FUEL STARVATION / EXHAUSTION
6 FALLACIES OF

"It can't happen to me..."

If a multi-thousand hour crew in a 767 can do it; if 134 flights in Australia over the last five years can terminate due to fuel exhaustion; if innumerable other pilots can terrify themselves, it can happen to you and you'd better believe it. If you're serious about the flying game, you know full well that anything can happen. Your job (yes, `job') is to cover off every eventuality to the best of your ability - ALL THE TIME.

"An aircraft is an aircraft is an aircraft..."

(or, `I can lean it out better than any book figures').

No matter how many hours you have in your logbook, never forget that manufacturers' manuals are not written merely to comply with legal requirements - they are there to point out the characteristics of the aircraft in question. Read and learn before you hire and fly!

"It'll be CAVOK by the time we get to the other end..."

(or, `on the basis of the forecast, I won't have to hold/divert'; or `the headwind will never be that strong')

In plain English (or more properly, Australian), this implies that you are putting your life - and your passengers lives - on the line. Are you so confident of the forecast that you can trade fuel for freight? Be aware of the reporting/forecasting limitations for your destination. Have enough fuel to divert.

"Aviation fuel's too expensive, and anyway, the ALA should be easy to find..."

Of course it is! But how much would you pay for another ten litres in the tanks when the gauges (see next item) read EMPTY, you're in marginal VMC and the only place to go is still (you think) 25 nm away?

"Fuel gauges are precise instruments..."

Yes, well, we all know the answer to that one don't we? (or perhaps it ought to be `shouldn't we?'). At best, a fuel gauge is a very approximate analogue of fuel contents. A good rule of thumb is to assume they **always over read**. Check fuel remaining against published consumption rates as part of your normal navigation cycle.

"I checked the tanks last night..."

Good for you! Any reason why you didn't check them this morning? (other than ICTTLN). Lots of things can happen in the wee small hours, from venting and leaks to thievery. Check contents and carry out a fuel drain as part of the first pre-flight of the day.

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FUEL STARVATION / EXHAUSTION
6 FALLACIES OF

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Editorial

SINCE 1986, there have been in Australia 75 accidents known to have been caused by fuel starvation or exhaustion, and a further 17 where these causes were strongly indicated. Of these accidents, 8 included fatal injuries to at least one of the aircraft's occupants.

Therefore, in addition to the covers, there is an article in this magazine concerning fuel management. Please take heed of what it says — there is nothing quite as embarrassing as hearing a lot of no noise from your trusty Pratt and Whitney or whatever on any occasion except that of having switched off, parked safely on the aerodrome. Checks before take-off and in-flight may be a chore, but it's these little things that help to keep us safe in the air — all the time.

Also about fuel: most will know that CAR 234 has been amended to say, in essence (*vive l'essence*), that you need only carry sufficient fuel to complete your flight safely. That is, no fixed, no variable reserves are prescribed for private/airwork category flights. In fact, the fuel you actually need for the flight has of course not changed; it is only the emphasis on pilot responsibility that is enhanced. Clearly, if you come to a grinding halt tangled up in the approach end fence you probably have not loaded sufficient fuel. Your consequent explanation to the judge will be interesting, to say the least!

The definition of 'sufficient', in line with the CAA philosophy of deregulation, is left to the operator. How to defend your idea of enough fuel for the trip is another matter, and in this exercise help is provided by a new Civil Aviation Advisory Publication (CAAP 234-1(1). This addresses all matters that have to be considered when calculating fuel requirements. Copies of the CAAP may be obtained from CAA Pubs Centre, address as in the inside front cover. For commercial (Air Operator's Certificate) work, the Company Operations Manual containing rules for fuel has to be approved by the CAA.

As the note at the foot of 'Low-flying' indicates, there have been a fair few losses over the last half-year. All are tragic, but those suffered by the professional (agricultural/mustering) community are especially galling, as that group comprises operators who should know all the risks, assess them and take appropriate precautions.

note: as part of the new airspace arrangements, an amendment to CAR 157 is in preparation changing the '1 500 feet' to '1 000 feet'.

I hope Neville Probert's piece on aerodynamics is sufficient to make an end to the argument on the effects (if any) of turning downwind. But perhaps there are those who would like to offer further enlightenment?

The survey concerning the possible fate of this publication has generated a welter of response and we thank our respondents. Our trusty database reveals opinion to be approximately 90% for continuing publication. In conjunction with other factors, these figures are being taken into account by those who will make the decision.

On the first yellow page is the result of the Caption Contest. I hope you'll agree that at least a little of the flavour of aviation has been caught by those chosen. There were around 200 entries, and here in the office we were able to chortle at some that in no way could have been selected for printing...

Fuel for thought (or vice versa)

Mark Perrett, FOI(GA)

Definitions

***Fuel exhaustion**: no fuel left in the tanks*

***Fuel starvation**: fuel in the tanks but for some reason, usually finger-trouble, not available to the keep the engine running.*

***TLAR**: 'That looks about right'*

WE ALL have a hoary old instructor, complete with wise sayings, somewhere in our aviation background. The one in mine *(G'day, Jimmy)* once pronounced on 'the three things most useless to a pilot'. They were:

— the runway behind you;

— the height above you; and

— the fuel you used to have [*or didn't load*].

I've tried to fly, and live, by that advice since.

Those of you VIC/TAS Safety Awareness Seminar groupies who are reading this will, I hope, recall the spectacle of me ranting about fuel management and the utter wastefulness of the fuel exhaustion/fuel starvation accident. The good news is, that's what I'm going to talk about again, and the bad news is, they're still happening.

Exhausting all the fuel in an airborne aircraft, or being unable, through mishandling or lack of time, to get access to fuel on board, is aviation's equivalent to the heart attack, and concludes with the same sort of results. By awareness and a healthy lifestyle, we can stave off, if not eliminate, ticker trouble; with good fuel management we can do even better in the operation of aircraft.

Why the song and dance? Well, you may or may not have first hand experience of this, but engine stoppages from fuel problems are so...ooo final. AND, more than any other type of accident, they are almost totally avoidable. BASI statisticians tell us that every year, in Australia, 14 major accidents take place as a result of fuel starvation or exhaustion. What a waste!

Before we start mumbling that accidents will happen — that they are an inevitable part of the human factor in the accident equation — let's stop and consider. I'll grant that there are occasions when a combination of factors, occuring in the same time scale, can overpower the pilot's capabilities — but I believe the great majority of accidents are avoidable even if the cost of avoiding goes outside other boundaries set by the participants — money, time, willingness, greed etc. Fuel related accidents, however, usually involve fewer factors, most of which are early indicators to the pilot and, if acted upon, can save the day.

Don't think it couldn't happen to you!

Let's look at some of the accident stories. Our list of involuntary contributors to this article ranges from student pilots to senior commercial GA pilots, even up to the captain of a Boeing 767.

- A Boeing 767 had an unserviceability in its main fuel quantity indicating system, but government approval was available for the aircraft to be flown on scheduled operations. The aircraft was refuelled using dipstick and calculations. Because of errors made using conversion factors required for the calculations, only half the fuel required was added. En route, both engines flamed out. Only the fortunate coincidences of the pilot's being a practising glider pilot and the proximity of a large disused airfield averted a major disaster.
- On the third take-off of the morning by an agricultural aircraft, the engine failed just after lift-off. As not enough time was available to select the alternate tank and restore fuel to the engine, the aircraft was severely damaged during the ensuing emergency landing. The aircraft had been refuelled the night before by 'other persons', but not to full. The fuel gauges were inaccurate, and very little fuel had been contained in the tank initially selected. The audible low fuel warning was not operational.
- A charter could not be fully refuelled because of the proposed load. The high-wing aircraft carried neither a calibrated dipstick nor a ladder, and an accurate visual assessment of fuel contents was difficult. A small amount of fuel was added, bringing the fuel up to an estimated 240 minute level for a 180 minute flight.

The power/fuel mixture setting used was on the high side of normal. After two-thirds of the planned flight, the pilot became concerned about his rapidly diminishing indicated fuel resources, and planned one diversion, then a further one as his concern increased. The engine stopped in the circuit area of the second selected airfield, and the aircraft was seriously damaged when unable to make it to the strip.

- On returning to land from an instructional flight, the student was asked to select another tank, but because of inexperience, shut off the fuel when he moved the selector to a position without actively seeking and finding the detente position.

- The aircraft departed with an estimated endurance of 430 minutes. During the return flight, the pilot decided to continue to a further field, a considerable distance beyond destination. When preparing for a precautionary landing because of low fuel indications, the engine stopped. In the forced landing, the aircraft overturned, with substantial damage. The aircraft had been airborne for a total of 366 minutes. On planned fuel usage, landing at the revised destination would have been well inside the fixed reserve.

Discussion

A BASI study covering an eighteen-year period drew a number of interesting conclusions:

43% of all fuel exhaustion occurrences resulted in accidents, as did 19% of fuel starvation occurrences. Also, 62% of fuel exhaustion occurrences forced pilots to land off-airfield.

The major factors contributing to accidents were:

— miscalculated consumption;

— poor in-flight decisions;

— inadequate pre-flight actions; and

— mismanaged fuel.

[note that some of these factors may seem to be very similar, but if you think about it each factor is really quite discrete — ed]

30% of all fuel starvation cases occurred during take-off or landing, and 22% (**including 3% on take-off!**) of all exhaustion cases did, too.

Fuel exhaustion accients/incidents occurred mostly in WA, followed by NSW, QLD and SA/NT, with VIC/TAS least.

In fuel exhaustion cases, pilot factors were involved in 89%, and in starvation cases 45%.

With the exception of a small hump in the 100-300 flying-hour group, fuel exhaustion accidents occurred across the spectrum of flying experience, but **by far the largest percentages of occurrences involved those with less than 100 hours on type**.

60% of all fuel exhaustion cases happened on private/business flights.

In aircraft factors, 48% of fuel exhaustion accidents were associated with fuel instrumentation, and 43% were related to tanks, vents, and drains.

Most needless occurrences arose from either failure to perform physical checks before flight or determination to continue flight with low fuel indications.

Other common elements are:

— failure to appreciate the hazards and consequences of fuel stoppages;

— incorrect results from using fuel conversion calculations; and

— scepticism regarding fuel contents gauges.

To attempt to discuss all of the conclusions I have listed would fill this magazine. I have presented them as seen in the hope they will generate consideration and discussion within your aviation group. Even so, a number of recommendations suggest themselves, both in general terms and in regard to various phases of flight.

General Recommendations

Always cross-check your fuel amount by at least two separate methods.

Do your utmost to ensure correct calculations of fuel required — **use tables or visual diagrams in preference to calculators.**

Constantly monitor fuel status in flight. Use a system, and record all your fuel management actions.

Take pains to understand fully the management of your aircraft's fuel system, and apply that principle to pilots you supervise.

If you have any influence over biennial flight reviews, make sure they cover fuel management knowledge, including:

— working the system;

— calculation of range and endurance (what's the difference?);

— in-flight calculations resulting from diversions; and

— the ability to determine fuel state at any stage of flight.

We can summarize what has been covered by making a list of items to consider when planning a flight.

Pre-flight planning

Use accurate fuel planning figures. Your school or provider organisation should keep up-to-date fuel consumption records for each aircraft.

Beware the use of 'standard' figures such as 240, 300, or 360 minutes — calculate, calculate, calculate!

Selectively use the fuel block on the flight planning form for planning your fuel consumption. Remember, a considerable amount of extra fuel is used for start-up, taxi, run-up, take-off, climbing and then manoeuvring prior to actual departure.

Know and use the maker's/operator's instructions for the determination of fuel necessary for the cruise segment of your trip.

Make it a rule to set out on even the shortest cross-country flight with full tanks, for you never know when or where you might have to divert. Plan to arrive at your destination with at least 45 minutes reserve fuel. That is for use if you are delayed unexpectedly in making your landing approach and NOT to be used as an en-route reserve if you encounter un-forecast headwinds. In other words, accept the administrative problems associated with a prudent diversion to an alternative aerodrome. Being safety-conscious does not mean you're a wimp!

Preflight inspection

Visually check the fuel amounts in your tanks. If at all possible, use a dipstick, but beware of inaccuracies of calibration or in the way you use it.

If, in calculating fuel amounts by differing means, you come up with more than 3% difference, accept the lowest figure.

Ensure absolute accuracy of 'fuel required' figures; check carefully conversions/calculations.

