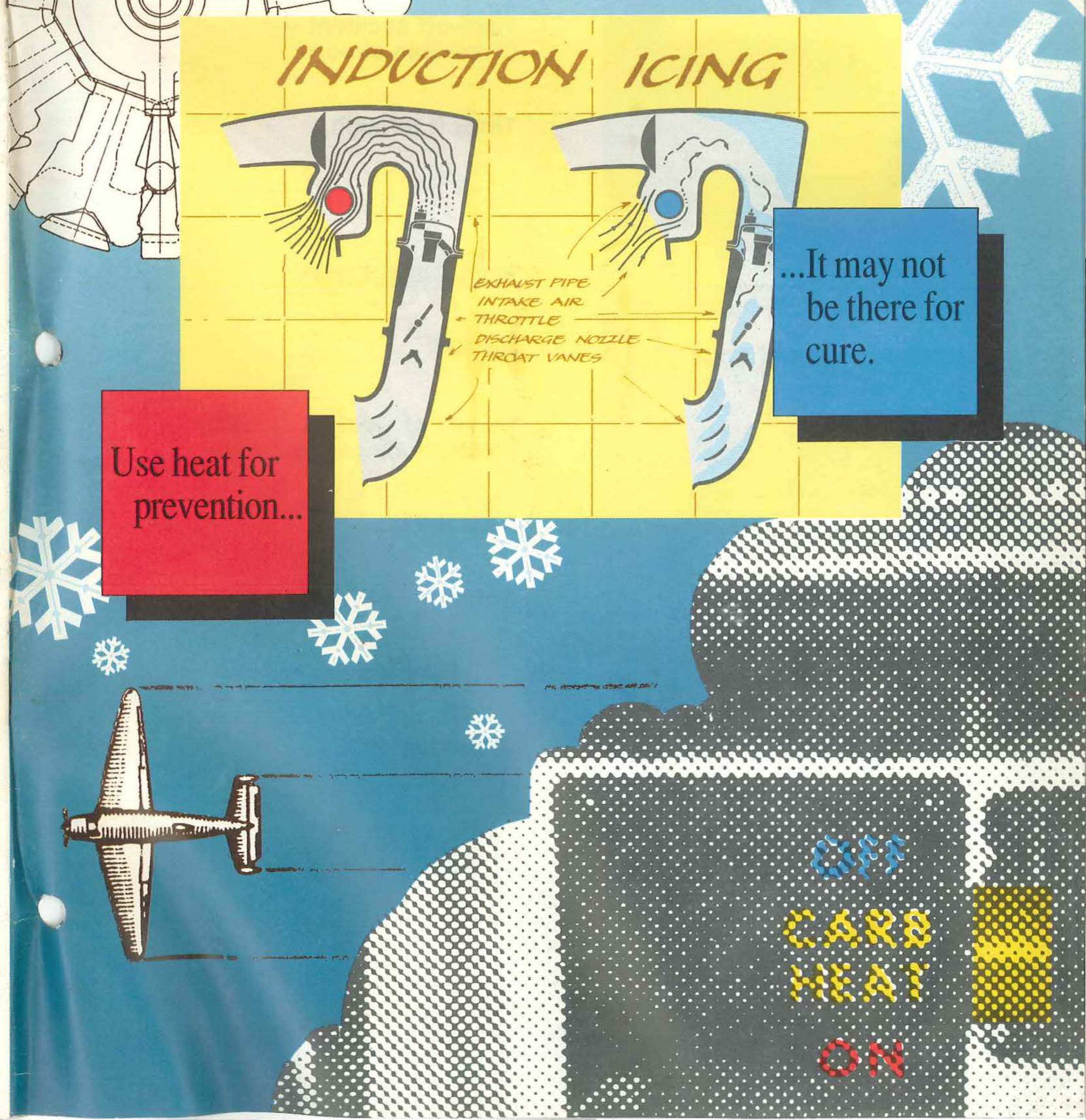
CIVIL AVIATION AUTHORITY AUSTRALIA

ASD 145
Winter 1990

Pick the CAA performers
See Airways Awards for Excellence
INSIDE

AUSTRALIA

# Aviation Safety Digest



*Aviation Safety Digest is prepared by the Civil Aviation Authority and is published by the Australian Government Publishing Service. It is distributed to Australian licence holders (except student pilots), registered aircraft owners and certain other persons and organisations having an operational interest in safety within the Australian civil aviation environment.*

*Distributees who experience delivery problems or who wish to notify a change of address should contact:*

*Manager, Publications Centre, P.O. Box 1986
Carlton South, 3053, AUSTRALIA
Telephone (03) 342 2000(4 lines); 008 33 1676
008 33 4191; (03) 347 4407*

*Aviation Safety Digest is also available on subscription from the Australian Government Publishing Service. There is a subscription form in this issue. Inquiries and notifications of change of address should be directed to:*

*Mail Order Sales
Australian Government Publishing Service
G.P.O. Box 84, Canberra, A.C.T. 2601,
AUSTRALIA
Telephone 008 02 6148. Telex AA62013*

*Subscriptions may also be lodged at Commonwealth Government Bookshops in the capital cities.*

*The views expressed in the Aviation Safety Digest are those of the editor or the individual contributor and are intended to stimulate discussion in the fields of aviation safety and related areas. They do not necessarily reflect the policy of the Authority nor should they be construed as regulations, orders or directives. The articles are intended to serve as a basis for discussion and even argument in an effort to identify and resolve problem areas and potentially hazardous situations.*

*Unless otherwise noted, articles in this publication are based on Australian accidents, incidents or statistics.*

*Reader comments and contributions are welcome but the editor reserves the right to publish only those items which are assessed as being constructive towards flight safety and will make editorial changes to submissions in order to improve the material without altering the author's intended meaning.*

*Reader contributions and correspondence should be addressed to:*

*The Editor,
Aviation Safety Digest
Civil Aviation Authority
G.P.O. Box 367,
Canberra, A.C.T. 2601, AUSTRALIA
Telephone (06) 268 4583*



*ISSN 0045-1207
B89/20570 Cat. No. 89 0558 2*

*Printed by Ambassador Press Pty Ltd
51 Good Street, Granville, N.S.W. 2142,
AUSTRALIA*

# Contents



# Editorial

Winter is upon us and, although by no means confined to that season, icing has the ability to cause problems to anyone flying an aeroplane. We hope that the covers and the article inside will serve to refresh your awareness of this ever-present hazard.

*Field Office Forum* is the first of what I hope to be a regular series of articles from those who deal with you on a daily basis. It is a furtherance of an attempt to increase the relevance of the content of the magazine, and I for one will be interested to find out if in fact there are any real differences State to State.

The Authority has a new Chairman of the Board and those of us who know Dick Smith are prepared for exciting times ahead. This magazine is in full support of the initiatives already produced, for there *is* a difference between a formal Public Service Department and the Government Business Enterprise that the CAA is about to become; this is thrown into sharper focus by the impending deregulation of Australian civil aviation. Our legislation, as I mentioned earlier, will reflect advances in thinking, and concerning safety in flight (which is what *ASD* is all about), perhaps I might quote the Chairman direct, from a presentation he made recently to CAA workers, in which he discussed that axiom of the business world, cost-benefit:

*. . . I do know that if you go to spend money in the most effective way you've really got to look at it in a cost-benefit way. Some of you might have read the Swedavia-McGregor report from New Zealand where they have done that. It appears they have been doing it in Northern Europe and in North America for about ten years now. And it does mean valuing a life and working back from that. People might be horrified, 'Oh, you can't value a life!' Well, that's what we've always been doing subjectively. You have to do that of course, because otherwise you just have to keep spending more and more money.*

As far as most of us are concerned, let me reiterate what I've said before in comment: the chances are that we as operators have got the complicated, expensive things nicely covered off — it's the simple and obvious that seems to catch so many out. Learning may be tedious and self-discipline onerous, but they gain us many points in the categories 'cost-effective' and 'flight safety'. It doesn't cost us megabucks to hold our lives in high esteem.

## Covers

*Front: 'Induction Icing' by Andrew Rankine CAA Graphic Design Studio*

*Back: Gary Clark (Ding Duck's idiosyncratic approach to flight safety can be seen in the new edition of 'Clear for Take-off')*



| | | |
|---|---|---|
| Editor: | | Roger Marchant |
| Editorial Assistant: | | Lyn Coutts |
| Diagrams: | | Kathy Foldszin<br>Soussanith Nokham |
| Cartoon | P12 | Soussanith Nokham |
| Photographs: | P8 | Brenton Hollitt |
| | P9 | BASI file photo |
| | P11 | Kim Wirth |
| | P17 | Andrea Hirschon |
| | P20 | Roger Marchant |

# Be ice conscious! or 'Give the carby a fair go...'

*Question: What is carburettor icing?*

*Answer: Carburettor Icing is the accumulation of ice in the fuel discharge nozzle, the butterfly valve and the Venturi of the fuel induction system. If this build-up is allowed to continue the supply of fuel/air mixture to the engine will reduce to the point where the engine may stop.*

## Case history 1.

'...post-accident examination of the engine revealed no evidence of any mechanical or system malfunction and later, when the aircraft was lifted back on to its wheels, the engine started and ran normally. Although the weather at the time was fine and very warm, the humidity was high and conditions were especially favourable for carburettor icing. The symptoms accompanying the loss of power were characteristic of the formation of ice in the carburettor and, in the absence of any mechanical defect, it was concluded that ice had built up undetected in the carburettor to the point where the engine had lost all power.'

## Case history 2.

'Shortly before taking off from Moorabbin on a dual training flight in a Cherokee 140, the instructor had briefed his student on practice forced landing techniques, including engine handling and the use of carburettor heat. Once airborne, the aircraft was flown to the local training area where, levelling at 2 500 feet, the student applied partial carburettor heat and closed the throttle to simulate engine failure. Leaving the carburettor heat control in this intermediate position, the student completed his emergency cockpit drills, selected a field and established the aircraft in a forced landing pattern, clearing the engine every 500 feet until the aircraft had descended to a height of 1 000 feet. Without clearing the engine again, the student continued the descent until, at 300 feet, the instructor was satisfied with his performance and told him to go around. But when the student opened the throttle, the engine did not respond. The instructor immediately took control but the aircraft was by now very low and he had no choice but to continue with the forced landing into the selected paddock. Although the ground was wet, the aircraft touched down normally and rolled to a stop undamaged.

The cool and humid conditions existing at the time were conducive to the formation of carburettor ice and when, a short time later, the engine was started and ground run satisfactorily, it appeared clear that ice had formed in the carburettor during the descent and the small amount of heat selected had been insufficient to prevent it building-up. When no fault could be found with the engine, the aircraft was moved to a dry part of the field and was flown back to Moorabbin without further incident.'