Ensure fuel filler-cap security AND seating. (Siphoning from a loose cap can rob you of most of your fuel.) Ensure drains and vents are working correctly.

Refuel on level ground — obviate inaccuracy and/or unwanted transfer.

Satisfy yourself as to the quality of the fuel (water etc).

Rock the aircraft to rid the tanks of trapped air.

In flight

Use a comprehensive fuel log, taking into account quantity and tank selection. Calculate the effects of changed ETAs and changed engine power configurations.

Make proper use of the mixture control. Remember, various leaning procedures exist for the cruise ('best power', 'range' and 'endurance') and consumption figures for these are markedly different.

Use the correct cruise power settings, derived from the maker's manual or the company operations manual.

Treat fuel gauge readings with suspicion! Cross-check the readings with another method (e.g. fuel flow x time). Learn the use of 'howgozit' graphs. Always believe the lower figure. That is, if cross-calculation tells you the gauges are over-reading, believe the calculation, (but re-check). If the gauges read less than you calculate you have, believe the gauges, because birdstrike, structural weaknesses, siphoning and venting can all cause unexpected loss of fuel.

Develop a system whereby at each reporting point or, say, every 30 minutes, you make a positive check of fuel remaining against time airborne, taking into account altitude and mixture.

Conclusion

I realise, if you are reading this, you probably belong to the converted, but I urge you in any case to help spread the word. Too many people become statistics for us to revert to the TLAR method of fuel management. In the aviation world's drift into de-regulation, more and more onus is devolving on to individual pilots. Under the CAAP system, we may expect a change in fuel management regulations. Then, what I am saying here will become even more important.

Never, ever, put yourself in the position of desperately wishing for the fuel you used to have, or could have had!

NOTE:

The very useful article ***Time In Your Tanks***, was re-published in *AOPA* magazine, February 1988. It is recommended reading!

ASD commends this article, and, noting that the introduction and discussion are interesting, asks that you read carefully the general recommendations and really try to follow each various 'ensure', 'monitor', 'beware' and 'check'. At least, you will have then done all you can to guarantee fuel to the carburettor, injector or nozzle.

A challenging comparison:

Instrument-rated pilots in Australia and USA

Robert Phillips, Research Section
Standards Development, CAA

CONCERNING instrument rated pilots in Australia and the United States:

- Do we have a smaller percentage of instrument rated pilots in Australia compared with the US?
- If so, does this mean that it is harder to get an instrument rating here?
- And does this also mean that aviation is more dangerous in Australia because we make it harder to get an instrument rating?

In trying to answer these questions, we must make international comparisons. But, as this paper will show, comparing data (especially statistics) from different countries involves as many pitfalls as, say, trying to fly VFR in IMC.

Statistics on instrument ratings

To begin with, we can only sensibly compare fixed-wing pilots in Australia and the United States. It is very difficult to compare other categories of pilots because of different requirements and classification systems in the two countries. So for 'pilots', read 'fixed-wing pilots'.

Also, we have to use the term 'commercial pilot' generically. The U.S. has only one class of commercial licence, whereas we have two. Airline pilots are excluded from this comparison because they all have instrument ratings.

Despite these problems, it is true to say that smaller percentages of Australian pilots have instrument ratings compared with their American counterparts. But the whole truth is more complex than that.

16% of America's private pilots and 85% of its commercial pilots have instrument ratings. By contrast, only about 3% of Australian private pilots, and about 40% of commercial pilots hold command instrument ratings.

In Australia, pilots can also hold a night VFR or copilot IFR rating, usually the former. In USA, in order to have a 'Night Flying Prohibited' endorsement removed from their licences, private pilots are required to do three hours night flying under tutelage, including ten take-offs and landings. However, there are no American statistics from which to make a comparison with Australia on night VFR privileges.

The best generalisation one can make is that, compared to an Australian pilot, an American private pilot is three to five times as likely to have an instrument rating.

Why is this so?

Could it be due to tougher requirements for obtaining a rating in Australia, compared to USA? Perhaps it's the weather, or it all could be due to other factors.

The answer is that all of these are relevant.

Instrument rating requirements

The attached table outlines the requirements for obtaining an instrument rating in the United States as per FAR 61.65, and for the Australian Command Rating under CAO 40.2.1.

INSTRUMENT RATING REQUIREMENTS : US -v- AUSTRALIA

REQUIREMENTS	UNITED STATES [1]	AUSTRALIA [2]
Cross-country as pilot-in-command Instrument time	50 hours	50 hours
• maximum on synthetic flight (ground) trainer	20 hours	20 hours
• minimum on aircraft category for which rating is required	20 hours (implied)	20 hours
• minimum hours cross-country	20 hours (implied)	20 hours
• dual instrument flight instruction	15 hours, at least 5 in an aeroplane or helicopter	10 hours
Minimum instrument time requirements	55 hours	40 hours [3]
Night flying	May be included in private licence training	10 hours, at least 5 of which as pilot-in-command for appropriate aircraft category
Total minimum time from ab-initio [4]	125	approximately 125

1. Instrument rating requirements as per Federal Aviation Regulation Part 61.65
2. Command Instrument Rating requirements as per Civil Aviation Orders Part 40.2.1
3. May be reduced to 30 hours for an instrument rated training course of integrated ground and air training, as per CAO 40.2.1.8.4
4. Does not appear to include flight test times

From the table, it is clear that the requirements are similar. The minimum flight time, simulator time and cross country time are similar, and the American system actually requires more instrument hours. In both countries, the minimum time ab initio to obtaining an instrument rating is about 125 hours, not allowing for flight tests.

It seems, therefore, that our system does not make it harder for a private pilot to obtain an instrument rating, and may actually make it somewhat easier.

In the American system, instrument ratings are issued in perpetuity, whereas in Australia they have to be renewed annually and lapse altogether if not renewed within two years. However, the US recency requirements are more stringent than ours. In Australia recency may be retained by completing just one hour of the appropriate kind of flying every ninety days; in US six hours of such flight is required every six months.

Therefore, with regard to comparative statistics, the US instrument rating system has greater scope for 'dormant' ratings. A pilot with a rating may not have obtained recency for several years, but will still appear as a statistical entity. In Australia 'dormant' ratings would cease after two years following expiry date, and be removed from the stats. Therefore, in terms of 'active' ratings the US percentages of instrument-rated pilots may be inflated compared to Australian figures.

Weather

People often assume that weather is a major factor in persuading pilots to obtain instrument ratings. That is, more pilots obtain instrument ratings in a country like the USA simply because the weather is generally worse there than in Australia.

If weather is the determining factor in pilots obtaining instrument ratings, then we might expect those areas of the US that have the worst weather conditions to also have the highest percentage of instrument rated pilots.

Yet it turns out that those regions of the United States where we would expect to find the worst weather conditions — Alaska and North West Mountains (the Rockies), have the lowest percentages of private pilots with instrument ratings (7.39% and 13.26%) and the lowest and third lowest for commercial pilots (82.25% and 81.93%).

Australian pilots who have flown in North America have pointed out that in remote areas such as Alaska, Northern Canada, the Rockies and the Sierras, many operations are better suited to VFR than IFR flying.

Reference to visual landmarks must be maintained, for example, when flying through steep mountain passes or landing in remote locations such as mining, timber or hunting camps. In many cases you fly VFR or you don't fly at all.

By contrast, in more densely populated areas (by people, airports and aircraft), there are likely to be more IFR operations. This is partly because of greater traffic density, controlled airspace, radar coverage and availability of navaids.

The other major cause is pollution. The densely populated areas of North America generate enough smog, fog and haze to create conditions that are frequently marginal or unsuitable for VFR operations. Pilots in these areas tend to get instrument ratings. In Australia, the situation is somewhat different. Pollution in the Sydney and Melbourne areas may be an incentive for pilots to get instrument ratings. But two-thirds of the country is even less densely populated than Alaska. Thus there are many VFR operations into remote landing strips at mines, cattle stations and so on. Furthermore, pilots can expect VFR conditions for at least 330 days per year. The terrain is generally flat. Railway tracks, roads and other landmarks are rarely covered by snow or forest, and the nearest navaids may be hundreds of miles away. In such conditions there is little incentive to get an instrument rating.

To summarise, the relationship between weather conditions and a pilot's propensity to obtain an instrument rating is not a simple one. Nor does weather seem to account for all regional variations in percentages of instrument rated pilots. It is clear that some other factors are involved as well.

Navaids

The region with the highest percentages of instrument rated pilots in the U.S. is the Eastern seaboard, around Washington and New York (18.4% private and 89.5% commercial). This is also the area with the highest concentration of radio navigation aids (average distance between navaid locations = 30.2nm) and presumably the greatest amount of air traffic.

It is clear from examining Jeppesen charts for the United States and statistics on percentages of instrument rated pilots by region that those regions with the highest density of navaid locations (mainly in the east and south) have higher percentages of instrument rated pilots than where navaids are sparse (centre, northwest and Alaska).

By examining navaid locations on Australian ERC(L) charts, it is clear that the concentration of navaid locations in Australia is considerably less than in the United States.

The average distance between navaid locations in Australia (91.4nm) is in fact greater than in the Arctic state of Alaska (61.8nm). Since only 7.39% of Alaskan private airplane pilots have instrument ratings, the corresponding Australian figure of 3.15% compares reasonably well.

In general, it would seem that the more navaids available, the greater the propensity for pilots to obtain instrument ratings. This is partly because they don't have to fly as far afield to do their instrument training. A case, perhaps, of supply influencing demand.

Controlled airspace

Navaids tend to be concentrated in those areas that are densely populated by people, airports and aircraft. These are the areas of controlled airspace, with radar coverage and direction by air traffic control. The advantage of flying IFR in these areas is that the aircraft has a transponder frequency (and individual code in North America). The aircraft is being monitored by ATC radar and the pilot feels safer; in fact, IFR aircraft often receive priority over VFR aircraft at major airports. For example, at Toronto (Canada), VFR flights are restricted at certain times of the day.

Given that most U.S. continental airspace is controlled, there is therefore a strong incentive for pilots to get instrument ratings.

Economics

Economics is another factor that might be expected to influence whether pilots gain instrument ratings. But the evidence is contradictory.

Average per capita income in the United States is about seventy per cent higher than in Australia. Surely, therefore, not only could a larger percentage of American pilots afford to get their instrument ratings, but more American citizens could afford to get their pilot licences in the first place.

In fact, the United States has fifteen times as many people, and fifteen times as many private and commercial pilots as Australia. To put it another way, despite our lower per capita incomes, Australians are twice as likely to take up the challenge of flying.

In the USA, however, it is commonplace for business people to fly their own aircraft to attend meetings in various parts of the country. For them, having an instrument rating is a distinct advantage. They are less inconvenienced by weather conditions, and thus able to make better use of their time in meeting fixed commitments.

Perhaps in Australia a smaller percentage of pilots who have such commitments fly for business/commercial purposes. And even for those Australian pilots whose time is precious, the clear azure skies for which this country is famous may be a disincentive to gaining an instrument rating.

Instrument ratings and safety

Finally, there is the question of whether having an instrument rating improves flying safety. In its 1985 review of FAR 61-65, the FAA published figures from a 1981 general aviation safety review, which showed this to be so:

Pilot qualification / flight condition	Accident rate
non-IFR in IMC	1 per 1459 hr
IFR in IMC	1 per 12186 hr
non-IFR in VMC	1 per 61900 hr
IFR in VMC	1 per 94819 hr

It should be noted, however, that in those days, U.S. pilots were required to have at least 200 hours flying time before they could obtain their instrument ratings. This requirement in itself may have significantly reduced accident rates for instrument rated pilots.

No comparable survey has been conducted in Australia, partly because the relevant data on flying hours is not available, but also because accidents are defined differently in the two countries. A good example is undercarriage failure; it may be defined as an accident in Australia and an incident in the U.S.

Nevertheless, the CAA's Safety Promotion Unit is well aware of the dangers of VFR pilots pressing on into bad weather. The Unit has produced a film on the subject called *Going Too Far*, which was released in April 1990.

You can obtain a copy of the full research report from the CAA Library or from the author in Standards Development, CAA, GPO Box 367, Canberra ACT 2601.

NOTICE TO PILOTS

Civil access to Military Restricted Airspace -Pilots are encouraged to ASK for approval to transit such Airspace. The military have advised that wherever possible such transits will be approved.