## Case history 3.

'A student pilot, while on a dual training flight in a Beech Musketeer from a country aerodrome in Victoria, was being instructed on in-flight emergency procedures. The exercise had commenced with the instructor demonstrating action to be taken in the event of fire. Starting at 4 000 feet, he had shut down the engine by closing the throttle and turning off the fuel and ignition switches. At this stage, he selected full carburettor heat. Once the aircraft was established in the descent and he was satisfied that the student was familiar with the procedure, he decided that, with the height still in hand, he would demonstrate re-starting the engine by diving the aircraft.

After stopping the propeller, the instructor set the controls for a restart, and then pushed the nose down until, at 125 knots, the propeller began to windmill. But when he levelled out and opened the throttle, there was no response from the engine. Double checking the various engine controls, he persisted with his starting attempts until, at 2 300 feet, he realised that the engine was not going to fire. Committed now to a forced landing, the instructor established the aircraft in an approach to a field only a short distance from the aerodrome and put the aircraft down without damage. Shortly afterwards, a licensed engineer examined the aircraft but could find no defect. The engine was started without difficulty and after it had been successfully ground run, the aircraft was flown back to its base by the CFI.

In all three case histories, the engine failure was attributed to the suspected formation of carburettor icing.

*Question:*

*How does Carburettor ice form and under what atmospheric conditions is it most likely to occur?*

*Answer:*

*Carburettor ice results from the cooling effects of fuel vaporisation and air pressure drop across the Venturi. The air can be cooled by as much as 40° C and depending upon the amount of moisture in the intake air it can condense to form frost or ice. Even a small amount can restrict the efficient flow of fuel/air to the engine.*

*The temperature range of + 15° C to + 30° C with a relative humidity of 50% is most dangerous, with outside temperatures around + 15° C considered most significant.*

*Question:*

*What are the warning signs available to the pilot?*

*Answer:*

*The effect of induction icing is a gradual, progressive decline in the power delivered by the engine. With a fixed pitch propeller this may become apparent by rough running, reduced RPM and thus reduced airspeed. With a constant speed propeller, there will normally be no change in RPM but the same decrease in aircraft performance will occur. With a manifold pressure gauge, a decrease in manifold pressure may be noted before any significant decrease in aircraft performance. With an exhaust gas temperature indicator, a decrease in exhaust gas temperature will occur before any noticeable decrease in engine and aircraft performance. If these indications are not noted by the pilot and no corrective action is taken, the decline in engine power will probably progress until it becomes necessary to retrim to maintain altitude and engine roughness will occur probably followed by backfiring. Beyond this stage, insufficient power may be available to maintain flight and complete stoppage may occur, especially should the throttle be moved abruptly.*



Every year the accident and incident records contain a number of occurrences in which carburettor (induction) icing was considered to be the probable cause of an engine power loss. BASI records indicate 97 cases of induction icing between 1980 and 1989, fourteen of which were followed by forced or heavy landings resulting in substantial damage to the aircraft. Remember, these are only the **reported** cases; it is not unreasonable to suppose that plenty more pilots were frightened by throttle stiffness and dwindling power attributable to the presence of ice in the fuel induction area. Carburettor (induction) icing has exposed the occupants of light aircraft to unnecessary danger and has cost operators many thousands of dollars during the past few years. Despite the increased emphasis placed on this problem by the flying training organisations, we find many light aircraft pilots are still being caught out. Simply, they spring the trap because they either fail to appreciate the wide range of conditions under which carburettor icing can occur, or do not recognise the symptoms in time to take corrective action. Although this phenomenon is by no means restricted to the approaching colder months of the year (over the last ten years 38% winter, 26% spring, 23% autumn and 13% in summer have been the proportions), it is an opportune time to again revise our actions as pilots should we suspect carburettor icing.

The following paragraphs offer you food for thought as to what happens, why it happens and when it is most likely to happen. A few minutes of your time thinking along these lines and refamiliarising yourself with the procedures laid down for each aircraft type you fly may some day save your life, or at least your hip pocket.

Vital to the successful management of an aircraft engine is a knowledge of its method of operation and a **DETAILED** knowledge of the manufacturer's instructions plus the relevant information contained within the flight manual, pilots notes, owners handbook, and company operations manual (where applicable).

**It is impossible to over-emphasize the need to comply with these instructions. The engine manufacturer has expended a lot of effort, time and expense to design and install a hot air supply to combat ice formation in the carburettor; he knows his product like no-one else: he has, in line with Government regulations, ensured that all test points have been satisfied in the operation of the engine. This necessarily includes the pilot actions necessary to avoid or mitigate induction icing.**

A quote from the aeronautical engine design standards applicable to Australia sets out manufacturer responsibilities:

*'Fuel and induction system*

*(a) the fuel system of the engine must be designed and constructed to supply an appropriate mixture of fuel to the cylinders throughout the complete operating range of the engine under all flight and atmospheric conditions.*

*(b) The intake passages of the engine through which the air or fuel in combination with air passes for combustion purposes must be designed and constructed to minimise the danger of ice accretion in those passages. The engine must be designed and constructed to permit the use of a means for ice prevention.'* (FAR 33.35)

It is up to you, the pilot, to recognise the conditions under which these means should be used. If you follow the book, you are doing the best in your ability to operate the aircraft safely and efficiently. As with everything else in aviation, ignorance, carelessness or plain negligence can exact a terrible toll.

The most important single factor is to be aware of the atmospheric conditions favourable to icing, and thus be on the alert for the operational symptoms in their early stages. The cooling effect of fuel evaporation within the carburettor will reduce the air temperature by as much as 15° C. In clear air conditions where the humidity exceeds 70%, or in rain, cloud, fog and some forms of haze, the moisture present can be sufficient to produce a dangerous accumulation of ice. Under these conditions carburettor heat may be required at some stages of the flight, and it may be necessary to clear the induction system prior to take-off. The operational application of hot air will vary with individual aircraft and engines, and **a pilot should follow implicitly the instructions contained in the manufacturer's or operations manual.** In addition, it is well to remember that under most conditions the formation of carburettor ice is a relatively slow process and it is possible for a pilot not to recognise the early symptoms of icing unless he is conscious of the significance of the meteorological conditions.

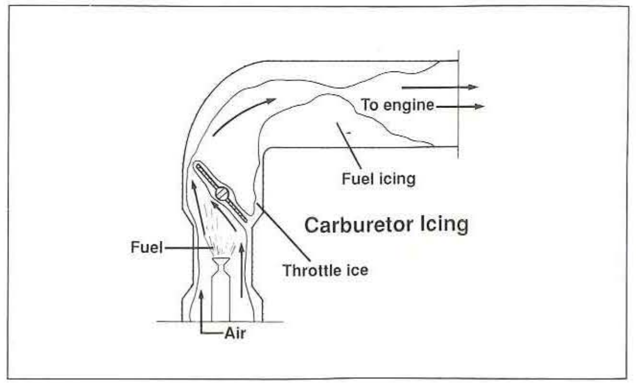
Basically, a carburettor functions a great deal like the expansion valve in a mechanical refrigerator, with the result that a temperature difference as great as 15° C can exist between the free outside air temperature and the carburettor-mixture temperature. A carburettor can literally manufacture its own ice — at any season of the year.

Three types of carburettor ice can be encountered. They are **Impact Ice, Throttle Ice, and Fuel Evaporation Ice.**

**Impact ice** is formed by snow, sleet or supercooled water droplets impinging on surfaces where there are changes of direction in airflow. It includes the ice formed when water strikes surfaces, such as carburettor air intakes, which are below 0° C. Impact ice may seriously affect engine operation where ambient temperatures are below 0° C, particularly if snow, sleet or sub-cooled liquid exists in the atmosphere.

**Throttle ice** is formed at or near the throttle, particularly when it is in a part closed position, and is due to the drop in temperature which accompanies the reduction in pressure created by the Venturi effect. It is formed from moisture particles which freeze outside the airflow boundary layer and are then carried to metal surfaces such as the throttle butterfly by their initial momentum. Comprehensive tests show that throttle ice may form in air temperatures up to about 3° C. Where the air temperature is above 3° C the cooling effect of the increased velocity alone is insufficient to result in icing.

**Fuel evaporation icing** is caused by the vaporisation of the fuel after it is introduced into the intake airstream. The heat required to change the fuel from a liquid to a vapour is supplied mainly by the airstream, with the result that even though the outside air temperature may be well above freezing point, the temperature of the air passing through the system aft of the fuel spray nozzle, and of the surrounding structure, can be reduced to below 0° C. This type of carburettor icing is the most common and it may cause rough running by upsetting the fuel-air ratio, or the mixture distribution through the manifold, as well as engine failure by obstructing the passage of air through the carburettor.






It is possible that all three types of icing will be encountered at the same time, but that arising from fuel evaporation is the most likely except in extremely cold conditions.

Recognition of the symptoms is easier if it is appreciated that ice in the induction system acts in the same way as closing the throttle. As ice builds up it obstructs the air flow, causing a reduction of power and, with a fixed pitch propeller, a reduction in RPM. With a constant speed propeller this reduction of power will not in the early stages affect RPM; however, boost, and airspeed, will decrease. Should the condition be allowed to progress to a point where the power developed is not sufficient to cause the propeller to remain above the fine pitch stops there will be a reduction in RPM even with a constant speed propeller. Irrespective of the propeller installation, a suspected formation of ice can often be detected by increasing the throttle opening. If the throttle movement is sticky or abnormal, or it fails to increase the power, there is a strong possibility that ice has formed and the application of hot air has already been delayed longer than is healthy — BUT it is still not too late!

Frequently pilots fail to recognise icing in its early stages and so attempts to increase the throttle opening by slight increments to compensate for falling off of RPM or boost. These are precisely the conditions that lead to maximum ice formation. Removal of ice already formed is best accomplished by use of full carburettor heat. If the pre-heat capacity of the system is sufficient and the remedial action has not been delayed, it is only a matter of seconds before the ice is removed. The pre-heat capacity can be increased by applying more power and, where possible, closing cowl flaps.

If ice formation is allowed to progress to a critical extent the loss of power may make it impossible to generate sufficient heat to clear the engine. It is for this reason that we have emphasised the need to recognise meteorological conditions favourable to carburettor icing and take early preventive action.

## Use heat for prevention — it may not be available for cure!

To prevent accidents resulting from intake icing, the pilot should be alert at all times for indications of icing in the induction system. The following represents the sort of advice/instructions given by engine manufacturers:

- Periodically check the carburettor heat systems and controls for proper condition and operation.
- Start the engine with the carburettor heat control in the COLD position to avoid possible damage to the system and a fire hazard because of a backfire while starting.
- As a pre-take-off vital action, check the carburettor heat effectiveness by noting the rev drop when heat is applied on run-up. If ambient conditions dictate, also check for the presence of carby icing (see next paragraph).
- When the relative humidity is above 50% and the temperature is below 20° C, apply carburettor heat briefly immediately before take-off to remove any ice accumulated during taxi and run-up. Generally, the use of carburettor heat for taxiing is not recommended because of possible ingestion of foreign matter with the unfiltered air admitted with the control in the **HOT** or **ALTERNATE AIR** position.
- Conduct take-off without carburettor heat, unless extreme intake icing conditions are present.
- Remain alert for indications of induction system icing during take-off and climb-out, especially when the relative humidity is above 50 per cent, or when visible moisture is present in the atmosphere.
- If you have carburettor or mixture temperature gauges, use partial heat to keep the intake temperature in the safe range. Without such instrumentation, full heat should be used intermittently as considered necessary.
- If induction system ice is suspected of causing a power loss, apply full heat or alternate air. Do not disturb the throttle until improvement is noted. Expect a further power loss momentarily and then a rise in power as the ice melts.
- If the ice persists after a period with full heat, gradually advance the throttle to full power and climb at the maximum rate available to produce as much heat as possible. Leaning with the mixture control will generally increase the heat but should be used with caution as it may stop the engine under circumstances in which a re-start is impossible.
- Apply heat for a short time to warm the induction system before beginning a prolonged descent with the engine throttled back. Leave heat on during the descent and then be ready to turn the it off after power is reapplied.
- Remember that intake icing is possible with temperatures as high as 40° C and the humidity as low as 50%. It is most likely, however, where temperatures are below 20° Celsius and the relative humidity is above 80%. The likelihood of icing increases as the temperature decreases (down to zero° C) and as the relative humidity increases.

*Note: the effects and recommendations described in this article are general in nature and while they may apply to most piston-engined aircraft, the final authority must always be the engine/aircraft manufacturer's recommendations and the (company) operations manual.*

**Finally, refer to all available operating instructions and placards pertaining to the aircraft to determine whether any special considerations or procedures apply to its operation** □

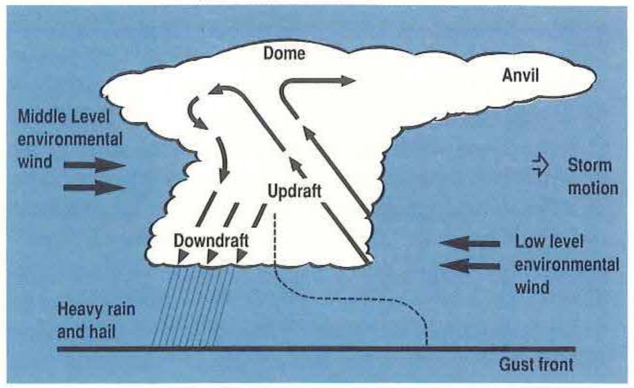
# Thunderstorms

*Bureau of Meteorology*

THUNDERSTORMS are the most violent and potentially destructive smaller-scale meteorological phenomenon encountered in Australia.

Storms vary in characteristics, particularly between the tropics and higher latitudes. However, a fundamental rule of all flying is: STAY WELL CLEAR OF THUNDERSTORMS. Associated hazards include turbulence, hail, icing, low ceiling and visibility, lightning, downdrafts, wind shear, tornadoes, squall lines, high intensity rainfall and flash-floods. Thunderstorms are usually classified as 'severe' if surface wind gusts exceed 92 Km/hr (50 kt) or hail stones have a diameter in excess of 2.5 cm (approx 1 in).

Severe storms are continuously well organised internally with the updraft and downdraft being separated. This is usually because a strong windshear (direction and speed) exists between the lower and middle levels of the thunderstorm environment.




The following are some SUGGESTED do's and dont's of thunderstorm avoidance.

## Do

Plan to avoid storms. In the first instance if flying into unfamiliar territory gain some appreciation of storm likelihood. Climatological information is available on thunderstorm incidence for preliminary planning.

Before becoming airborne check the forecast and plan an alternative route if thunderstorms are predicted. Planning will be far more rational in the calm of the briefing office than in flight when confronted with the problem. Be prepared to divert before thunderstorms become unavoidable.

Avoid by at least 30 km any thunderstorm identified as severe or giving an intense radar echo.

Reduce air speed immediately to the manufacturer's recommended airspeed for turbulent air penetration at the first sign of turbulence.

## Don't

Don't land or take off in the face of an approaching storm. A sudden gust front could cause loss of control and downdrafts can produce a fatal altitude loss.

Don't attempt to fly under a thunderstorm even if you can see through to the other side. The vertical currents and turbulence and wind shear can lead to loss of control or damage to the aircraft. Large hail can suddenly occur in areas with good visibility.

Don't trust the visual appearance as a reliable indicator of turbulence inside a thunderstorm.

Don't assume the air above a storm is necessarily turbulence-free.

## If you cannot avoid penetrating a thunderstorm, following are some do's before entering the storm

Tighten your seat belt, put on your shoulder harness if you have one, and secure all loose objects.

Plan and hold your heading to take you through the storm in a minimum time.

To avoid the most critical icing, establish a penetration altitude below the freezing level or above the level of minus 15 degrees Celsius.

Verify that pitot heat is on and select carburettor heat or turbine-engine anti-ice. Icing can be rapid at any altitude and cause almost instantaneous power failure and/or loss of airspeed indication.

Configure your aircraft for turbulence penetration using power settings and airspeed recommended in your aircraft manual.

Turn up cockpit lights to highest intensity to lessen temporary blindness from lightning.

## Following are some do's and don'ts during thunderstorm penetration.

Keep your eyes on your instruments. Looking outside the cockpit can increase danger of temporary blindness from lightning.

Let the aircraft 'ride the waves'. Manoeuvres in trying to maintain constant altitude increase stress on the aircraft.

Don't change power settings; maintain settings for recommended turbulence penetration airspeed.

Don't turn back once you are in a thunderstorm. A straight course through the storm most likely will get you out of the hazards in the shortest time. In addition, turning manoeuvres increase stress on the aircraft □



# Take-off accident — Moorabbin airport

*Reprinted from ASD 1*

IMMEDIATELY after becoming airborne from Moorabbin Airport, Victoria, on 17 January 1953 the port engine of an Avro Anson failed. The aircraft continued across the aerodrome a few feet above the ground until it struck a telephone post on the road at the northern boundary of the aerodrome and crashed into a field on the opposite side of the road. The crew of three were uninjured. The aircraft was extensively damaged by collision and impact.

## History of the flight

On the evening of the day prior to this flight the aircraft was inspected by a licensed aircraft maintenance engineer and found to be airworthy. After the aircraft was loaded and immediately prior to flight the pilot carried out a pre-flight inspection and just before leaving the tarmac the engines were given a full run-up. An engine revolution drop of approximately 150 revolutions on the starboard magneto of the starboard engine revealed during this run-up was cleared after the engine had been operated for some 15 to 20 minutes.

The aircraft was then taxied to the take-off point where the pilot carried out a pre-take-off cockpit check. The commencement of the take-off was quite normal and after travelling approximately 1 800 to 2 000 feet the aircraft became airborne. At this stage, the pilot felt a loss of power which he at first thought was in the starboard engine because of the previous rpm drop. However, he immediately realised, from the tendency of the aircraft to swing to the left, that the power loss was on the port side and was moving to pull the port throttle off when the engine momentarily picked up again. The pilot thought that it was only a temporary loss of power and decided to continue to take-off, but almost immediately the port engine failed completely. Realising that he would not be able to climb away, the pilot elected to fly under some telephone wires on the northern boundary and land in a paddock across the road rather than attempt to bring the aircraft to rest within the aerodrome boundary. The aircraft gradually lost height and the main wheels struck a mound of earth near the aerodrome boundary. It then bounced across the road and struck a telephone post, severing some 14 feet of the port wing, and finally struck the ground on the other side of the road, coming to rest in a cultivated field.


## Analysis

An examination of the engines failed to reveal any defect, abnormality or evidence of malfunctioning that may have contributed to or caused the engine failure.

The testimony of the pilot and crew revealed that there had been an unnecessary, unorthodox and complicated manipulation of the fuel cocks prior to take-off which suggested that the engine failure could have been due to mismanagement of the fuel system.

The nature of the engine failure was consistent with fuel starvation. Furthermore, the stage at which the engine failed corresponds with the point an engine would fail if the fuel had been turned off at the pre-take-off position.

Interrogation of the pilot revealed that this was only his second flight as a pilot of an Anson aircraft for some nine years and that he was not entirely familiar with the fuel system.

There is no possibility that the take-off could have been continued after the loss of one engine as tests show that an Avro Anson, with the undercarriage down, will only just maintain height on one engine, at an all-up weight of 7 400 lb, when operated under standard atmospheric conditions at sea level. The aircraft in this case was loaded to approximately 8 200 lb.

## Cause

The cause of the accident was the failure of the port engine, just after the aircraft became airborne, which resulted in the aircraft being unable to climb away. The engine failure was caused by fuel starvation probably due to mismanagement of the fuel system by the pilot □

# Think it through!

pilot contribution

I'M WRITING to relate an experience I had one spring. To set the scene, I had been operating an Aztec in N.Qld for several weeks, when I had to ferry it back down to Melbourne.

I had already ferried the aircraft to Sydney, the only major unserviceability being an alternator; this didn't affect me in any way as at this stage I was operating in the Private category and therefore was quite legal. The DME, too, was u/s — due to the exorbitant price quoted to replace a valve whilst away. I didn't consider these to be major problems, as it was a straight-forward flight that was planned.

The day after I had arrived in Sydney I departed for Melbourne, the planned route being SY-SLS-CB-CRG-ELW-PLE-EN. I obtained a forecast that indicated there was no cloud forecast between SY and CB, but from CB onwards tops were forecast up to 8 000ft. Based on this, I saw no problem in flying to CB at 8 000, then climbing to 10 000 to remain clear of cloud.

In Sydney that day the weather was fine and beaut, so I dressed in shorts and a tee-shirt. I got airborne and all was going well. As I passed Shellys I started to feel a little cold, so I selected the cabin heater. Unfortunately, that particular day it decided not to work (it had been OK the day before). However, I decided I could handle the temperature; I was only a little uncomfortable and anyway I had a sweatshirt I could put on.

I then commenced a climb to 10 000 and much to my surprise I found myself in cloud approaching Canberra. By the time I reached cruising altitude I was still in cloud and there was a little bit of rime ice forming on the wings. 'What's a bit of ice?' I thought to myself. I had encountered that plenty of times before.

However, and much to my surprise, near Corryong the ice quickly thickened. The OAT probe froze over at -4 degrees Celcius, and I was starting to feel the cold: in fact I was finding it difficult to write or operate the push-to-talk switch.

The ice build-up continued and I dropped to my Lowest Safe Altitude of 7 600, which itself was difficult to maintain. I was starting to get a bit concerned, due to a number of factors. Firstly, the oil temps were red-lining. I didn't like the look of this; obviously the coolers had iced over. Then there was the fact that I had only one alternator — should it fail, I would be left in a real predicament. Another worrying factor was that the airspeed had dropped from 140kt in the cruise to a meagre 100kt, yet my next LSA was 8 400. I could see the reason for the drop in airspeed: the HF antenna had grown ice about an inch thick before it snapped off. Need I say what the wings looked like!