Accident response

Cessna 152 -v- Cessna 152, 29 May 1990

Circumstances

The pilot of VH-BFT, with limited experience in General Aviation Airport Procedures (GAAP), had completed a successful period of dual instruction immediately prior to the accident flight and was on a solo circuit when the accident occurred.

The pilot of VH-TNO was completing the first circuit following a solo period in the training area.

The pilot of BFT, turning downwind from its first take-off, gave a downwind call in the early downwind position and was told by the Aerodrome Controller to 'follow the Cessna entering mid-downwind in the 10 o'clock position'. This was TNO, rejoining the circuit via the crosswind leg, in front of BFT. BFT's pilot acknowledged the instruction. The pilot of TNO then gave a mid to late downwind call and was told to follow the twin (DEP, a Piper Navajo) on late downwind. The sequence DEP, on late downwind, TNO, mid to late downwind, and BFT, early to mid-downwind was then established.

The pilot of BFT did not sight TNO at any stage downwind, but instead identified the twin on late downwind as the aircraft to follow. The pilot of TNO sighted and followed the twin, as instructed. TNO's pilot also sighted BFT behind and to the right and assessed that BFT was clear of TNO. The two aircraft proceeded to carry out normal circuits.

During their independent turns on to final approach to runway 06, BFT, which turned base leg inside TNO, descended onto TNO from above, behind and slightly to TNO's left. BFT's right wing tip leading edge contacted the top of TNO's vertical stabilizer, bending the top one third of the rudder, causing it to jam, and denting and dislodging the fairing at the top of the tail fin.

The relative positions of the two aircraft during the base leg and turn onto final approach prevented either pilot from seeing the other aircraft until after the collision. Following the collision the pilot of TNO realised that something had happened, that the aircraft rudder was jammed and that an immediate landing was necessary. The pilot of TNO continued straight ahead and landed on runway 06. The aircraft ran off the runway onto the grass.

The pilot of BFT sighted TNO shortly after the collision, diverted to the left and below TNO and initiated a go-around. BFT eventually landed safely.

Three controllers were on duty in the Jandakot control tower at the time of the accident. One controller occupied the Aerodrome Controller's (ADC) position and a second controller the combined position of Surface Movement Controller (SMC) and Co-ordinator (Co-ord). A third controller, occupying the Senior Tower Controller's position (Snr Twr), had completed a handover/takeover after coming on duty and was occupied at the rear of the tower.

Circuit traffic at the time of the accident was moderate, although traffic during the period immediately before the collision was heavy. In the hour before the collision, 98 movements were recorded with a further 66 during the hour of the accident.

In the 12 minutes prior to the accident a disproportionate number of movements (44) were recorded. There were seven other aircraft in the circuit when TNO joined downwind, with six remaining at the time of the collision. Radio traffic was also very heavy during the period immediately prior to the collision. The ADC made and received 125 two-way radio transmissions during the 12 minutes preceding the accident.

Having allocated a downwind sequence to the two aircraft, and believing that BFT pilot's acknowledgement of sequencing instructions meant that TNO had been sighted, the ADC's attention was concentrated on the other circuit traffic.

During the 2 minutes 40 seconds between the ADC's last downwind call to TNO and the collision there were 14 two-way transmissions.

The workload and practices were such that the ADC did not observe either TNO or BFT again until immediately prior to the collision. The ADC had checked the runway was clear of traffic, was moving TNO's flight strip and was giving its pilot a clearance to land when the impending collision was first noticed. As both aircraft were head-on to the tower and the aircraft were approximately the same distance from the threshold it was not possible for the ADC to determine which call-sign belonged to which aircraft. The ADC was unable to give any collision avoidance instructions, as this could have made the situation worse.

Responsibility for separation in the circuit area at Jandakot rests with the pilots-in-command of circuit aircraft. Assistance is provided by the air traffic controllers by issuing instructions for rejoining, downwind sequencing and landing clearances. Safe separation in the circuit depends on a good look-out and on the pilot understanding the controller's instructions, following those instructions or advising the controller if the instructions have not been understood or cannot be complied with.

In this accident, both the pilot of BFT and the ADC thought that the downwind sequence instruction had been understood and was being followed. The pilot's inexperience led to a traffic misidentification, whilst a combination of workload and aircraft positions probably led to a less than adequate look-out and consequent failure to sight the conflicting aircraft.

Despite the presence in the tower of three controllers, circumstances, workload and the belief that the pilot of BFT had sighted the conflicting traffic prevented the developing collision from being observed by the Tower Controllers until it was too late.

Significant factors:

The following factors are considered relevant to the development of the accident:

1. Pilot inexperience

The pilot of BFT was inexperienced in aviation and particularly in GAAP. Although instructed to follow the Cessna entering mid-downwind in front at the 10 o'clock position, the pilot identified a different aircraft, a twin of different make, late downwind in the 12 o'clock position. A more experienced pilot would be expected to look for the aircraft at 10 o'clock, to know the difference between that aircraft and another on late downwind and, if it was not identified, indicate that fact to the Tower by radio. The pilot had completed a dual trip immediately prior to the accident flight and although difficulties were initially encountered with Jandakot circuit procedures the instructor's final assessment was that the pilot's procedures were satisfactory.

2. Distraction by other procedures and/or cockpit visibility problems

As stated above, an experienced pilot would be expected to sight another aircraft in front and to the left at the same height on downwind. Although the reason why the pilot of BFT did not sight TNO during the downwind leg could not be determined, there were three main possibilities:

(a) The pilot was concentrating on the downwind spacing from the runway, and manipulation of the aircraft controls and/or downwind checks. This caused a distraction which prevented a good look-out

(b) The position of TNO in relation to BFT was such that the left-hand windscreen pillar prevented the pilot of BFT from sighting TNO

(c) A combination of both the above.

3. Task Saturation

The radio transmission traffic during the period preceding the collision was very heavy. An experienced pilot would be expected to listen to the radio transmissions to help determine the position of the traffic in the circuit. The pilot of BFT had the opportunity to recognise a mistake when the pilot of TNO was given downwind sequencing. Inexperienced pilots, attempting to cope with the other tasks associated with circuit flying may mentally tune out the radio traffic that does not refer to their aircraft.

4. Failure of the Safety Net

The safety net, an overall safety concept provided by the Tower Controllers, is dependent on the controllers having the time to carry out their sequencing, landing clearance and other tasks as well as being able to inspect the circuit for unsafe situations in the making. The ADC, having given the pilot of BFT sequence instructions and believing that they were understood and followed, was then engaged on other tasks and did not check the late downwind to final legs of the circuit again until immediately prior to the collision. The Surface Movement Control Co-ordinator and Senior Tower Controllers were engaged in their own tasks and did not observe the developing confliction. Consequently the safety net did not work.

5. Aircraft Identification Problems

(a) The position of the aircraft in relation to the ADC prevented the ADC from being able to differentiate between the conflicting aircraft, and so issue collision avoidance instructions.

(b) The use of the words 'Cessna' and 'twin' may not have provided sufficient identification information. A Cessna can also be a twin.

BASI Recommendations

1. All pilots and operators at GAAP aerodromes should be reminded, through the publication of this incident in either the BASI Journal or the Civil Aviation Authority (CAA) *Safety Digest*, of their obligations to ensure that they and/or their pilots and students understand and comply with circuit radio and operational procedures. In particular, student pilots should not be permitted to operate solo in a GAAP circuit unless they are fully conversant with all the required procedures.

2. The Civil Aviation Authority should carry out a review of the operational and administrative procedures used in the Control Towers at GAAP airports with a view to improving the safety net provided by the Tower Controllers.

In particular, the CAA should consider the allocation of a specific task, 'traffic spotting', to one of the Tower Controllers. At airports where there are high traffic densities and/or there is a significant pilot training component, this task may need to be allocated to an additional tower position.

CAA ATS comments

Since this incident, great changes have been wrought at Jandakot. The commissioning of a second runway has split the aerodrome into what are virtually two independent operations, each under the control of a separate Aerodrome Controller with a dedicated frequency. This brings Jandakot into line with all other GAAP aerodromes (except Camden — traffic there does not yet warrant such upgrading).

This change in procedure has halved the area that each Aerodrome Controller is required to monitor, which means a very much enhanced traffic-spotting ability. The 'new' Jandakot is working well, and we consider the current arrangements more effective than employment of a separate 'traffic-spotter'; resource utilisation is more efficient and job satisfaction much greater. On the occasions that operations are confined to one runway, manning levels do allow the use of a dedicated traffic-spotter.

CAA Operations Branch comments

While a reminder that pilots are primarily responsible for their own separation while operating in GAAP control zones would not go amiss, some other actions may also bear consideration.

The possibility of air traffic controllers advising pilots of position in the landing sequence as well as the type of aircraft preceding them. In this instance, had the pilot been told that he was number three, he might have been alerted to both the aircraft ahead, and thus less willing to accept that the aircraft he actually sighted was the one to follow.

The present system also relies upon pilots being aware of the names of different types of aircraft, and assumes that they can recognise these aircraft in flight — a surmise not necessarily correct, particularly in the case of student pilots (in this case, though, one would have thought that the pilot would have recognised the same type of aircraft as he was flying himself).

Perhaps a standardised system of naming different types for recognition purposes would be of value, for example, 'Cessna' for all high wing Cessna aircraft, and 'Light twin' for all such types might suffice. Training organisations would then be required to ensure that student pilots were at least familiar with designated generic types, prior to flying solo. An article in the *Digest*, on the problems related to visibility from high wing types, stressing the need for adequate training in lookout procedures, may also be of value.

[ASD finds it hard to believe that instructors do not emphasise such problems to each student. Or are we being naive? Alternatively, I'm sure I'm not alone in discerning an association (possible poor instruction) with the inadequacies described in the article 'A little learning...' in ASD 147 — ed]

Mooney M20F

from a BASI report

The aircraft was being used for pilot-under-instruction training towards CSP and retractable landing gear endorsement. This was only the second flight on type for the PIC and first for the pilot under instruction.

Both pilots stated that the pre-landing checks had been completed and that the landing gear 'down and locked' light was illuminated and this was rechecked on final approach to the runway. The pilots reported that touchdown seemed normal but the aircraft soon adopted a left wing low attitude. The propeller then contacted the runway surface and the aircraft collapsed onto its underside before skidding to a halt.

A thorough examination of the landing gear system revealed no fault. The type and location of abrasion damage to the nosewheel doors and the lack of damage to the main gear fairings and brake assemblies indicated that the doors were closed when the aircraft contacted the runway. In other words, the landing gear was in the retracted position.

It was noted that the red and green post lights on the instrument panel indicating high and low vacuum pressure were of the same type as the landing gear position lights. The green vacuum light was seven centimetres from the green 'landing-gear down' light, in approximately its two o'clock position. It was considered possible for the crew to have mistaken one light for the other.

Significant factors

- neither pilot was familiar with the aircraft type
- the landing gear was not extended
- the pilots possibly mistook the green vacuum light for the green landing gear light on the intrument panel
- the aircraft landed with the gear retracted.

ASD makes a further observation: similar lights, different (and vital) functions — should they be quite so close together? Traps for young players #1001?

ASD 147 CAPTION CONTEST

I know he's the captain, but do we really have to kiss his feet each time ?

The contest was judged by two senior members of the CAA's Vic/Tas Field Office, Warren Dickson (AGM Corporate Management) and Mike Lewino (AGM Safety Regulation). They reported that it was great to do business with us all, and selected the following:

WINNER:

I know he's the captain, but do we really have to kiss his feet each time ?
P Novakovic, PO Box 1004 COOLANGATTA, 4225

HONOURABLE MENTION:

I'm sure the flight attendant said "board the aircraft through the forward door".
Mark Nelson, 43 Hang Lok Road, HONG KONG

Well crew - I suppose you are wondering why I've called you all together here ?
W Heitbrink, 1/114 Castle Hill Road, WEST PENNANT HILLS, 2125

Now you all may be wondering why we are gathered here today.
Bryan O'Toole, Lot 2, Beaudesert/Beanleigh Road, WOLFFDENE, 4027

Quick! Hide! the CAA inspectors coming!
R Schultz, 15 First Ave, NTH DANDENONG, 3175

Beam us up Scotty!
John Markoulis, 36 Milner Road, GUILDFORD, 2161

Wow! What a big rubber band!
Andrew Baxter, 10 Palisade Lane, WILLETON, 6155

The judges

A handsome, suitably inscribed plaque is being produced, courtesy of the Vic/Tas Field Office, and will be despatched to Peter Novakovic ASAP. To the runners-up we offer our congratulations for their imagination, and to all the two hundred readers who entered the contest go our thanks for lightening the drabness of (some of) our days!