I informed Cooma FS of the problems and they suggested that I should head there, as it was CAVOK. Unfortunately for me, the LSA for such a diversion was again 8 400, so I had to rule it out.

As the aircraft was becoming almost impossible to handle, I decided it was time for an actual diversion. I had not declared an emergency (what was the use — who could help me anyway?) but I was prepared to if my airspeed dropped any further.

Albury was the nearest suitable aerodrome, so I commenced a descent and headed there. Having passed 6 000, the aircraft started to shed ice, so I figured I was home and hosed. I'd land at Albury, remove the HF antenna, put on a warm set of clothes and reset the circuit breaker to the heating unit.

All these plans were dashed when I was informed that the only way to get to visual was via a VOR/DME approach. But of course the DME was u/s so all I could do was continue on to Essendon, as the weather was fairly crook north of the divide. The only other available place was Mangalore, but the weather was down on the deck there, too.

I eventually landed at Essendon without further incident. The HF antenna was still hanging on and the VOR antenna, which had been forward-facing, was bent back by the airflow over the accumulated ice so that it was perpendicular to the tail.

I feel that I was extremely lucky not to have become another statistic. If I had not have been alone there would almost certainly have been a disaster, for I think any extra passenger weight would have put us down.

All this trouble was caused by the desire to get home quickly. I took the short route without consideration of variable factors such as icing and cloud heights. Met forecasts are just that — forecasts. I had no plan of action to get me out of strife. As soon as I started collecting ice, I should have diverted to a more suitable route and, remembering that both oil temps were red-lining, we all know what would have happened if I had lost an engine...



Perhaps I should have declared an emergency, I don't know, but I was concerned about the consequential grilling that I would possibly receive from the Department. Maybe there could be some discussion on this aspect.

I hope that from my experience the readers of the Digest can learn too.

**Ben Schiemer** *(Examiner of Airmen GA) thanks the sender for a letter full of good messages, and makes the following observations:*

### Unserviceabilities

*Yes, in my opinion, it's OK to carry 'legal' deficiencies (there have been suggestions that if it's fitted it should be working, but that makes people avoid fitting a lot of good gear). But..., unless you're remaining within the circuit, don't count on the weather being good as a condition of going unless the patterns are widespread and stable, and if you plan to fly over tiger country, desert, unfamiliar regions or through CTAs, make every attempt to have operational redundancy in critical gear.*

### Weather

*Forecasting seems to be an art with about Prob 05 of being spot on. Because we know this, we tend to interpret the likelihood of the Met man being right or wrong in the light of our preferences at the time. What we must do is steel ourselves against proceeding on a forecast that has to be accurate if we are not to be in trouble. In this particular case, the cloud tops were forecast 8 000 and safety* ***depended*** *upon that being right! It wasn't. Like summer, autumn and winter, spring weather is fickle, only more so.*

### Clothing

*I've seen a lot of pilots flying in light clothing — even wearing thongs. But look at what the kerosene cowboys wear: boots, gloves, fire-resistant suits and helmets — and for the most part their job is no more hazardous than flying a GA aircraft. In an accident, the poorly clothed pilot will have much less chance of saving self, family or friends, and as the article shows, even a minor snag (heater failure) can become a major problem in adverse circumstances.*

### Icing

*It is dangerous to venture into icing conditions if your aircraft is not suitably equipped. If it isn't fitted with wing boots (that work), propeller heater and so forth, it wasn't meant to be flown into visible moisture above the freezing level. Here, our correspondent met only light ice: in heavy icing conditions an aircraft can be in dire straits in seconds, and out of control before it can be turned about. Wings lose their contour and drag increases; controls lock up and intakes block over. Perhaps worst of all, unheated props gather ice and become unbalanced: a potentially lethal sequence unless the engine is shut down, and then where is there to go? And at GA airspeeds, once there is an accretion of ice it is necessary to descend well below the freezing level before it will melt away.*

### Emergency

*If you have an emergency, a potential emergency or even an incipient problem, tell someone. Forget the OK phrases; tell it like it is and then either act upon any advice received or do what you as captain think is best. The ATC/FS staff will be your co-pilot until the danger has passed. Remember that, much as they do not need it, a call for help certainly relieves the tedium of (their) routine — they will want to help and use their professional expertise to your benefit. In this case, had the FS officer known about the icing problem, traffic hazards would have been assessed, cloud areas could have been mapped out from airborne reports, suitable diversions would certainly have been suggested (it is unrealistic to assume a pilot knows everything about possible bolt-holes), and other contingency actions would have been completed to cope with the emergency.*

### A grilling

*I won't deny it's happened, but that's the human condition. However, I believe a 'grilling' is much the exception, and not to be genuinely feared anyway, simply because the CAA, despite a bad press, will not support an unreasonable member of its staff. The overwhelming majority of us are keen to educate rather than berate, because we are well aware which approach is the more effective in the prevention of accidents. Obviously, if someone starts to abuse us we react like anyone else, but really, a 'grilling' is more the stuff of stories than of fact. To see us as ogres is to deny us one of our most pertinent functions — that of sensible analysis, evaluation of options and further education of all pilots (including ourselves) who have experienced dangerous situations in the air* □

# Quiz Quiz Quiz

(Answers on page 21)

Q1. You are captain of a charter flight and arrive over your destination only to find the aerodrome temporarily closed. There is 150kg of usable fuel remaining.

Your pax ask that they be taken to their second choice, 160 nm away. Aircraft details: Cruise fuel flow 80kg/hr; TAS 180kt 'Approved' holding consumption 48kg/hr

(a) In nil wind conditions, how far may you plan to fly from your present position (overhead the original destination) and still return if that aerodrome is declared 'open'?

(b) What is the effect on the distance calculated in (a) of
- (i) tail-wind out increase/nil/decrease?
- (ii) head-wind out increase/nil/decrease?

(JJ Harrison, Examiner of Airmen (Theory)

Q2. ATC direct that you climb/descend 'at standard rate'. What is required?
(G Evans, ATC Townsville)

Q3 (a) When the pilot of an aircraft at the holding point to a runway calls 'Ready', what conditions must be met?

(b) Having received line-up clearance from the Tower, may a pilot back-track to the runway threshold?

(GR Finlayson, Senior Tower Controller)

Q4. What is the rated coverage of a VOR beacon?
- (a) 60 nm
- (b) 120 nm
- (c) depends on the station — look it up in ERSA
- (d) depends on your altitude

(Mike Hennessy, Airways Surveyor)

Q5. You are to conduct a VFR private flight from Roma to Gladstone. You hold neither a NGT VFR Rating nor an Instrument Rating, so you must plan to arrive prior to last light Gladstone.

You have obtained the following TAF for Gladstone:

TAF GLA 2008 26005KT 9999 2CU030 4AC160
RAPID 2301 18010/25KT 5CU030
INTER 0608 2000 17TS 5ST007 2CB035
27 30 28 26 1019 1020 1019 1017

Your calculated last light for Gladstone is 0754UTC and you have a total time interval of 89 minutes.

What is your latest possible departure time Roma?

(Alan Betteridge, Flight Service instructor)

Q6. May a private pilot legally replace a broken radio aerial on an aircraft?
- (a) No
- (b) Yes, providing he owns the aircraft
- (c) Yes, on VFR aircraft only
- (d) Yes, on private aircraft only
- (e) Yes




AVIATION SAFETY DIGEST reports incidents, recounts stories, relays technical information, represents the pilot and others involved in aviation, and, to the extent that it falls short of being a legal document, reflects the viewpoint of the CAA.

We have noted previously that regulation alone may well have been exhausted as a means of reducing accidents. This is not to say the CAA is on autopilot — there are moves afoot to make CARs, CAOs and subsidiary legislation more user-friendly (or at least, somewhat simpler).

Although an aviator will always benefit from reading about another's brush with disaster, we are all fortified in the diligence of our personal pursuit of safety by the knowledge that there are a lot of fellow flyers who think twice — nay three times even — before committing themselves (and their passengers — never forget the pax) to operations in marginal conditions. Self-discipline, mechanical reliability and the correct application of hard-gained expertise are but the three leading links in the chain of circumstances that define a truly successful flight.

The wide range of submissions that cross the editor's desk are testimony that 'marginal conditions' cover practically everything. There are a million articles out there in the real world, and a zillion incidents (99% of which you wouldn't dream of putting your name to — that's OK, we'll respect your desire for anonymity). So why not share your hard-earned lessons? As I said, **your** story is unique!

To be part of this accumulated wisdom, those with an interest in flying, be it as a professional or paid-for-by-yourself, will do themselves a favour by reading the Digest on a regular basis; if you do not obtain a free copy, the subscription form is, as they say, overleaf.

# AIRFLOW

## Feeling a little query?

The AIRFLOW column is intended to promote discussion on topics relating to aviation safety. Input from student pilots and flying instructors is particularly welcome.

Anonymity will be respected if requested. 'Immunity' applies with respect to any self-confessed infringements that are highlighted for the benefit of others.

Write to: AIRFLOW
*Aviation Safety Digest*
G.P.O. Box 367
CANBERRA A.C.T. 2601
Australia

AERONAUTICAL INFORMATION SERVICE AUSTRALIA

# NOTICE

## CURRENT DOCUMENTATION AND PLANNED NEXT ISSUE

| Document | Current Issue # | Planned Next Issue # |
|---|---|---|
| DAP(E) | 28–6–90 | 23–08–90 |
| DAP(W) | 31–5–90 | 26–7–90 |
| INTERNATIONAL AGA 0 - 1 - 2 | 31–5–90 | 30–5–91 |
| AIP ( book ) | 3–5–90 | 23–8–90 |
| VFG (book ) | 3–5–90 | 23–8–90 |
| AIP/MAP | 14–12–89 | 23–8–90 |
| VFG/MAP | 14–12–89 | 23–8–90 |
| DAH | 14–12–89 | 23–8–90 |
| ERSA | 8–3–90 | 23–8–90 |

# Dates quoted are effective dates

NOTE : NOTAM CLASS I AND CLASS II ARE TO BE READ IN CONJUNCTION WITH THE ABOVE DOCUMENTS

ISSUE : 10
DATE : 08 MAR 1990



# Field Office Forum

## Western Australia

IN Western Australia the aviation industry is faced with the problem of providing services to a small population spread across a large land mass: less than one tenth of the population of Australian lives in an area approximately one third of the Australian continent. This small population means smaller revenue generation with consequential limitations on the size and numbers of the facilities that can be provided.

This set of circumstances has resulted in the development of perhaps higher than average numbers of Authorised Landing Areas (ALAs) to service mainly private and charter operations in Western Australia. People in the aviation industry are probably aware that the concept of establishing landing areas by general description is a means of enabling more people to benefit from aviation without incurring the costs associated with the CAA having to accept responsibility for the day-to-day standard of these facilities.

A number of the larger country towns in WA provide ALAs which are, to all intents and purposes of the users, the same as licensed aerodromes. This similarity in appearance has led some pilots to overlook or ignore the essential differences between licensed aerodromes and ALAs.

An important example is that there is no system of notification to pilots when an ALA is unsuitable for aircraft operations. To overcome the dangers associated with attempts to land at ALAs which are either temporarily or permanently unserviceable, the CAA introduced a requirement (see AIP AGA-6-2), that pilots are to ensure that the runway is suitable for landing or take-off. The Notes at AGA-6-6 go on to remind pilots that they may require the approval of the landowner before using an ALA.

It seems that familiarity breeds complacency and during 1989 we saw in WA a number of incident reports submitted after pilots had landed at unserviceable ALAs, thankfully without major damage or injury. In one incident, a pilot attempted to land in the middle of runway works — to the embarrassment of the pilot, anger of the council workers, and confusion of the ALA owner.

The message must be brought clearly home to all pilots who operate regularly into ALAs that even though the strip may look like a licensed aerodrome there is no system established by the CAA whereby pilots can be, or are, notified of runway works in progress, of temporary damage, erection of power lines, or even of the closing down of maintenance at an ALA. Even if you fly to town once or more a week, it is your responsibility to ensure, each time, that the ALA will be suitable for your landing.

There is also a message in this for the owners and operators of large 'public' ALAs (in the main, country councils or shires). Firstly, be aware that the CAA does not, and cannot, exercise control over the condition of your 'aerodrome' and, most importantly, cannot provide a system of notification to pilots when you intend to carry out runway works or otherwise change the usability of the ALA. When using an ALA, a pilot is under a common law duty of care to his passengers to take reasonable care in all the circumstances to prevent injury. It is, of course, also the pilot's responsibility to ensure that the aircraft is of a type authorised to land and take off at that ALA, that the aircraft is engaged in operations specified in the instrument of authorisation for that place, and that any conditions specified in the authorisation are complied with.

ALA owners should also consider their situation at common law, under which is owed a duty of care to pilot and passengers of aircraft that are to use the ALAs. An owner providing an unlicensed aerodrome which is generally intended to be available for public use, but is temporarily not suitable for that purpose, may be held liable if reasonable steps are not taken to bring this to the attention of pilots who are likely to use the facility and thereby cause damage to their aircraft and injury to themselves or other persons.

Although it is not possible to use the NOTAM system of notification in association with ALAs, consideration can be given to the use of notices in local newspapers, to posters at the ALA itself, notices posted at the offices where landing fees are collected, and even aviation magazines such as AOPA. Owners are advised that there is no restriction under aviation law on the collection of fees for use of ALAs; indeed such revenue might be used to fund an appropriate notification system.

Finally, ALA owners in need of assistance in the marking of unserviceable areas etc are advised that the CAA Field Offices may be able to act as consultants, on a fee-for-service basis, for all matters associated with aerodrome standards and aerodrome operation □

# My BFR

*Pilot submission*

ON THE PHONE Ron seemed such a reasonable sort of bloke. He reminded me of the need to do a flight review every two years. Even offered to drive out, look over my property and let me operate from my own ALA. Naturally, I agreed to that.

Anyway, Ron turned up last Wednesday.

He said he was a bit surprised to see the plane outside my homestead because the ALA is about a mile away. I explained that, being closer, this trip was more convenient. Actually, there are power lines crossing it at about midway but it's really no problem to land and take off because at the half-way point you are always on the ground.

For some reason Ron seemed nervous. So, although I had done the pre-flight inspection only four days earlier, I decided to do it again. Because he was watching me carefully I walked right around the plane three times instead of my usual once.

My effort was rewarded because the colour returned to Ron's cheeks — in fact, they went bright red.

In view of Ron's obviously better mood I told him I was going to combine the flight test with my requirement to deliver three poddy calves from the home paddock to the main herd. After a bit of a chase I caught the calves and tossed 'em in the back.

We climbed aboard but Ron started nagging about weight and balance calculations. Of course, I knew that sort of thing was a waste of time because the stock likes to move about a bit. However, I did assure Ron that I keep the trim wheel araldited to neutral so we would always remain stable.

Anyway, I started the engine and cleverly minimised the warm-up time by tramping hard on the brakes and gunning her to 3 500 RPM.

I then discovered that Ron has very acute hearing. Through all that noise he detected a metallic rattle and demanded I account for it. Actually it was caused by a screwdriver that last month fell down a hole in the floor and lodged in the fuel selector mechanism. The selector can't be moved but because it was on 'All Tanks' I figured it didn't matter. However, as Ron was obviously a nit picker I blamed the noise on vibrations from a stainless steel thermos I keep in a beaut little possie between the windshield and the magnetic compass.

My explanation seemed to relax Ron because he slumped back in his seat and looked at the cockpit roof.

I released the brakes to taxi out but unfortunately the plane gave a leap and spun to the right. 'Oh hell', I thought, 'not the starboard wheel chock again.'

The bump jolted Ron back to full alertness. He looked around wildly just in time to see a rock thrown up by the propwash disappear through the windshield of his new Commodore.

While Ron was busy ranting about his car I ignored his requirement that we taxi to the ALA and took-off under the powerlines. Ron didn't say a word — at least not until the engine coughed at lift off, then he screamed, 'Oh God!'

'Now take it easy', I told him firmly, 'that often happens on take-off and there's a good reason for it.'

I explained patiently that I usually run the plane on standard MOGAS, but one day I accidentally put in a gallon or so of kerosene. To compensate for the low octane of the kero I siphoned in a few gallons of super MOGAS and shook the wings up and down to mix it up. Since then the engine has been coughing a bit, but in general it works just fine.

At this stage Ron seemed to lose all interest in the flight test. He pulled out some rosary beads, closed his eyes and became lost in prayer.

I selected some nice music on the HF to help him relax.

Meanwhile, I climbed to my normal NOSAR NO DETAILS cruising altitude of 10 500 feet.

On levelling out I noticed some wild camels heading into my improved pasture. I hate camels and always carry a loaded .303 carbine clipped inside the door. We were too high to hit them, but as a matter of principle, I decided to have a go through the open window.

The effect on Ron was electric. As I fired the first shot his neck lengthened by about six inches and his eyes bulged like a rabbit with myxo.

In fact, Ron's reaction was so distracting that I lost concentration and the next shot went through the port tyre.

Ron was a bit upset about the shooting ('Probably one of those pinko animal lovers', I thought) so I decided not to tell him about our little problem.

Shortly afterwards I located the main herd and decided to do my fighter pilot trick.

Ron had gone back to praying when, in one smooth sequence, I pulled on full flap, cut the power and started a sideslip down to 500 feet.

About half way through the descent I looked back to see the calves gracefully suspended in mid air. I was going to comment on this unusual sight but Ron had rolled himself into the foetal position and was emitting high-pitched squeals.

At about 500 feet I levelled out but for some reason we continued sinking. When we reached 50 feet I applied power and that helped quite a lot.

As luck would have it, at that height we flew into the dust cloud caused by the cattle and went IFR. I made a mental note to consider an instrument rating as soon as the gyros are repaired. Suddenly Ron's elongated neck and bulging eyes reappeared. His mouth opened wide, very wide, but no sound emerged.

'Take it easy', I told him, 'we'll be out of this in a minute.'

Sure enough, about a minute later we emerged; still straight and level and still at 50 feet. Admittedly, I was a bit surprised to notice we were upside down. This minor tribulation forced me to fly across to a nearby valley in which I did a half roll to get upright again.

By now the main herd had divided into two groups leaving a narrow strip between them. 'Ah', I thought, 'there's an omen. We'll land there.'

Knowing that the tyre problem demanded a slow approach I flew a couple of steep turns with full flap. Soon the stall warning horn came on and so I knew we were slow enough. I turned steeply onto a 75 foot final and put her down. Strangely enough I had always thought you could only groundloop in a taildragger.

Halfway through our third loop Ron at last recovered his sense of humour. Talk about laugh... I've never seen the likes of it: he couldn't stop!

We finally rolled to a halt and I released the calves. I then began picking clumps of dry grass. Between gut-wrenching fits of laughter Ron asked what I was doing.

I explained that we had to stuff the port tyre with grass so we could fly home.

It was then that Ron started running. The last I saw of him he was off into the distance, arms flailing in the air and still shrieking with laughter. I later heard he had been confined to a psychiatric institution.

Anyhow, that's enough about Ron; I just got a letter from CAA withdrawing, as they put it, the privilege of holding a licence to fly. Now I admit I made a mistake in taxiing over the wheel chock but I can't see what else I did that was so terrible. Can you? □



# Survey of General Aviation crashworthiness features

'CRASHWORTHINESS' — a part of aviation that nobody really wants to know about — suddenly becomes top priority when you are in an aircraft that might be just seconds from an unplanned interface with terra firma.

Sometimes items of crashworthiness, such as worn seat attachments, frayed seat belts or faulty inertia reels, are often overlooked during the routine inspections of the aircraft systems.

To gain an understanding of the various aspects of crashworthiness features in GA, the Aviation Medicine Branch are conducting a survey of aircraft in service. Members of the Branch, in company with Airworthiness officers are visiting various centres throughout 1990. Aircraft, selected at random from the various types of GA operation (training, ag. charter, etc), will be carefully inspected. Not, though, before obtaining the owner/operator's consent — this is in no way surveillance: it is an exercise in education for the CAA with the object of gaining information on the broad issues of crashworthiness.

**Better knowledge = better safety;**

**the surveys are for the benefit of all and your co-operation is sincerely appreciated.**

# NIL DEFECTS

## Cranky business

A major contributing factor to failure in piston engines is the heat treatment process associated with the weld repairs of crankcases and cylinders, according to an investigation by the CAA.

The investigation, carried out over the last several months, found that a significant number of repaired crankcases and cylinders had failed in service.

CAA investigators found that the failures were caused by the initiation and rapid growth of fatigue cracks — some of which resulted in the complete separation of cylinders, cylinder heads and, once, a severe in-flight fire.

These fatigue cracks were related to the adverse effect welding repairs had on the strength of the heat-treated aluminium alloys used in the original engine components. Analysis of the investigation results showed that repair procedures were not ensuring that the welded alloy component was returned to specification.

A report on the issue says, 'Any repair process which involves heating — for example, pre- and post-heating, stress-relieving or heating to allow disassembly and re-assembly of parts of a component — may effect the mechanical properties of the component by affecting [the strength of the material].'