ASD 147 was obviously contentious, for we have received much more mail than usual. The following letters are typical:

Dear Sir

Mr Tizzard *(ASD 147)* demonstrates a total lack of comprehension of what was in my letter. As a consequence his response is irrelevant and meaningless.

I wrote to draw attention to a very real defect in current legislation. What happens to the VFR pilot who is caught inadvertently in non VFR conditions? The answer is that the present legislation kills a proportion of those unfortunate pilots, legally and efficiently.

There is no fundamental flaw in my understanding of what to do in non VFR conditions. Mr Tizzard's advice, to hold, divert or make a precautionary landing is excellent advice. The fatal problem with it is that circumstances can arise where none of these options can be exercised.

He describes instrument training in the RPPL and UPPL syllabi as being there to teach pilots that flight in IMC conditions is highly undesirable. In plain English, what he is saying is that instrument flight training is there only to frighten the student. This theme is repeated a few lines later in the '175 seconds to loss of control'. The use of fear as a training aid disappeared generations ago.

While I would prefer to ignore it, comment must be made on Mr Tizzard's discourtesy. Public debate on an issue cannot take place when it descends to the level adopted by Mr Tizzard.

It is grossly insulting to be told that my comments are 'not merely disingenuous'. This is followed by the observation that he cannot determine whether I have any aviation knowledge or whether I am acting for a constituent. Other considerations aside, these observations are completely irrelevant. The matter for debate is the adequacy of the regulations.

For the record I have held a licence for 26 years, owned my own aircraft for more than 20. Furthermore, as a Senator I would never feel constrained to act in the interests of any of my constituents. Indeed I would be failing in my duty if I did not.

Since the *ASD* has been published, I have been contacted by a large number of people, some as far away as Perth and the majority total strangers. Without exception they have all been outraged at the attitude and conduct of Mr Tizzard. For my own part, in what has now been a long and close association with the CAA and its predecessors, I have never experienced anything but unfailing courtesy in my many dealings with its officers, Mr Tizzard excepted.

My letter was written out of concern for the pilot who is genuinely caught out in non VFR conditions. But the issue is much wider than that. Pilots should be able to fly in IMC conditions without a Command Rating with the proviso that there are some limitations on what they can do. Other countries with far worse weather conditions than Australia successfully operate an En Route IMC rating. The very fact that the CAA grants a night VMC rating means the CAA accepts and condones pilots flying at night in IMC.

Senator David MacGibbon

CAA comment by Paul Middleton, *Assistant General Manager, Standards Projects Branch, Safety Regulation and Standards Division:*

The introduction of the Command Instrument Rating in 1987 was a reduction of the requirements of the previous decade. It was designed as a 'minimum standard' instrument rating at considerably reduced monetary cost to the holder. It is a compromise between the highly questionable 'enroute rating' and the previous standards.

To date, the Authority is very pleased with the Command Rating. While some sectors of the industry claim it is far too lenient, the accident rate for IFR is still comparable to that of pre-1987.

No doubt readers are aware that the overseas 'enroute rating' is not an open slather arrangement, but contains requirements for 'let-down' training through to severe restrictions on use depending upon the country.

ASD *merely adds that the Senator's letter suggests any VFR pilot can 'inadvertently' get into non-VMC conditions. Is he therefore proposing an IFR rating as part of the PPL?*

Dear Sir

I was most disturbed to read Steve Tizzard's attack on Senator David MacGibbon and his support for the en-route instrument rating in *Aviation Safety Digest 147*. For the information of Mr Tizzard, the Senator is an experienced pilot and a Freeman of the Guild of Air Pilots and Air Navigators. He is well informed on aviation matters and was a member of the recent Senate Select Committee into the airline pilots' dispute.

Senator MacGibbon is supporting the efforts of the Guild over many years to reduce the loss of life in weather-related accidents. Our research has shown that even the limited instrument expertise of a Night VFR pilot and the consequent ability to fly in cloud to an area of known VMC is sufficient to produce an accident rate from such causes five times lower than that of the general pilot population.

The key to instrument proficiency is recency and the proposed en-route instrument rating would enable pilots to maintain that recency within their limited capability. Such ratings have been successful in the UK and in Singapore.

A few diehards within the CAA and its predecessors have consistently blocked the proposal despite its success overseas and its wide support within Australia from such organisations as AOPA.

Mr Tizzard should also be aware of Recommendation 59 of the Air Safety Regulation Review. 'The Civil Aviation Authority and the industry should investigate the feasibility of introducing an en-route instrument rating along the lines proposed by the Aircraft Owners' and Pilots' Association and the Guild of Air Pilots and Air Navigators'.

It is time to do something other than simply preaching at VFR pilots to avoid a non VMC situation. Many pilots have died attempting to remain in VMC. Had they had the benefit of some recent instrument experience they would most likely have survived. It is time to implement Recommendation 59 of the Air Safety Regulation Review and get the en-route instrument rating under way.

P K Davenport, Chairman, Australian Region Guild of Air Pilots and Air Navigators *(Phil Davenport is a pilot with QANTAS)*

GAPAN *sent us statistics (supplied by DoT for the years 1972-76 inclusive) in support of his proposition of the five-times-lower accident rate. Here are extracts from the GAPAN letter:*

Weather Related Accidents

Instrument Rating controlled flight	*Loss of control in flight or accidents into terrain*	*Other Weather related accidents*
Class 3 or higher	2 (2)	7 (1)
Class 4 or 5	1 (1)	1
No Rating	17 (14)	74 (1)
Total	20 (17)	82 (2)

(parentheses indicate fatal accidents)

As of 30 June, 1976, there were 1332 holders of Night VMC ratings out of a total pilot population of 18449 (7.2%)

On a pilot population basis, the 7.2% Night VMC pilots had 5% of the loss of control and terrain collision accidents, and only 1.2% of other weather-related accidents.

As Night VMC ratings were then a requirement for the issue of a CPL, the annual hours flown by a Night VMC pilot were from anecdotal evidence at least three to four times that of an unrated private pilot.

When the additional annual hours flown by a typical Night VFR pilot are considered (say three times as many), Night VMC pilots flying 21.6% of the hours had 5% of the loss of control and terrain collision accidents, giving a probability of between 4 and 5 times lower than non-rated pilots. The overall weather-related rate for Night VMC rated pilots flying 21.6% of the hours had 1.2% of the accidents for a probability 18 times lower than the non-rated pilot population.

The Guild proposes a standard of en-route instrument flight considerably in excess of that currently required for Night VFR. Indeed, the standard proposed is substantially that for a Command Instrument Rating, without the let-down procedures which currently occupy a considerable portion of the course. As night flying away from extensive ground lighting requires substantial instrument rather than visual reference, we feel that such operations should qualify as instrument time for En-Route Instrument recency purposes.

GAPAN *also notes the figures are rather dated, but submits that the high fatal accident rate of the loss of control or flight into terrain accidents is a major source of concern.*

ASD, *in turn, suggests that these figures support the argument that to fly in cloud requires at least a Command Instrument Rating, for there is nothing in the statistics presented to suggest that NVFR pilots enter IMC. If NVFR pilots do in fact fly on the gauges, perhaps we need a new definition of VMC.*

A cogent argument might be that the '3 to 4 times' the annual hours flown by Night VMC rated pilots would, apart from anything else, have delivered the message that IMC is inappropriate for VFR operations. To such an extent, we propose, that such pilots would realise their limitations, either on the ground at the briefing stage or well before being committed to flight in cloud during a trip. Notice the figures don't mention the number of Night VMC (NVFR) rated pilots who avoided accidents, by day or night, simply because they possessed sufficient self-discipline to cancel their *plans or, if the weather airborne deteriorated, had no qualms about making an* ***early*** *decision to hold, return, divert or even carry out a precautionary search and landing, all in VMC.*

In summary, this magazine agrees with Mr Middleton — if you want to fly in cloud in Australia, you should be professional and get yourself a Command Rating (the 'minimum standard', and more or less what GAPAN proposes). Don't forget that, although pressures may exist for you to be trained on each of the the various let-downs, you can gain your rating on just one aid. The hours, the instruction and, yes, the money you spend will all increase the safety and convenience of yourself and your passengers.

Of course, 'minimum standard' can be defined and re-defined ad nauseam, but isn't that where we came in...?

Dear Sir,

The Senator's comments would truly represent many VFR pilots' views regarding a possible en-route instrument rating. Certainly, twelve months ago I felt the same. I privately fly a C182 Australia-wide, about 300 hours a year.

The Senator's comment relating to the fact that 'in the real world, VFR pilots, if they fly enough, will be faced with non-VFR conditions at some time' is certainly true, and I faced this more and more as my flying hours clocked up. I am an Electronic Engineer and have always felt confident flying on instruments. I had been hoping for quite some time that this new en-route instrument rating would be introduced, because it suited my situation perfectly. Finally, however, I felt compelled to make the effort and justify a Class 1 Instrument Rating, as it now has become easier without the Morse code requirement.

This was when the 'real world' of IMC flying caught up with me. I know now that there can be no en-route or intermediate rating, because of the many factors and situations that can and do arise when you actually enter that cloud. A pilot flying in IMC must be able to safely conduct procedures for an undetermined length of time. Flying in IMC is not merely keeping the aircraft upright, it is precise flying within tight tolerances to enable the pilot to know the plane's position accurately at all times.

The Senator is completely unfounded in his comments about the exorbitant expense of over 30 hours, frequently in a twin. I conducted my Class 1 training totally in a 210, making my rating valid for single-engine aircraft only. Concerning the comment 'stress of constant renewals', I believe the licence currency requirements are very realistic. I know myself that after three weeks without an ILS, when I actually perform one it may be within tolerance, but not as good as I have done.

The Senator also made mention that a VFR pilot holding an 'en-route' rating would not abuse the privilege and not take off in solid IMC. Of course, in time the situation would arise when the pilot would feel confident enough to try it.

Consider the following case:

Say the pilot departs Parafield to the east on a still morning and heads straight into stratus at 1500 ft, expecting to pop out at say 4000, a few minutes later. The pilot may be stuck in it a lot longer than planned! On the climb out, icing may occur at a much lower altitude than ever imagined, or forecast (it has happened to me out of Parafield). This could be instant panic for the VFR pilot, who continues heading over the Mt Lofty Ranges, still in cloud, not climbing as fast as planned but simply hoping to get on top of it. Now, not being 100% sure of position, the decision is made to return. To avoid hitting anything it is necessary to remain in cloud for some time coming back over the ranges. Say some 25 minutes have now passed. If panic hasn't resulted in a spin and crash, how can a safe landing be made without following a prescribed Instrument Approach to either Adelaide or Parafield? Surely now, a full emergency must be declared and the aircraft be radar-vectored to a [visual] approach to the runway.

I now know from personal experience that all the Class 1 training undergone is necessary to ensure the safe landing of a flight such as that described above. I honestly believe the way the Class 1 regulations and procedures are laid out are precisely what is required for the pilot to carry out safe IMC flight, and so I strongly support Steve Tizzard's view. If Senator David MacGibbon is a private pilot, I strongly urge him and any other private pilot to simply get a Command Instrument Rating if they need to fly in cloud; their views will change, just as did mine. The rewards of operating IFR anywhere and everywhere are wonderful, generating the safest and most self-satisfying flying possible. There cannot be an in-between: you either fly in IMC by the Class 1 rules or you don't fly in IMC at all.

K. Eldredge

Dear Sir

When I retired, some years ago, from airline flying, I continued to hold a private licence. Two years later I renewed it with three hours on a Tiger Moth, thereby completing the full circle. It amazed me to find that while it was an easy aircraft to hire, the club instructors headed for the hills when I asked for someone to take me for a quick refresher. I have had a great affection for the Tiger ever since my instructor demonstrated a landing backwards and upside down, and was astonished at the terror it seemed to inspire in what appeared to be an otherwise normal group of pilots.

Two years later, when confronted with another renewal, without having flown in the meantime, I chose to let the licence lapse.