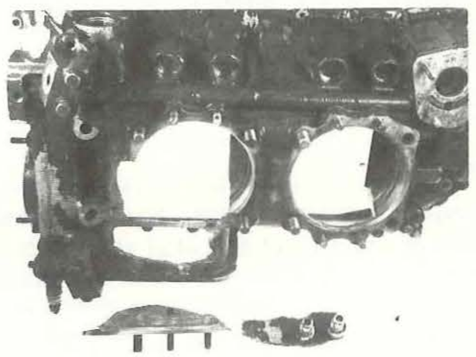
The report, titled 'Deficiencies in Crankcase and Cylinder Repair Procedures — Continental Lycoming Horizontally Opposed Engines', was presented at a conference of CAA Airworthiness officers in Canberra on 20 February 1990.

The conference, involving technical specialists responsible for engine defect analysis, maintenance related problems and material evaluation, was told that there was an increasing number of failure in piston engines which had been welded. It was also told that the Federal Aviation Authority in the US had noticed a similar trend.

The Canberra conference decided that the way around the Australian problem was an education program to spell out to industry the proper techniques to be used for the welding of aluminium alloy engine components. The planning of this education program is now underway and industry will be advised as soon as the program is finalised.

*Aviation Safety Digest* will keep you up to date on these initiatives ☐

**Lycoming O-360 crankcase**



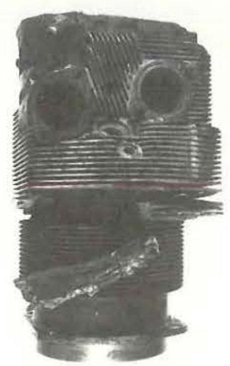
*Nature of failure*: Large section of crankcase broken away

*Nature of repair*: Extensive welding in the lower skirt region, lower cylinder deck region, no.3 cylinder

*Time since repair*: 270 hours

*Cause of failure*: Rapid propagation of fatigue crack, initiating near a stud. Parent metal softened in the region of stud thread, hardness 60-85 HV10, original component hardness in the range 97-101 HV10.

**Lycoming cylinder GSO-480**



*Nature of failure*: Partial separation of cylinder head from barrel - severe inflight fire with engine mounts so badly affected that the engine sagged onto the lower cowling.

*Nature of repair*: Cylinder barrel chromium plated.

*Time since repair*: 400 hours +

*Time since last inspection*: 21 hours

*Cause of failure*: Separation of head caused by rapid fatigue crack growth from barrel retention thread. Cylinder head material had been softened by processes used to disassemble and reassemble the cylinder during chromium plating, hardness of the head in the range 60-68 HV10 - original material hardness in the range 88-92 HV10.



# AIRFLOW

Dear Sir,

I have been told that aircrew members should not be blood donors. This came from an unqualified source. I am aware that I could get an expert opinion from Aviation Medicine but I felt a paragraph or small article in the Safety Digest on this matter would benefit a number of people. Maybe you could give this some consideration for a future Safety Digest.

Gary Cameron

*From time to time the question is asked by flight crew members as to whether or not they may donate blood. In a healthy individual the donation of one unit of blood every four to six months should not cause any problem likely to interfere with that individual's ability to operate an aircraft. All blood donation centres check the donors haemoglobin level prior to taking blood. If this level is thought to be on the low side of normal, blood donation is not proceeded with. The only other significant effect related to blood donation is the loss of 500mls of fluid volume from the central circulation. This fluid depletion will invariably be replaced over the ensuing 24 hours by normal drinking. In light of the above, individuals who donate blood should allow the elapse of at least 24 hours prior to proceeding with duties as a flight crew member.*

*Dr R W Liddell , Director, Aviation Medicine*

Dear Sir,

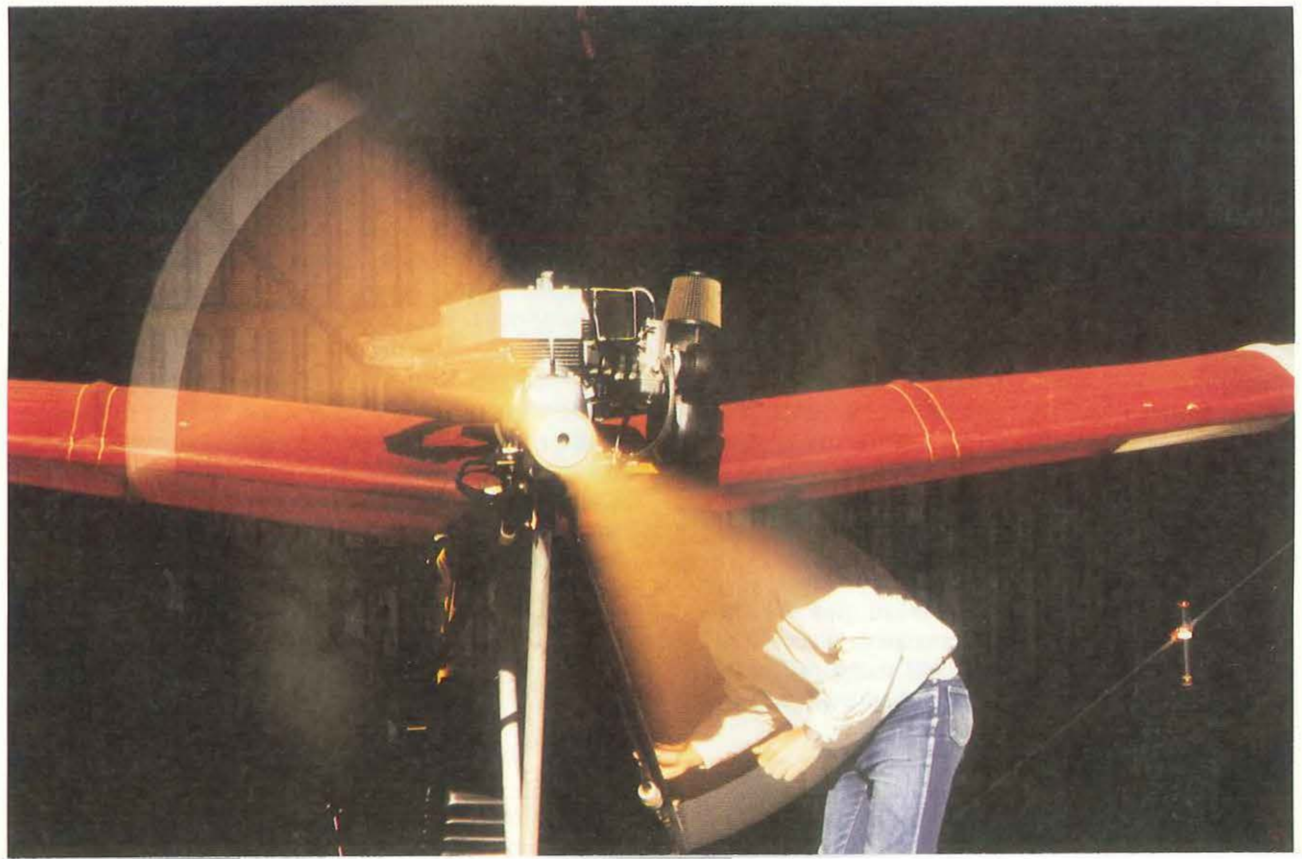
Re *ASD 142, AIRFLOW*, page 18:

The reference by R E Baird, and your reply, reminds me of the everyday habit of grabbing hold of the propeller to push or pull an aircraft around. The engine may be cold or hot (she's right, mate!). Is the ignition switched ON or OFF? — and I wonder if the ignition's earths are intact? (Gosh-where *are* those earth points?) Offenders often are experienced airmen, and include instructors.

I'd like to see BLAZONED REMINDER SIGNS around the hanger and in the flight office. While I'm on the job, thank you for your valuable publication. The QUIZ is a very good idea, too; helpful and informative, especially to the many who are no longer with training organisations.

Old and Not So Bold.

*. . . and thanks to you, too, O&NSB, for your support. OK, so we don't hear about too many heads being chopped off as a result of unexpected ignition, but, once again, the chance of such an accident is a risk that is totally unnecessary for anyone to take.*



# AIRFLOW

Dear Sir

The Summer *Aviation Safety Digest* contained an article, on the subject of mid-air collisions between gliders, which highlights an anomaly existing in the operation of aircraft cruising at or above 5 000'. Whilst their powered counterparts are busily maintaining quadrantal cruising levels, giving accurate position reports, and evaluating the relative position of other traffic in their area, all in the interest of collision avoidance, glider pilots do not maintain a particular level or track, or, as your article implies, carry VHF COMMS. Whilst gliders cannot, by necessity, maintain levels or tracks, the carriage and use of VHF COMMS, if they intend operating above 5 000', would reduce the risk of mid-airs. If a glider pilot copies the position report of an IFR CHARTER aircraft which indicates his track will cross the 'cloud street' in which gliders are operating, a simple broadcast could avert disaster. If a glider inadvertently drifts into an AFIZ (a glider pilot I know says this happens occasionally at places like Dubbo) it would be appropriate to alert the AFIS.

The disregard for other traffic which results from the rules under which gliders operate is, however, overshadowed by what I consider a dumbfounding disregard of the pilot's own safety. Your article described two, apparently experienced, pilots who climbed into aircraft from which they were quite prepared to jump and in which all landings are forced, yet did not have the facility to transmit a MAYDAY when an apparent risk became reality. One pilot, injured and bleeding, had to land near the 'pie cart' in the hope that someone would notice him and come to his aid.

I believe anyone who can fly an aircraft, powered or otherwise, can be taught how to use a FISCOM, and should be obliged to carry and use VHF if he or she intends to operate at or above 5 000'. In the meantime, all those powered pilots who thought they were safe on full reporting at or above 5 000', beware! Gliders may be there. Many are deaf and dumb, and many carry a piece of emergency equipment you don't — a parachute!

Yours faithfully

Clint Mckenzie

*Standards Development Division and the Operational Standards and Procedures Branch of Airways Operations Group offer the following comments on Mr McKenzie's observations:*

*The matter of carriage and use of radio by gliders was considered at length by the Authority's Standards Development Division last year, to honour a commitment given when the flight notification requirements were reviewed in 1979. In fact many gliders do carry quite sophisticated VHF radios and there are circumstances when their use is required (e.g. in controlled airspace). In his article Duncan Ferguson didn't say, but it is quite likely his radio was rendered useless by the collision, just as may occur to an aeroplane. The limitation on glider radios is more due to limited battery capacity than technical sophistication or pilot ability to use them.*

*Glider pilots, like all VFR traffic or IFR traffic flying in VMC, must keep a good lookout, and are obliged to maintain separation from powered aircraft by 500 feet/600 metres.*

*If glider positional information were passed by VHF radio to aircraft and/or Flight Service, it would only be of limited value. The information is valid for approximately two minutes only; beyond that time the altitude and position cannot be predicted.*

*Apart from traffic, another reason for aeroplanes and helicopters to give position reports is that the CAA has the search and rescue alerting responsibility for them. Gliders have their own approved organisation — the Gliding Federation — for search and rescue alerting.*

*The gliding symbol + +, with or without a W to indicate wire launching, is intended to imply the presence of gliders within a 20 mile radius. When a gliding contest is on and several gliders are flying the same course, a NOTAM is issued to advise other pilots of this.*

*Gliders planning to fly beyond 20 miles from their base are requested to advise Flight Service so that other pilots may be made aware of a glider in the area, but bear in mind that the pilot's intentions may change depending on the weather encountered en route. Nevertheless, FS, having received a radio message from a glider that operations are taking place in a particular area 5 000ft and above, will provide general information to IFR, RPT and MLJ , (and, indeed VFR aircraft on a 'one-off basis) eg 'Glider operating in . . . area at time . . .,last reported level . . .'.*

*In short, the best way to protect your aircraft is to rely on your own (and your passengers') eyes instead of somebody else's radio, which can at best only indicate that there may be something to see.*



# AIRFLOW

Dear Sir,

'Sequence of Events' (*ASD 142*) prompts me to have my say in the knotty question of Instrument Ratings.

There is only one useful instrument rating in this country: the first class instrument rating, the same as a Jumbo pilot has, together with the renewal and recency requirements. It also represents the sort of time and expense that I for one can't afford, let alone keep on the off-chance that I might be caught in cloud someday. As a private pilot of thirty years' experience, now flying a SE four-seater, that rating is completely out for me.

In Britain, where I learned to fly, and where instrument flying is a part of life (or death if you don't have the experience), they brought in the very successful IMC rating. It was useful for people like myself, who just needed to penetrate cloud in a controlled condition to go, say, VMC on top, or descend through cloud into VMC before landing. We were thus able to go, rather than stay on the ground, or, what was worse, go and try to remain below cloud and risk scattering ourselves over the hills.

I'd like to know people's reaction to such a licence in Australia, particularly as the night rating is not now considered an instrument rating, and opinion appears to be 'Don't go!', rather than help to get us airborne.

For instance, I was in a twin from Kalgoorlie to Perth. In command was a four-ringer with an instrument rating. On take-off he immediately selected autopilot and stayed on it throughout the journey. About 50 DME Perth, under radar control and just past last light we were cleared to descend from our cruise at 10 000ft. There was a band of cloud, tops about 7 000, base around 3 000; LSALT was 2 500. The first penetration was in patchy cloud with some sky reference, and part ground reference. As we reached 4 000, it was solid whiteout for about thirty seconds before we broke clear. My point is that under VFR I would be illegal to do that, and would have had to divert. With an IMC rating, that slight penetration of cloud would allow me to complete my journey, without the complication of a full IFR rating.

E A Mills

*Requests for an en route instrument rating have surfaced many times over the years. Quite rightly, in our opinion, the authority of the day has not developed a rating for the purpose specifically described by the correspondent, although he is right in implying that a signal delight in flying is the ability to climb out through some cloud, enjoy a smooth ride on top, then descend through patchy cloud at your destination without having to do an instrument approach. No need for a formal and expensive course here! However, let me give you another scenario: some years ago I expected such a trip, from S. Qld to Canberra, for the weather men had assured me of VMC all the way. No sir! By the time I reached home I had flown an NDB approach to just above MDA for a fuel stop at Dubbo, and then was faced with a 'real' ILS into Canberra. Total time in cloud five hours thirty and two instrument approaches when the forecast had indicated virtually no cloud!*

*Proponents of an en route instrument rating for the Australian scene should think again. Forecasts are notoriously inaccurate, due to, I hope, the relatively few weather stations given the size of the continent. Frequently there are no reliable forecasts or actual reports of weather (ie no met. observer) at the destination. Therefore I believe it would be irresponsible, on the balance of probabilities, to state that the proposition would hold good as an approved procedure for Australian conditions, either down to lowest safe or any other selected height. In my opinion the hardest part of any instrument approach — and that is what you might be committed to once you have entered cloud — is the necessary manoeuvring from arrival overhead the beacon to the commencement of the outbound leg. The rest is relatively easy.*

*To summarise: the 'en route' instrument rating is currently catered for by the Command Instrument Rating, the only safe way, I believe, to even consider flight in IMC. Although commercial pressures exist to train you on all aids (NDB, ILS/LLZ, VOR and DME), a rating may be obtained on only the NDB if you so wish. You need to pass the relevant exams, with just 15 hr of simulator time plus 15 hr of additional flying training IF YOU ARE GOOD ENOUGH. If you are serious about your flying, that's the way to go! —* ***Steve Tizzard*** *(E of A, GA)*

*[and refer* ***Brian Hill's*** *letter in ASD 144 re financing this achievement — Ed]*

# '...Take a deep breath!'

*Incident:—*

*At first glance the details of the flight might not have seemed particularly unusual — just a Cessna 172 on a private VFR flight from Broken Hill to a country town in South Australia. But it didn't take Adelaide FS long to notice one thing that was out of order: the pilot had reported to Broken Hill that he was cruising at FL 140. A Cessna 172? . . . At 14 000 ft? The FSO called the aircraft and enquired anxiously of the pilot: 'Are you equipped with oxygen?'. The reply was slow in coming, with the words slurred and enunciated very slowly . . . 'Nuh-eg-a-tive'.*

*The FSO immediately suggested that the pilot begin a descent to below 10 000 ft. This advice was followed, although communications from the aircraft still reflected a state of mental confusion and drowsiness on the part of the pilot. However, once established below 10 000 ft there appeared to be no further evidence of incapacity, the radio transmissions became crisp and competent and the flight was completed without further incident.*

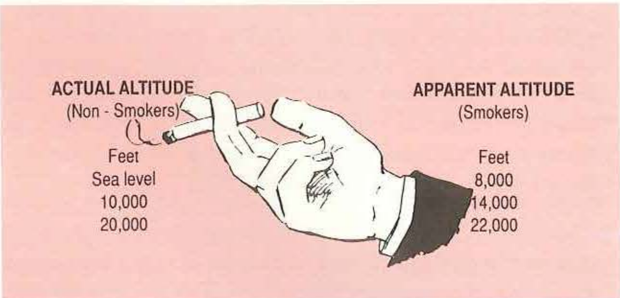
*The pilot later explained that he had climbed to FL 140 in an attempt to avoid the strong headwinds encountered at his planned level of 6 000 ft. Altogether, the cabin altitude had been above 10 000 ft for around 35 minutes. Throughout this time, of course, the pilot should have been using oxygen.*

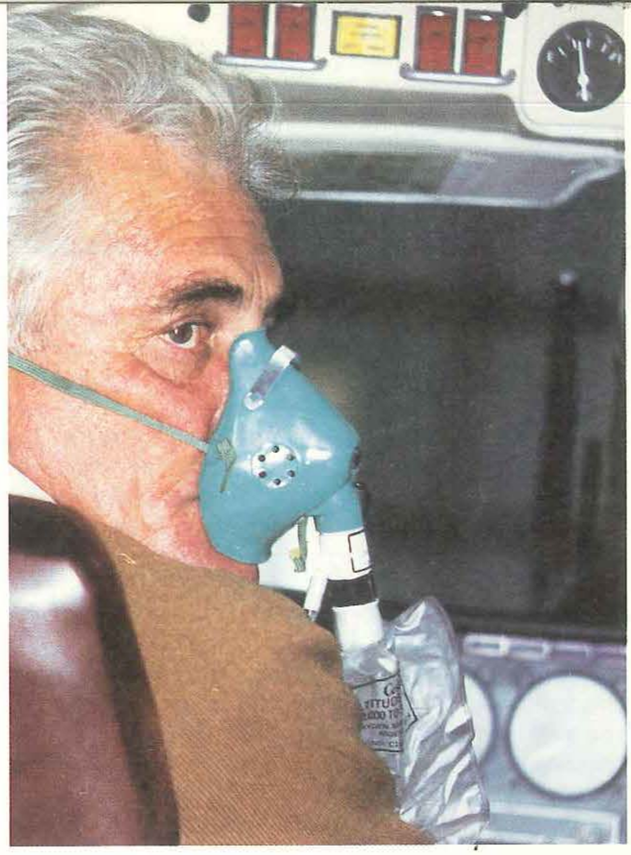
*On this occasion he was lucky — an alert FSO picked the apparent anomaly in aircraft type and actual altitude and made an intelligent assessment of the true situation. As it was, the flight ended safely, but it is more than possible that had it continued at FL 140 without the pilot being on oxygen the progressive effect of hypoxia (oxygen deprivation) would have led to disaster. (from a previous ASD)*

*Incident:—*

| | |
|---|---|
| *Aircraft type:* | *Beech Baron* |
| *Pilot rating:* | *Senior Commercial* |
| *Category:* | *Private flight — Corporate/executive* |
| *Details:* | *Pilot failed to make a position report; INCERFA declared; contact finally made and aircraft descended to below 10 000 ft; flight completed normally.* |
| *Diagnosis:* | *Pilot had fallen 'asleep' for 22 minutes.* |
| *Reason:* | *Hypoxia allied to fatigue* |

★ ★ ★



CIVIL AVIATION Order 20.4 has been reissued, and one positive result is that it now should be significantly less expensive to fit an oxygen system for certain types of operation.

This article only addresses *single-pilot* aircraft (there are additional changes in the Order relevant to multi-crews, but they will be actioned by company check and training organisations).

Essentially, the new Order now allows **chemical** oxygen systems to be fitted for operations by pressurised aircraft up to FL 250. The changes to achieve this are:

(a) the deletion of the previous requirement for a pre-flight functional check, ie actually donning a mask and breathing the gas (not possible with chemical systems because, once initiated, the oxygen-producing reaction is unstoppable);

(b) for the operating crew, a reduction in the minimum quantity of supplemental oxygen to be provided from 45 to 15 minutes; and

(c) a choice for the aircraft operator to provide 30 minutes of oxygen for 10% of the passengers or — and this is part of the amendment — **15** minutes for 20% (chemical systems, although generally able to supply all passengers, only last about 15 minutes and once oxygen is initiated it will be necessary to descend to below 10 000 ft before the supply runs out).

It is important to remember, though, that there is still a requirement to confirm the physical serviceability of the system (mask, hoses etc pass your visual examination), and that there must be an approved self-check feature, eg 'press-to-test' light, to assure you that the system has not previously been fired. This is necessary because the equipment is likely to be fitted behind panels, and anyway it may not be immediately obvious from looking at the oxygen generator whether or not it has already been used.



A further, and most important, point is that the pilot's oxygen mask must have an integral microphone (CAO 108.26.5). It's not much use (dangerous, in fact) to try to pass your ATS messages 'off oxygen' when you're above 10 000 ft cabin altitude.

So the new Order can make compliance somewhat cheaper for operators of pressurised aircraft, and oxygen may be seen both as an aid to more efficient operations and as a further form of insurance against the possibility of being forced into a threatening situation in the air.