My reasons were as follows:

- There seemed to be little point in renewing the licence just to have it. I did not have the time to use it, and I had other things on which I preferred to spend my time and money.
- I realised that I was rusty on control and circuit procedures and was probably becoming a hazard to myself and others. This would not have been difficult to overcome, but I also realised that there must be others similarly placed but without my years of background, who could well be swanning around in the same airspace.

The odds, in other words, were becoming unfavourable, so I quit while I was in front. Had I decided to continue, I would have wanted a solid refresher. Perhaps I was over cautious, but there it is. I have always been a devout coward.

One of the things that prompted this letter is the sad similarity between this *ASD* and almost any other since it was first published. Only the aeroplanes have changed.

It would seem to me that the PPL course is inadequate in content and suffers from possible discontinuity. I know there is a severe problem with cost, and that a more comprehensive and cohesive course would eliminate numbers of aspiring pilots for financial reasons, if no other.

But in these increasingly crowded skies may this have to be considered?

Are we looking at a civilian equivalent of CFS?

As I do not want bullets through my kneecaps, I will leave it there. But is it a case of 'Your money or your life?' Remember we have a sort of relief valve in the Ultralights.

The letter from Senator MacGibbon is dangerous. Lots of people will believe an authoritative statement from a Senator, but Senators have been making authoritative statements for over two thousand years without allowing themselves to be confused by facts. While I would never say that much of his letter is codswallop, I would hesitate to accept his offer of a lift.

If I tread on any toes because of my opinions I am unrepentant, but if these opinions are out of line because by knowledge and understanding they are out of date, then I do apologise.

'Biggles'

'Biggles' (name and address supplied) is ex-QANTAS, with some 16 000 hours.

Dear Sir

I feel I must write to express my disappointment in this present summer edition of the *Safety Digest*. The submission by Jeff Bolinger titled '89rs' is an offence to the standard of the publication and one would question the wisdom of its inclusion in any edition, and, the maturity of the author.

I was under the impression that this new look *Digest* was to reflect an intelligent and helpful presentation for the benefit of all airmen. What then is the value of a contribution such as this which is extremely negative and critical of a significant number of pilots.

In this article pilots such as myself are reportedly not 'real pilots' at all, we have 'wasted our hard earned dollars on a flying fantasy', we are 'accidents about to happen' etc etc.

I felt personally hurt by the insolent and degrading terms and remarks made by Mr Bolinger. Indeed, I should like to see some official reply to the inferences and accusations made by this egotistical person. After each check flight I am assured by my instructor that I am a safe pilot. Is he right, or is Mr Bolinger right? Am I a pest to other pilots, as I am said to be in this article?

I am aware of my limitations and fly accordingly, and I resent reading in the *Digest* that I am a liability to my fellow airmen and that 'with any luck I might get tired of it and give it away'.

This kind of material will do nothing to advance the cause of safety, nor will it perpetuate the sense of brotherhood among airmen.

K M Cooke

['a significant number...'? — ed]

The next extract was a further thought by a correspondent in his reply to our spin questionnaire:

...I commend the comments in your article '89rs', as I went down that road. Because of a lack of funds, I amassed only 60 hr total in the six years following my RPPL. At this point I let my licence lapse, as it was obvious that I wasn't maintaining a suitable standard. When I took up flying again in 1986, thirteen years after first gaining my licence, I was surprised how far behind the ball I was, although age may have been a factor. If you can't afford to fly at least 25 hours a year, you should not obtain a licence. Note that I consider 25 hours the absolute minimum.

S D Mellow

...and again, from another concerned pilot:

Dear Sir,

I have just completed reading the article entitled '89rs', which highlights a personal concern that I have had for some time, ie, the currency of licence status under the 2-year Private Pilot's Licence Aero Medical and Biennial Flight Review as now applies.

Some twenty or more years ago, it took me a lot of money and effort to gain the licence from which I have had some enjoyment and sense of achievement in safari-type expeditions, glider towing etc. For this reason, I am most reluctant to relinquish the licence. However, financial commitments with children at school, and the usual attendant costs of just living allow very little time or money for flying. In fact, I'm almost down to the bare amount every two years when the BFR is due.

The item mentioned above highlights the matter, and I have been dreading the introduction of MONTHLY currency checks as a strict requirement for retaining the PPL.

This stems from having a totally vitriolic stream of abuse fired very effectively at me of recent date by a group of three what I understand to be either Commercial Pilots and/or instructors. Their main thrust ran as follows:

It's people like you who cause most of the bad accidents/incidents, give all light aircraft operators a bad name, cause hold-ups and delays at airports because you don't know the latest correct procedures, don't keep an adequate lookout in busy areas because you're involved in trying to remember how to control the aircraft (meaning placement of switches and controls), cost all tax-payers and GA pilots a lot more than it should in mailing necessary information; and all this JUST SO PEOPLE LIKE YOU CAN HAVE THE STATUS SYMBOL OF A PILOT'S LICENCE!

It was concluded that the CAA should:

- call in all log books and scrutinise the frequency of the licence-holder's flying;
- ask those who fly less than once a year what their intentions are; and
- cancel the licences of those who now only fly once a year or less UNLESS they go through a complete and comprehensive ground and air course and undertake to fly regularly every 30 or perhaps 60 days thereafter.

Tough talking indeed! I would have to surrender my licence and say 'goodbye' to ever flying a light aircraft again — a very sad day indeed.

Again, TOUGH! It would be a damn sight sadder if I caused my wife to be a widow, my children to be orphans, or if I was the cause of another person's death or injury simply because I was not fully alert and aware of what I was doing in the air, even with the best of intentions, by not being properly and fully current.

I have written this to obtain your opinion on the matter, and also to see if the opinions so strongly expressed to me are shared by others in the flying business. Surely there must be a way for those of us who love to fly to be able to retain our licences and not be the perceived 'menaces' as would appear. Otherwise, flying will become a rich person's hobby and those with real talent and a sense of responsibility will be excluded.

With some trepidation,

Yours in aviation,

'VJE' (name and address supplied)

'VJE' may be contentious and even a little inaccurate, but he's certainly no wimp. Any ideas?

Dear Sir

I am writing to you in deep concern of the standards of flight training, or should I say the lack of!

I am an aerobatic flight instructor based at Bankstown airport, and most licensed pilots we get as aerobatic students share Mr Perkins's lack of confidence in recovering from level stalls, wing drops at stall, and incipient spins.

Pilots at the UPPL level should be confident at recovering from these situations, if they are not it is because of poor instruction, and through no fault of their own.

The poor instruction is caused by a lack of understanding by the instructor of those manoeuvres that in my mind are essential for a pilot to know. The instructor himself is uneasy in demonstrating the manoeuvre and avoids demonstration by saying it is dangerous to perform. This information I have gained from many students.

To say that a manoeuvre is dangerous, and yet not understand what is involved is sheer ignorance on the instructor's part, and should not be tolerated.

Many of our students have been down this road, that is why they come to us in order to obtain confidence in their flying, especially in the manoeuvres mentioned above, which have been so badly tarnished by the ignorant.

Once they complete our course many of them often say "WHY WASN'T I TAUGHT THAT IN THE FIRST PLACE!" They are referring to our stall recovery techniques and other BASIC manoeuvres.

WHY INDEED! Because the Civil Aviation Authority is not using its authority to uphold an acceptable flight training standard. We all should be aiming for a high standard, not just the minimum required, as we have now, which inevitably brings everything down to the lowest common denominator.

I believe that the CAA should review its minimum acceptable candidates from various schools.

I also believe the standard for issue of a Grade 3 instructor rating should be increased greatly to include syllabus items like those mentioned, and candidates tested on them. Instructors should be stopped from teaching incorrectly — or even at all, as in the case with some of my students.

These matters need to be addressed now, not until someone else is killed by a manoeuvre that he/she is incapable of recovering from, merely because he/she was never shown how to recover.

Let us all lift our game, that includes you too, Civil Aviation Authority!

D Nidzovic

Concerning 'Heavy Landings', in ASD 147, we have received some interesting input. I hope you won't accuse us of stressing (overstressing?) the obvious if we print this extract from a letter by the Director, Flight Standards, CAC Vanuatu. He speaks from personal experience:

'...the fact is, that when an aircraft suffers a heavy landing (even a crash!), the impact rarely feels as bad as everybody on board expects. Almost any external observer will wince, but inside the aircraft it doesn't feel that bad. The reason is quite simple: any airframe (or even your car), in breaking up, bending, crumpling or whatever, is in fact absorbing impact forces, which are therefore not being strongly transmitted to the occupants. A rigid, exceptionally strong airframe may survive impact more successfully, but at the expense of its occupants. I remember an MU2 flared for landing at 50ft. It fell to the earth with a thud that severely damaged the airframe (surprise!), but both pilots were astonished at the damage done, because 'the landing seemed quite normal'.

The lesson, of course, is that your approach looks abnormal, late or high, the severity, or otherwise, of the touchdown should not be a basis for deciding to carry out a detailed post-flight inspection. If you flare either very early or very late, one of the subsequent bad signs is that you do not bounce: an airframe efficiently absorbing shock by crumpling just doesn't!

When I discuss this with pilots, they usually respond 'Of course we understand that', but I believe that too often this conscious process of thought doesn't get applied when driving an airframe, otherwise more heavy landings would get reported than now is the case.

ASD, in agreeing with this, re-implores pilots to write-up or at least report anything untoward that might have happened during their stewardship of the aircraft.

Dear Sir,

I read with interest the article on heavy landings in *ASD 147.*

I flew the aircraft in question only two or three weeks prior to the incident described. After a firm night touch and go, which was certainly not hard, the gear in transit light remained illuminated after gear up selection. After cycling the gear without any change in the situation, I returned to Bankstown and reported the problem.

In this case, the LAME simply re-adjusted the microswitches and the problem went away — for a couple of weeks.

Such problems are not uncommon in Piper aircraft with this type of undercarriage system. The undercarriage has no uplock, and depends upon hydraulic pressure to hold the gear up. If for any reason one of the gear up microswitches trips, even with inflight turbulence, the electric driven hydraulic pump will start and the gear in transit light illuminate. Cycling the gear will usually clear the problem.

In this particular aircraft, I suspect that there had been some progressive movement at the undercarriage attachment point which prevented the microswitch from closing properly.

AIRFLOW

The microswitch adjustment should not drift so quickly without some underlying cause.

While the Airworthiness Branch of the CAA has no history of progressive undercarriage failure on Piper Arrows, there is always a first time. Qantas had an undercarriage collapse on a Boeing 707 during push back a few years ago. The aircraft in question had been used for circuit training at Avalon for some time, and happened to have more landings than any other 707.

We must keep in mind the fact that most single-engine aircraft in Australia are quite old. The probability of age-related mechanical failures should encourage pilots to be particularly diligent in pre-flight checks. LAMEs should also consider whether the need to adjust some part like a microswitch might indicate something more serious happening nearby.

John R Colwell

ASD remarks that it's sure that LAMEs do just that as a matter of course. As for preflight checks, well, the beast you're looking at is about to take you into the wide blue yonder; you want it to bring you safely back, too.

Dear Sir,

I would like to relate the following experience in the cause of flight safety, particularly in areas of high density such as the circuit area:

The weather was VMC and safe, so I decided to take a student for a lesson on circuits and landings at our uncontrolled aerodrome. We gave taxiing, backtracking and departure calls and, since there was no other traffic, just a first base call. From then on we maintained a listening watch and, of course, look-out. My intention, as normal, was to give calls when hearing traffic or sighting other aircraft, either airborne or on the ground.

We were downwind at 500 ft AGL when we sighted an aircraft in our 2 o'clock (we were on right-hand circuits RWY 18), same level, nose to nose at about 200 metres we immediately turned left, and I transmitted the direction of the runway in use. As the response was not of good quality, I subsequently requested the other pilot's intentions. 'Transitting to the south' was the reply!

Now, I thought, how really nice of him — going through a circuit area at 500 AGL without saying a word. Surely he valued his life as much as I did mine?

On the ground, I checked the register, found the aircraft type, and estimated a closing speed of around 200 kt. Then I flipped through 'Aircraft and Aerospace 1991 Annual Reference Edition' to obtain details of the aircraft and, lo and behold, came across an article 'Basics to avoid a mid-air collision'. The para read: 'When you fly close to an aerodrome or ALA, do you overfly or throughfly the circuit area?'

Now this was eminently interesting and relevant, so when I rang Flight Service to check the info was up to date, I mentioned the incident and the article. The Briefing Officer said 'Oh yes? I wrote that piece!' — too much of a coincidence? I don't think so.

I hope people will observe some simple rules and commonsense when flying past an uncontrolled aerodrome, ie either fly at or above 1500 ft AGL, or keep clear by at least 3 nm.

As for me, well, even when there is apparently no other traffic, I will give a call on every circuit, even though it may congest the frequency. After the incident described, I'm afraid I can't rely on others to adhere to the correct procedures.

Neil Johnston

CPL, CFI

Two notes:

1. *Let's keep coincidences out of the circuit!*
2. *Be advised that, though 1 500 ft will keep you away from virtually all propeller traffic, it's not sacrosanct — anyone can fly circuits at that altitude, and most jets do.*

Do you lose airspeed when you turn downwind?

Neville Probert, Aircraft Performance Engineer

'AOPA', the journal of the Aircraft Owners and Pilots' Association of Australia, recently published a series of letters to the Editor on the subject of turning downwind in strong wind conditions. Some writers warned that an aircraft loses airspeed when turning downwind, but gains airspeed when turning into wind. Others disagreed. The debate proved to be a lively one and attracted many letters.

Supporters of the proposition that an aircraft loses airspeed when turning downwind offered detailed explanations resembling the following:

Consider an aircraft flying at 80 knots true airspeed into a 30 knot headwind. Its ground speed is 50 knots. It turns through 180° and its ground speed increases from 50 knots to 110 knots. The 60 knot increase in ground speed is the result of an acceleration which can only be caused by loss of height or additional thrust from the engine. It takes time for the aircraft to accelerate to 110 knots ground speed and until that happens the airspeed must be below 80 knots.

Some writers warned that many fatal accidents have been caused by pilots carelessly turning downwind and recommended that in an emergency close to the ground a quick turn into wind would be beneficial because of the additional airspeed which results. Others disagreed. The AOPA experience has shown that the subject is of great interest to most pilots, but clearly there are at least two conflicting viewpoints. It should be of benefit to all pilots, particularly instructors and those new to aviation, to understand why it is NOT inherently hazardous to turn downwind and why an aircraft DOESN'T gain airspeed when turning into wind.

This theory of a cyclic variation in airspeed during turning flight in wind conditions is almost as old as manned flight itself. It became a popular but incorrect explanation for the unintentional spin which was poorly understood and caused many fatal accidents in the years before improvements such as the Handley-Page slat. Most attempts at proof are theoretical. Observations offered as practical evidence relate to bodies other than aircraft in free flight, or to occasional experiences which are best explained in terms of induced drag or local atmospheric effects. Despite development of the Flight Data Recorder and Inertial Navigation System no sound evidence has ever been found of any cyclic variation in airspeed due to wind.

Many pilots appear to have been deceived by the following kind of experiment involving a 360° turn:

Heading into wind they note the indicated airspeed and then roll into a steep turn. Induced drag increases and as they turn downwind they observe a decrease in airspeed or loss of height. They continue the steep turn until heading into wind again and then roll wings level. Induced drag reduces and they observe an increase in airspeed or gain of height. They will observe the same things regardless of the wind speed or their initial and final heading.

Flight testing of an aircraft's turning performance, if it is to be credible, must be done in a steady turn in order to minimise the transient effects caused by a varying lift coefficient. Helicopter pilots sometimes observe changes in airspeed during apparently steady turns but this is due to changes in forward thrust or sideslip.

Persistence of the belief in a loss of airspeed when turning downwind appears to be due to a misunderstanding of Newton's First Law of Motion, sometimes called the Principle of Inertia. Those who predict a loss of airspeed when turning downwind usually explain that it is due, not to the action of some force, but to *inertia*. In fact, this idea contradicts the Principle of Inertia which asserts that a body's speed and direction will change only if some external force acts on the body. The Principle of Inertia applies to true airspeed with as much validity as it does to ground speed[1], although the presence of turbulence, wind shear or wind gradient can cause fluctuations in airspeed unrelated to the action of any force. The theory incorrectly attempts to explain the increase in groundspeed as being due to excess thrust or loss of height. But it offers nothing to suggest what force might be responsible for a decrease in airspeed.

[1]PHYSICS *Section 1-3 Reference Frames*, by David Halliday and Robert Resnick , published by John Wiley & Sons Inc., New York 1966, states:

The velocity of a train has one value if measured by an observer on the ground, a different value if measured from a speeding car, and the value zero if measured by an observer sitting in the train itself. None of these values has any fundamental advantage over any other.

and

Consider reference frames moving with uniform velocity with respect to each other. Observers in different frames may obtain different numerical values for measured physical quantities, but the relationships between the measured quantities, that is, the laws of physics, will be the same for all observers.

In order to uncover the correct explanation for the motion of an aircraft turning in wind let's first review something familiar to all pilots — forces acting on an aircraft in flight. Figure 1 shows three aircraft flying straight and level.

Of the four forces acting on an aircraft only thrust and drag appear on these diagrams. These two forces on aircraft A are equal and it has a constant speed. Aircraft B experiences excess thrust and its speed is increasing. Aircraft C experiences excess drag and its speed is decreasing.

Figure 2 shows an aircraft turning in level flight at constant speed. Thrust and drag cancel so they are not shown. The force pointing towards the centre of the turn, the centripetal force, is the horizontal component of the lift acting on the aircraft. The velocity of the aircraft is also shown. (This is the true airspeed and heading of the aircraft). Even though the centripetal force is large it does not increase or decrease the speed of the aircraft because it acts perpendicular to the velocity. The radius of turn of the aircraft through the air is partly determined by the magnitude of the centripetal force. The centre of the turn through the air lies in the direction indicated by the centripetal force.

Figure 3 shows two aircraft turning in level flight. Aircraft A is experiencing excess thrust and its airspeed is increasing. Aircraft B is experiencing excess drag and its airspeed is decreasing. Notice that the resultant force on each aircraft is no longer perpendicular to the aircraft's velocity.

When a force acts on a body in motion any component of the force perpendicular to the body's velocity causes the body to turn, following a curved path, but does not affect its speed. Any component parallel to the velocity causes the body's speed to increase or decrease, but does not cause it to turn.

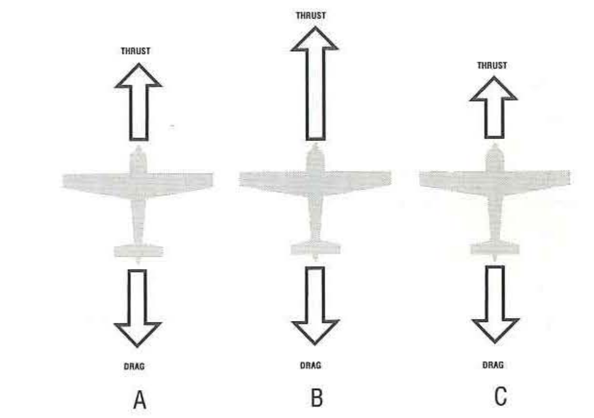


FIGURE 1

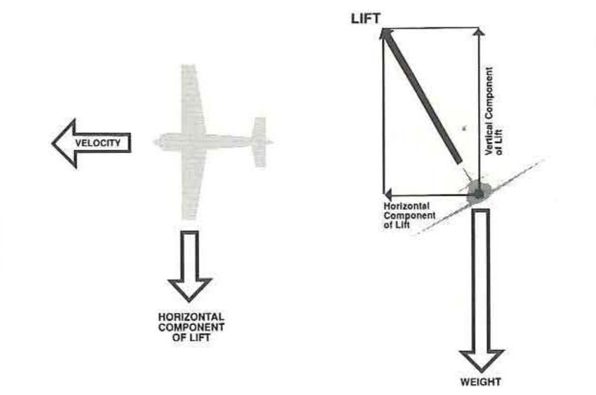


FIGURE 2
Aircraft turning in level flight at constant speed

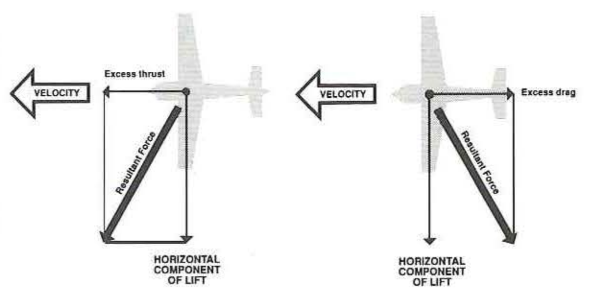


FIGURE 3
Two aircraft turning in level flight

Let's return to the problem of an aircraft turning in strong wind conditions. Figure 4 is an aircraft making a steady, level turn, shown as it is heading crosswind. The thrust and drag are equal and have been omitted. The triangle of velocities has been added, showing:

- airspeed and heading,
- wind speed and direction,
- ground speed and track.

Notice that the horizontal component of lift is perpendicular to the heading, causing no change in airspeed. More importantly, notice that the horizontal component of lift is NOT perpendicular to the track. It is instructive to resolve this force into two components, A and B. Component A acts at a tangent to the aircraft's curved path across the ground. It is a tangential force causing an INCREASE in ground speed. Component B is a centripetal force causing curvature of the aircraft's path across the ground. Notice that the ground speed is increasing even though there is no change in airspeed. The radius of turn observed from the ground is partly determined by the magnitude of component B. The instantaneous centre of the turn observed from the ground lies in the direction indicated by component B.

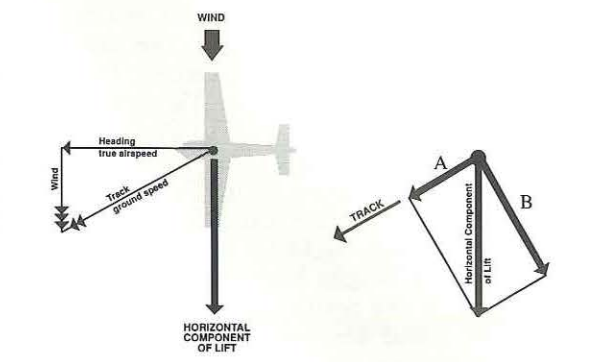


FIGURE 4
Aircraft heading crosswind in steady left turn

Let's now examine an aircraft as it turns into wind. Figure 5 shows the aircraft, halfway through its turn, heading crosswind.

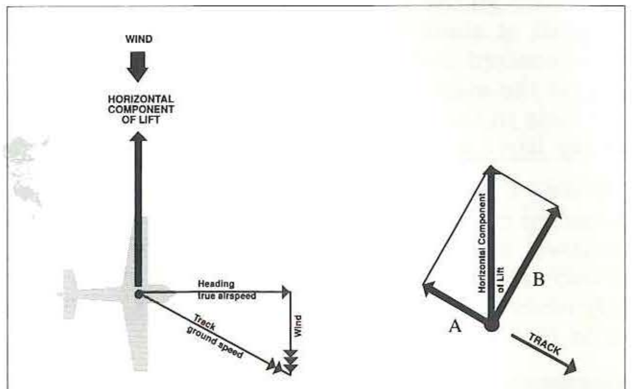


FIGURE 5
Aircraft heading crosswind in steady left turn

As expected, the horizontal component of lift is perpendicular to the aircraft's heading but it is not perpendicular to its track. This force can again be resolved into two components, A and B. Component A is a tangential force causing a decrease in ground speed. Component B is a centripetal force causing curvature of the aircraft's path across the ground. Notice that the ground speed is decreasing even though there is no change in airspeed.

It should now be clear that the cyclic variation in ground speed when an aircraft is turning in wind conditions is brought about by the *tangential component of lift*. The increase in ground speed when turning downwind does not occur due to excess thrust! The decrease in ground speed when turning into wind does not occur due to excess drag!

At the instant a turning aircraft is tracking parallel to the wind its tangential component of lift is zero. As it continues to turn, the component of lift tangential to its path across the ground increases to a maximum value at the instant the aircraft is tracking directly crosswind, and then decreases again as the turn continues.

The lift on an aircraft acts perpendicular to the aircraft's direction of motion through the air, so never causes any change in airspeed. Any horizontal component of lift is always a purely centripetal force. Consequently there is no force to cause a loss of airspeed when an aircraft turns downwind unless there is a gain of height, a reduction in thrust or an increase in drag. Similarly there is no force to cause an increase in airspeed when an aircraft turns into wind unless there is a change of height, thrust or drag. But relative to the aircraft's direction of motion across the ground the horizontal component of lift is partly centripetal and partly tangential if there is any wind. The tangential component causes the change in ground speed.