**COMPARATIVE ANALYSIS OF HYPOXIA SYMPTOMS VS ALTITUDE**

| Ambient Altitude (Feet) | Time before Symptoms | Typical Symptoms |
|---|---|---|
| 0 | | none |
| 4000 | | some loss of night vision |
| 10000 | 4 Hrs. | fatigue, sluggishness |
| 15000 | 2 Hrs. (or less) | fatigue, drowsiness, headache, poor judgement |
| 18000 | 1/2 Hr. (or less) | false sense of well-being, over-confidence, faulty reasoning, narrowing field of attention, blurring vision, poor memory |
| 20000 | 1/4 Hr. (or less) | loss of muscular control, judgement, memory, reasoning, time-sense; repeated purposeless movements; emotional outbursts |
| 22000 | Minutes | convulsions, loss of consciousness |
| 26000 | 4-6 Min. | loss of consciousness |
| 30000 | 1-2 Min. | loss of consciousness |
| 38000 | 30 Sec. (or less) | loss of consciousness |
| 50000 | 10-12 Sec. | loss of consciousness |

As a general observation, it's important to realise that, although the rules only *require* oxygen above 10 000 ft cabin altitude, mild hypoxia, the first stage of oxygen deficiency, manifests itself particularly by night **above 4 000 ft**, causing a significant loss of visual acuity ('Aeromedical Training for Flight Personnel', Department of US Army, 1983). And if you're one of that fast-disappearing(?) breed, *the pilot who smokes*, be aware that even at sea level the oxygen efficiency of your body may be equivalent to that of a non-smoker at 8 000 ft!

*NOTE: If you are the proud owner of an unpressurised aircraft which is able to fly above 10 000 ft, supplemental oxygen could increase your operational envelope dramatically, if only by allowing you to climb above the weather or take advantage of favourable tailwinds aloft. However, as you are required to breathe oxygen continuously above 10 000 ft cabin altitude, chemical systems will be of limited value because they normally only last for 15-20 minutes. Better by far, if you wish to consider flight above that altitude, to fit a gaseous oxygen system* □

A1(a).

$$\text{Time to PNR} = \frac{\text{Safe Endurance} \times \text{G/S Back}}{\text{G/S Out} + \text{G/S Back}}$$

Safe Endurance = Fuel remaining minus Reserves (ie plan to arrive back with reserves intact). Therefore 150 minus fixed reserve (45 minutes at approved consumption rate) 36 = 114 kg. This figure represents 115% (ie flight fuel + 15%), so 100% = 99 kg. 99 kg @ 80 kg/hr = 74 min safe endurance

$$\text{Time to PNR} = \frac{74 \times 180}{180 + 180} = 37 \text{ min}$$

$$\text{Dist to PNR} = \frac{\text{Time to PNR} \times \text{G/S out}}{60} \text{ nm} = \frac{37 \times 180}{60}$$

= 111 nm

(b)(i) Take the example of a 40 kt tailwind from departure:

$$\text{Time to PNR} = \frac{74 \times 140}{360} = 28.8 \text{ minutes}$$

$$\text{Distance to PNR} = \frac{28.8 \times 220}{60} = 106 \text{ nm}$$

(ii) For a 40 kt headwind:

$$\text{Time to PNR} = \frac{74 \times 220}{360} = 45.2 \text{ minutes}$$

$$\text{Distance to PNR} = \frac{45.2 \times 140}{60} = 105 \text{ nm}$$

In other words, for both tail and headwind the distance to PNR will DECREASE (standard navigation formulae)

A2. A rate of climb/descent of at least 500 fpm until the final 1 000 feet of the level change, then a rate of 500 fpm over the 1 000 feet to the assigned level
(AIP RAC/OPS 0-23 10.2.3.3)

A3.(a) If cleared for take-off, a pilot should not backtrack *or* stop in a lined-up position; the aircraft must make a 'roll-on' take-off in one continuous movement.

(b) Yes
(AIP RAC/OPS-0-52 subject 5)

A4. (d). For planning purposes, the rated coverage of a VOR is:

| Aircraft altitude (feet) | Range (nm) |
|---|---|
| Below 5 000 | 60 |
| 5 000-10 000 | 90 |
| 11 000-15 000 | 120 |
| 16 000-20 000 | 150 |
| Above 20 000 | 180 |

(AIP RAC/OPS-1-46 8.2.2.4)

| | |
|---|---|
| A5. Last light as calculated UTC | 0754 |
| minus 10 minute 'buffer' | −10 |
| minus 30 minute Wx holding | −30 |
| Latest possible arrival time UTC | 0714 |
| minus total time interval | −89 |
| Latest possible departure time UTC | 0545 |

(AIP RAC/OPS-0-12. 3.2.2 NOTE 2 *[but see also NOTE 1]*;
VFG 24-1 and 24-2)

A6. (c)
(ANO 100.5.1 Appendix II)

# GROUND TO AIR

SCENE: Charlene and Ralph are at the counter in the Bankstown Briefing Office, and have submitted a flight plan for a below 5 000 ft flight to Hillston in South-West NSW.

**FS Briefing Officer:** Let's have a look ... you've indicated Katoomba, Cowra and abeam West Wyalong as reporting-points by putting a plus against them. You've also nominated a SARTIME. If you intend proceeding B050 on a SARTIME you don't need to plan reporting points, or to make position reports. But you are required to make a broadcast prior to transitting the aerodrome at Cowra, and again at West Wyalong if you are within 10 miles of the aerodrome. Plus your inbound call at Hillston.

**Ralph:** What sort of broadcast?

**FS B.O:** Well, basically you are required to broadcast at 20 miles from the aerodrome, or descending through 5 000 feet, your aircraft type, position, actual level, estimate and intentions. Something like ... *'All stations Cowra, ZZZ Cessna 172, two-zero miles north east, two thousand, Cowra at four five, overflying for Hillston'*, will do fine. Incidentally, you'll be pushing it to get VHF contact with Wagga FS at Hillston. You'll probably have to cancel SAR by phone, since you don't have HF.

**Charlene:** We'll phone Wagga FSU when we get into town.

**FS B.O:** Fine, but please do not forget! I'll just amend your plan to indicate that you'll be cancelling SAR by phone.

**Ralph:** Does that happen often — pilots forgetting to cancel their SARTIME?

**FS B.O:** More often than it should. My guess is that pilots tend to get preoccupied once they reach their destination. Who knows — perhaps they are just so relieved to get there that cancelling SAR is sometimes overlooked, especially if they are unable to make radio contact with Flight Service, and have to cancel by phone.

**Charlene:** Checklists would help.

**FS B.O:** Sure, but who takes their checklist with them to the pub, once the aircraft is tied down? By the way, have you checked the frequency boundaries on the latest Visual Enroute Charts? You will be changing area VHF frequency several times en-route, and you will need to be on the correct VHF frequency when you make your broadcasts overflying Cowra and West Wyalong, and inbound to Hillston.

**Ralph:** Will we get frequency change reminders from Flight Service?

**FS B.O:** No, as I mentioned before, aircraft operating below 5 000 on a SARTIME are not required to report their progress. Flight Service would not know where you are.

**Ralph:** Does that also mean we wouldn't get traffic information?

**FS B.O:** That's right. Not unless you intend to climb to 5 000 feet or above.

**Ralph:** What if we do decide to climb above 5 000?

**FS B.O:** Well, first of all, you have to report to Flight Service that you are doing so. You tell them your callsign, aircraft type, position and time at that position, intended altitude, next position and estimate, and destination. You will then get traffic on any IFR, RPT or military low jet that you may be coming into conflict with by climbing to the level above 5 000. If you're unable to contact Flight Service, you broadcast the same information.

**Ralph:** Once we're above 5 000, will we continue to get a full traffic information service?

**FS B.O:** You'll get traffic information on IFR, RPT and MLJ aircraft only when you advise changing level. Or, if you specifically request traffic, you'll get information on all other conflicting aircraft, but it only refers to that particular point in time. Flight Service aren't obliged to continue to pass traffic to you.

# GROUND TO AIR

**Charlene:** Why's that?

**FS B.O:** Mainly, FS workload. In any case, pilots of VFR aircraft are required to keep a lookout for other aircraft, and to listen to the area VHF frequency to ascertain whether there are any other aircraft in their vicinity.

**Ralph:** If we're above 5 000, are we then required to report our position?

**FS B.O:** Yessir! Let's say that you're finding it a bit bumpy below 5 000 and decide to climb to say, 6 000; you're required to make the report prior to climbing, and then make position reports as if you are a FULLSAR flight. The difference, of course, is that if you miss a position report, Flight Service wouldn't commence SAR alerting until your SARTIME has expired.

**Charlene:** Fair enough. Tomorrow, we'll be pushing on down to Mildura and then home to Moorabbin, depending on whether we finish our business in Hillston on time.

**FS B.O:** No problem. Give Wagga FSU a ring to get your briefing and to submit your flight plan details. Have you operated into an AFIZ recently?

**Charlene:** No, not for some time. I was going to brush up on AFIZ procedures tomorrow morning.

**FS B.O:** The main thing to remember about an AFIZ is that everyone is required to make several mandatory reports, so that the FSU can effectively assess you for traffic purposes.

**Ralph:** And those reports are ...?

**FS B.O:** The first is the report at 15 miles from the AFIZ boundary, which in this case would be at 30 DME. By this time you should have taken note of the ATIS on the NDB. If memory serves me correctly, you're reminded of right-hand circuits on runways 27 and 36 at Mildura. So your report would be something like this: *'Mildura, ZZZ, Cessna 172, 30 miles north east, four thousand, circuit area at zero five, inbound; received Bravo'*. Mildura FS will then provide you with traffic information, if there are any other conflicting aircraft.

**Ralph:** And then comes the circuit area report, right?

**FS B.O:** Right! *'ZZZ, circuit area Mildura, runway 27'*. Then after you've landed and are clear of the landing area, *'ZZZ, landed'*.

**Charlene:** OK, thanks. What about when we're ready to depart again?

**FS B.O:** First of all, listen to the ATIS to find out which runway is preferred, then make your taxiing report prior to entering any of the runways *'Mildura, ZZZ, Cessna 172, taxing for Moorabbin, received Charlie, runway 27'*.

**Ralph:** What about traffic information?

**FS B.O:** If there's any conflicting traffic, Mildura FS will pass it to you, otherwise you'll get the advice: *'No traffic'*. Remember, don't enter the runway until you have received traffic information. Once you're airborne, report: *'ZZZ airborne'*.

**Charlene:** Yes, it's all coming back to me now. We report departure: *'ZZZ departed three zero, tracking one three three, climbing to five thousand five hundred'*, and we get area QNH from Flight Service.

**FS B.O:** That's right. Will you be descending OCTA into Moorabbin?

**Charlene:** Yeah; we're getting good at Lane of Entry procedures.

**FS B.O:** Well, everything looks in order here; got your weathers and NOTAMs?

**Ralph:** Yep; thanks for your help.

**FS B.O:** No problems, enjoy your flight.

**Charlene:** 'Bye.