A turning motor vehicle derives its centripetal force from the action of tyre on road, so its ground speed remains constant during a steady turn. A control line model aeroplane derives its centripetal force from a person stationary on the ground, so its ground speed remains constant except for the consequences of the cyclic variation in drag. Neither of these two bodies experiences constant airspeed during a turn if there is any wind. Helicopter rotor blades derive their centripetal force from the mast which in forward flight is moving relative to both the ground and the air, so neither the ground speed nor the airspeed of the blades remains constant. But birds, boomerangs, insects and aircraft are unique. When turning in free flight they derive their centripetal force from the air, so their airspeed does remain constant during a steady turn.

The airspeed of an aircraft will vary from time to time for any one of a variety of reasons, but turning downwind will not cause a decrease in airspeed and turning into wind will not cause an increase in airspeed.

Confessions of an undeserving survivor

Contribution by reader Christopher Hutchinson, an older and not so bold pilot.

THE FOLLOWING stories are offered in an attempt to get the message across that it does not matter how serious a young pilot might be about treating flying procedures with the utmost respect and professionalism, he just cannot expect to fly in cloud without appropriate training and get away with it. I am absolutely convinced of this, at last. I genuinely believed that I had absorbed sufficient knowledge of others' experiences after reading bundles of *Digests* to believe that I could never fall foul of the strange phenomena that affects one's brain when flying in cloud. I believed that I had full control of myself, and therefore my aeroplane at all times I flew and believe me, I did pride myself on flying precisely, crisply and always by the book. How wrong I was!

Young pilots must become convinced by some means, other than a real-life experience, that when inexperienced aviators enter cloud, their bodies control their minds and senses no matter how level-headed(!) they may otherwise be.

I have a son training as a navigator in the RAAF, from whom I expect a far higher standard of responsibility and honesty than I ever asked of myself, so the letter from Senator David MacGibbon and reply from Steve Tizzard, Airflow, *ASD 147*, has after many years, brought me to life; a life I might add that Steve Tizzard might well — and with reason — say that I have no expletive deleted right to still enjoy.

When I learned to fly, I lived at Lightning Ridge and trained in clear Western NSW skies with Walgett Aero Club. Under-the-hood sequences were not on the prescribed syllabus in those days and I gained my UPPL with little more than a casual interest in the artificial horizon and vertical speed indicator.

However, my instructor was demanding and meticulous and I took a very responsible approach to the precision of my piloting. I believed that my dedication to flying by the book in a crisp and precise manner would serve me well and I wondered in amazement at the folly of many of those I read about in the *Digests* who entered cloud, distrusted their instruments, gave way to senseless feelings such as the 'certainty' that a wing had dropped etc and ended their journeys in disaster. It could never happen to me I felt. (I know, you have heard it over and over again).

Lightning Ridge to Wagga — hours on type 140

Magnificent flight, clear skies, full SAR at 8 000 ft. Scattered Cu, tops around 5 000, started about 30 minutes before Temora. Ten minutes out of Temora I commenced a descent through a hole in 4/8 cover. Arrived over Temora exactly on the ETA but at 500 ft AGL to avoid scud. A heavy shower was passing over Temora at the time and conditions were bumpy and uncomfortable compared to the tranquillity and clear conditions at cruise flight level. Despite the rain, I could see Wagga bathed in sunlight about 30 nm to the South, compass heading exactly 180. I had descended over Temora to get a positive visual fix preparatory to the last leg of the journey, as the countryside had been bare of fixes for over an hour and I had no navaids. To proceed directly towards Wagga at 500 ft AGL in rain and scud looked dangerous so I elected to climb through a hole in what now looked to be about 7/8 cloud, to climb back to the original altitude expecting then to be in clear sky all the way to Wagga. I trimmed the aircraft at about 500 ft/min rate of climb, controls centred and concentrated on holding heading on the magnetic compass. At about 1 000 ft the hole in the sky closed and for the first time in my life I was flying in cloud.

No way I thought, will I get flustered. Hold the heading on the magnetic compass, keep controls centred, altimeter is showing steady rate of climb, airspeed looks fine, little aeroplane in AH looks level but ascending. No problems, just hold that heading.

Compass swung a degree off course so I gave it a little right rudder, just a little. I kept the control column centred. Funny thing, but the compass swung a bit more off course so I gave it a bit more right rudder and again, and again ...... At exactly 3 700 ft the noise of increasing airspeed drew my attention from a singular fixation on the compass problem and the fact that I now had on full right rudder. I arrested that spiral dive by centring the controls, cutting off the power and raising the nose as the airspeed decreased. The aircraft levelled as I broke through the scud just above the rooftops of Temora. I will always remember that red galvanised iron.

Why did I concentrate on the magnetic compass with its inherent sluggishness on south characteristic? My mind was so literally clouded by the situation that I didn't want to use the DG because of its one-degree-every-half-hour inexactitude. I wanted to be so precise in that white environment that the DG which served me so well in VMC was no longer accurate enough! What a professional! I would not have lived had I not had some training in full spin recovery. What is worse, some of the very much more responsible than I residents of pretty little Temora might well have died with me.

It's a funny thing now, looking back on this experience, to reflect on how quickly the eyes and mind can work together to scan and record the flight instruments. When the noise of the increasing airspeed alerted me to my predicament, my hands and feet worked to get the power off and centralise the rudder and re-trim from the nose up trim set for the climb. In what seemed to be milliseconds, the eyes left the magnetic compass and scanned the full panel. I can still see the airspeed nearing the red zone, the altimeter reading 3 700 ft and rapidly descending, the artificial horizon toppled, the directional gyro rotating, the VSI, the ball etc. etc. then the red corrugated iron!

Walgett to Lightning Ridge — hours on type 150

Fourth trip of the day, bringing food to our store in floodbound Lightning Ridge. A trip I could do with my eyes closed. Almost every flight I had ever flown had included a Walgett — Lightning Ridge leg. Departed Walgett with full tanks in light rain but fair visibility about one and a half hours before official last light but decidedly less in reality due to weather. Rain increased and visibility reduced on route and aircraft was subject to severe buffeting and most of flight was conducted at 500 ft AGL to maintain reference to ground features. Lightning Ridge was not on the nose at the time it should have been and surrounding countryside gave no clues to its direction. Flying by the book, I opted for the reciprocal heading to get me back to the point where I last had a positive fix, namely Walgett. I thought about winds, but due to the conditions there were none of the usual features that I knew of that would give me any indication, such as dust behind cars, smoke from fires, ripples on dams. Just rain, buckets of it rushing up the windscreen. However, the VFG said fly a reciprocal heading when lost. I saw the Barwon River as I crossed it but the familiar silos around Walgett were nowhere to be seen. Absolutely nowhere to land on the flood-drenched country. Not a road in sight. Back to the Barwon river, the only earthly feature I recognised. I could use it to find Walgett only if I knew which side of Walgett I was on. Otherwise I would be heading for either Brewarrina or Collarenebri without sufficient light to reach either. I guessed and turned towards Brewarrina in minimum visibility. I guessed wrong and never passed Walgett.

I elected to ditch in the Barwon but could not find a straight section free of trees. Yet the Barwon looked a better place to land than the tree-studded and flooded countryside. Visibility was about 200 metres from about 200 ft AGL. I continued my search for a straight bit of river when I overflew a homestead with a sodden dirt road in front. I elected to land on the road in front of the homestead, expecting the nose wheel to bury in the mud and the aircraft to turn over. At about 50 ft on finals, in near darkness, I realised that I was about to land on the backs of a flock of sheep that were running along the road under me. I decided to fly a circuit at 50 ft AGL and land as planned, hoping the sheep would be gone. Then, as I turned crosswind for my chosen place to die, I passed over a long row of white painted tyres and a windsock on higher ground adjacent to the homestead!

I landed and I lived on. I had in fact flown through a squall (the buffeting) enroute Lightning Ridge. I was 12 nm off track when I reached what should have been Lightning Ridge and 24 nm off track when I reached the Barwon after flying the reciprocal heading to Walgett.

Yes, Mr Tizzard, I know that you will be saying that I deserved to be amongst the sheep in that flock West of Walgett, and who am I to argue?

ICAO airspace — a positive view

Ben Schiemer, FOI (GA)

Introduction

THE ICAO AIRSPACE classification system is contained in Annex 11, Amendment 33. The system was adopted by ICAO on 21 March 1990, and under our agreements with ICAO Australia is obliged to implement the classifications or to register differences. If we so chose we could register so many differences as to reflect our existing system rather than adoption of the ICAO airspace classifications, but this would be done only if we were convinced that our existing system was superior to the incoming ICAO system.

We are in an international environment, and standardisation brings its own safety benefits, so we cannot stick with what we've got just because it is too much trouble to change — sooner or later the change must come, and CAA is on balance sure that the change will not degrade safety standards if we can get pilots to concentrate on the changes until we all become used to them. The new system is in fact simpler than the existing system, and carries fewer illusions about the nature of our safety net.

The objective of any form of organisation of air traffic is to enable flying activity to take place with the minimum chance of collision. With the introduction of ICAO airspace classifications, pilots will find few changes in the way they operate in CTA, apart from some simplification in flight planning and notification, especially for VFR.

Outside controlled airspace we currently rely on self-separation based on a combination of direct and indirect movement advice and see-and-avoid practices. Not all aircraft carry radio, and in 'remote' AFIZs it is a fair guess that not all movements are reported. It is worth remembering that the present system does not in any way guarantee safe separation — as we all know, the worst case for operations OCTA is in higher traffic densities, where the present system can quickly overload and become markedly reduced in effectiveness.

Under the ICAO system, traffic advice from ATS will not be available at all in Class G airspace. We will be relying on other pilots — and they will be relying on us. We were anyway of course, but FS made it feel like Big Brother was looking out for us. In controlled airspace, VFR aircraft will be given more flexibility and responsibility for their own separation, although clearances will still be required.

The procedures to be adopted under the ICAO airspace classification system are being addressed elsewhere, so I will confine myself to some background ideas that may help us make the most of what we are to get.

It is my belief that a network of measures can be constructed to achieve equivalent safety in the new airspace. Many of the things I will suggest would equally enhance the safety of operations in the current airspace, but the fact is that they have not been widely addressed in the past.

Some Ways to Improve Safety OCTA

To improve safety, what can influential aviation personnel (FOI'S, ATS officers, ATO'S, CFI'S, Instructors, senior pilots and industry managers anywhere) do? Here are some recommendations.

- **Speed**. Reduce speed in terminal areas — a study has shown that see-and-avoid is 97% effective at closing speeds of 100-200 kt, reducing to 47% above 400 kt. In addition to the 250 kt limit below A100 I have proposed a limit of 200 kt below A050 for all public transport aircraft.
- **Workload**. Particularly in bigger aircraft, ensure that approach checks are done outside 15 nm and above A100. When OCTA, try to have no FMS/GNS/IRS manipulation and minimise other checks on taxi and in flight below A100.
- **Aircraft**. Discourage use of aircraft with poor visibility from the cockpit, disorganised or unnecessarily complicated instrumentation, high angles of incidence at low speeds, complicated checks and etc. Among light aircraft, I give the Baron three out of ten and the Beech 76, nine. Among jets simple is safe — lots of toys are a disadvantage, as is sweepback, big pillars and posts. Checklists, maps or devices should not be placed on the glare-shield of any aircraft.
- **Radio**. Encourage carriage and use of radio. If there is no statutory requirement, a hand-held radio can be carried instead of a certified radio unit and can be used to good effect provided its power (range) limitations are understood. Studies show that a traffic alert greatly enhances see-and-avoid practices, and long-range communication is not usually critical. In addition, instructors can reduce the formality of radio without turning it into a CB by teaching the objective of a radio call as the first priority, and the form of the call second.

- **Lights**. Promote strobe lights at all times and within (say) 10 miles of any significant aerodrome insist on the use of landing and taxi lights below A100.
- **Evasive Manoeuvre**. How many of us have practised the standard manoeuvre? Not many I guess, and still less have practised it enough to overcome the reflex dart to the left that we use driving to work — practice may save us those fractions of a second that could mean the difference between hit or miss. The manoeuvre should be in every training syllabus, and tested in every flight review.
- **Accuracy Versus Lookout**. We all strive for flying accuracy. With 500 ft vertical separation as the norm we had better be good at it — flying accurate altitude needs to be emphasised in our training and checking. But what about lookout versus flying accuracy at MDA or in the circuit? It is easier to rate flying accuracy, and I would venture most check pilots mark down the pilot who does not fly accurately in those circumstances, without assessing lookout with equal stringency: perhaps a change of culture is in order.
- **Letdowns**. Instructors should ensure that all pilots are made aware of instrument letdown procedures, so that pilots are always well aware of what an IFR aircraft is likely to be doing.
- **Transit**. VFR pilots should avoid planning transit over busy aerodromes or nav-aids. Try to go where others aren't!
- **Clock System**. Introduce the clock system of aircraft location at the initial phase of flying training and keep it in use. How many of our students and co-flyers can look at another aircraft and tell the other pilot our relative position, clockwise?
- **See-and-Avoid**. Introduce into air studies see and avoid and its limitations. An excellent BASI study on the subject will soon be in print.

I am confident that if these ideas were put into each training syllabus and firmly established as part of our flight culture, the air would be safer after ICAO than before. There must be many more ideas out there — let's hear them.

The advent of the ICAO airspace classification will not greatly change the way GA operates. Just as most of us could do it better now, we can do it better under the new rules, for we are the ones who either enhance or degrade safety, and that won't change much whether we use the old or the new system.

ASD merely comments that there is not a lot in the preceding paragraphs that pilots ought not already to be meticulous about, anyway.

What's the 'arm in it?

pilot contribution by Raymond M Johnstone

FRIDAY WAS CLOUDY — no good for photography — so I took advantage of the day to have the engineers check out a persistent oil leak from no. two engine. To save labour, I de-cowled the engine for them.

After lunch, I returned to the airport, checked their work and re-cowled the engine. All that remained was to wheel the aircraft back from the hangar and taxi it to dispersal.

The aircraft was parked on a slight rise, so I released the brakes, removed the chocks, then gave it a gentle nudge so that it might start rolling down the slope. I'd done this many times before.

The aircraft quickly gathered momentum, so I threw a chock under the mainwheel, which went *CLUNK* right over it. Behind, parked at right angles to our path, was a Cessna 210 and I had visions of my aircraft's tail collecting it amidships.

So I used the only tools available — my hands — in an attempt to avert an accident. The nosewheel tyre quickly picked up my hand and fed it through the gap at the top, gouging out part of my hand in the process. My wrist and forearm quickly followed. By this time, I had become resigned to living the remainder of my life with one arm, and the thought crossed my mind that this therefore superfluous piece of flesh and bone might make a useful tool to retard the motion of the aircraft, by acting as a wedge.

The hypothesis proved correct and the aircraft stopped. Fortunately, there had been sufficient friction between rubber and forearm skin to stop the aircraft before my elbow was crunched, so no permanent injury was sustained.

Apart from my stupidity in allowing circumstances to evolve in the first place, the most intriguing aspect of the experience was this thought: what evolutionary process or history of self-preservation so prepared me that a part of my body could be sacrificed and instantly recognised as a tool?

ASD makes no comment on the writer's philosophical question, but hopes that this grisly story will help prevent similar incidents. We asked the author for a re-run of the incident, for the benefit of our photographer, but he declined...

Low flying

CAR 157 (1) An aircraft shall not fly over any city town or populous area at a lower height than 1 500 ft, or any other area at a lower height than 500 ft.

Rod Bencke, FOI (GA)

CAR 157 was written, along with other Regulations, as a result of the accumulated experience of many pilots, and after many unnecessary and tragic accidents.

Have you heard of Cobber Kain, a New Zealander and an ace in the Royal Air Force in WWII? He died not as a result of enemy action, but in the conduct of unauthorised low flying. He was doing a beat-up to impress his friends. They were all very impressed and the best came at the end, when he hit the ground and killed himself.

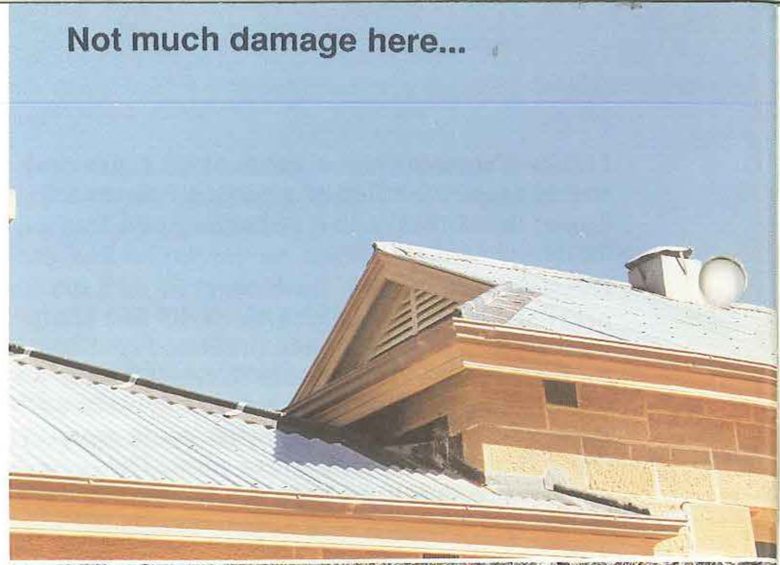
And how about Bluey Truscott, DFC and Bar? He was an RAAF ace. Bored with operating from Exmouth after the excitement and drama of battle in Europe and the Pacific where he claimed many kills, Bluey decided to do a few mock attacks on a Catalina he was escorting to base. Unfortunately on the last attack Bluey didn't realise the Cat was about to land — and it is almost impossible to judge height over smooth water. Despite frantic last-minute calls of 'Pull up, pull up!' from his wingman, Bluey hit the water at high speed and was no more.

These accidents, and alas there have been innumerable others before and after, were caused by highly trained pilots attempting impromptu, unplanned low level flying.

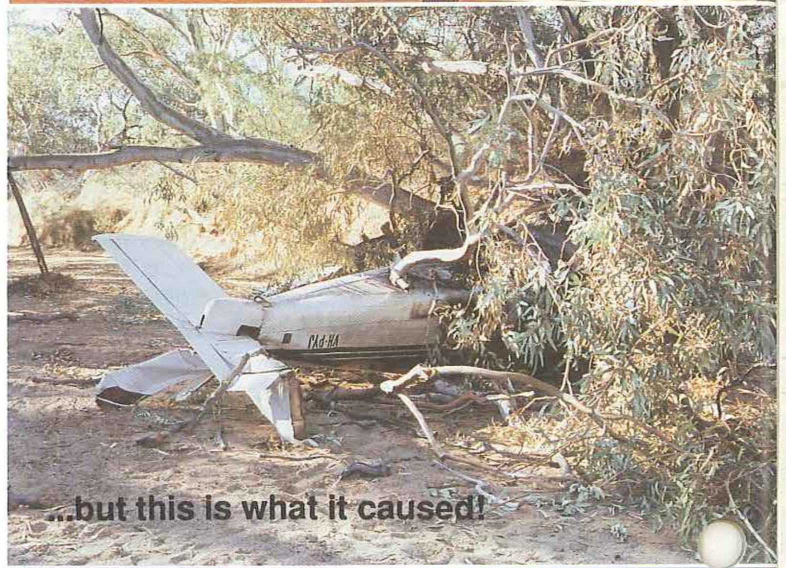
'But', you might say, 'they were airforce pilots. That sort of thing does not happen to civilians, right?' — Wrong! How about this, it happened late last year:

Five pilots together with the family of one of them flew in two aeroplanes to an outback town in New South Wales for a weekend away. On the Saturday and Sunday mornings both aeroplanes were observed carrying out low flying activities. On Sunday afternoon a couple of the pilots decided it would be good fun to try a little low level bombing using flour bags. The target was to be in front of the hotel. The first pass, at around 50 ft, resulted in the bomb overshooting the target. *Never mind, let's go round again for another go.* The second pass was below 50 ft and it appears the flour bag jammed in the window through which it was to be dropped.

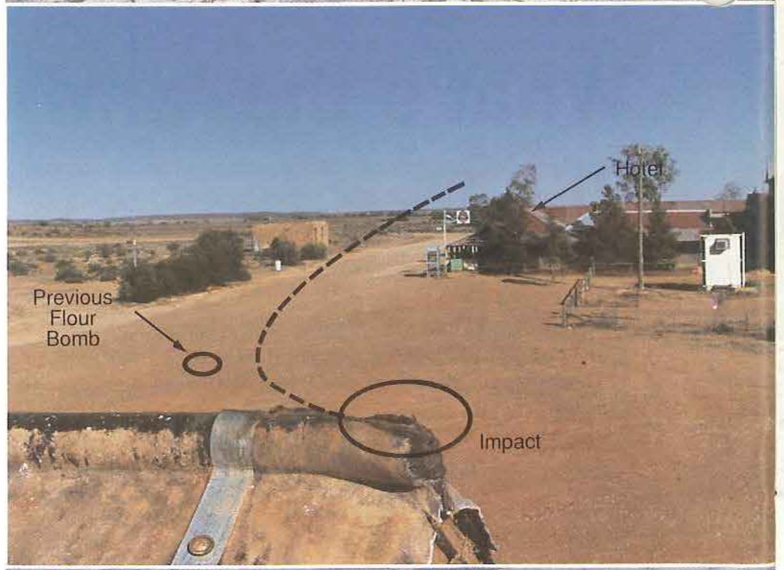
The spectators in the hotel saw both pilots trying to release the flour bag and were horrified as the aeroplane entered a steep climbing turn to the left. The bank angle increased to over 90° and the port wing buckled as it collided with the roof of the court house.

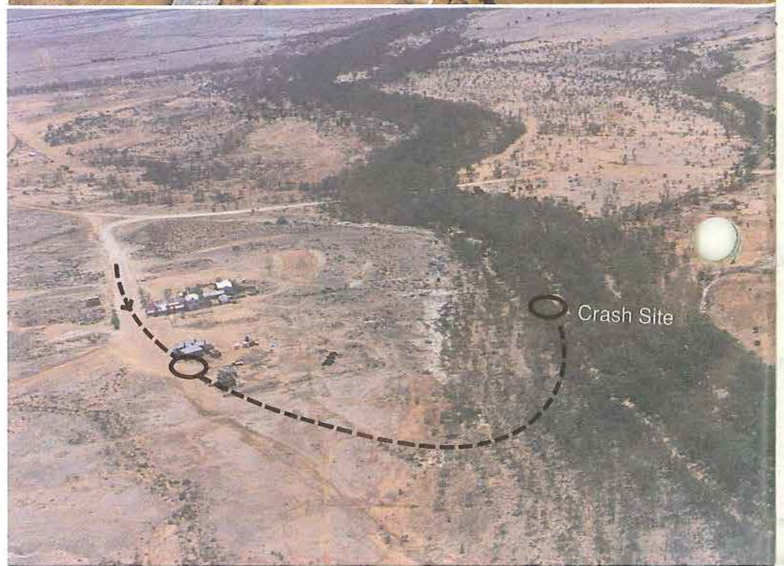


Not much damage here...



...but this is what it caused!





The aeroplane made a complete 180 before it struck some trees, where it cartwheeled and crashed upside down. As a result of the crash and the leaking fuel the machine caught fire — a fire so intense that no one could approach to help. Three people died a most terrible death. And this was supposed to be fun.

It was lucky the aeroplane did not end up in someone's house, for people on the ground also have a vested interest in how safely aircraft are flown.

Some operations — crop spraying, cattle mustering and power line inspection, require the pilot to fly at low level. Pilots engaged in such operations are required to undergo special training in order to conform to the requirements of CAR 157. The training covers pitfalls and dangers encountered at low level and how best to counter them. False airspeed perception, wires, and terrain avoidance requirements -v- available aircraft performance are among the dangers emphasised. Engine failures are demonstrated and pilots are taught the best way to conduct a forced landing with the little reaction time available. These emergency drills are then practised (for a basic agricultural licence some 40 hours of intensive flying is required) until all pupils are justly confident of their ability.

The armed forces have a particular requirement to fly at low level. Even though service aircraft are specifically equipped or even designed for the task, the military rely heavily on comprehensive low level training, close supervision, regular check flights and a large array of restrictive orders to ensure that their operations are as safe as possible. Every low level sortie is preceded by meticulous planning, a full briefing and careful vetting before the flight is cleared.

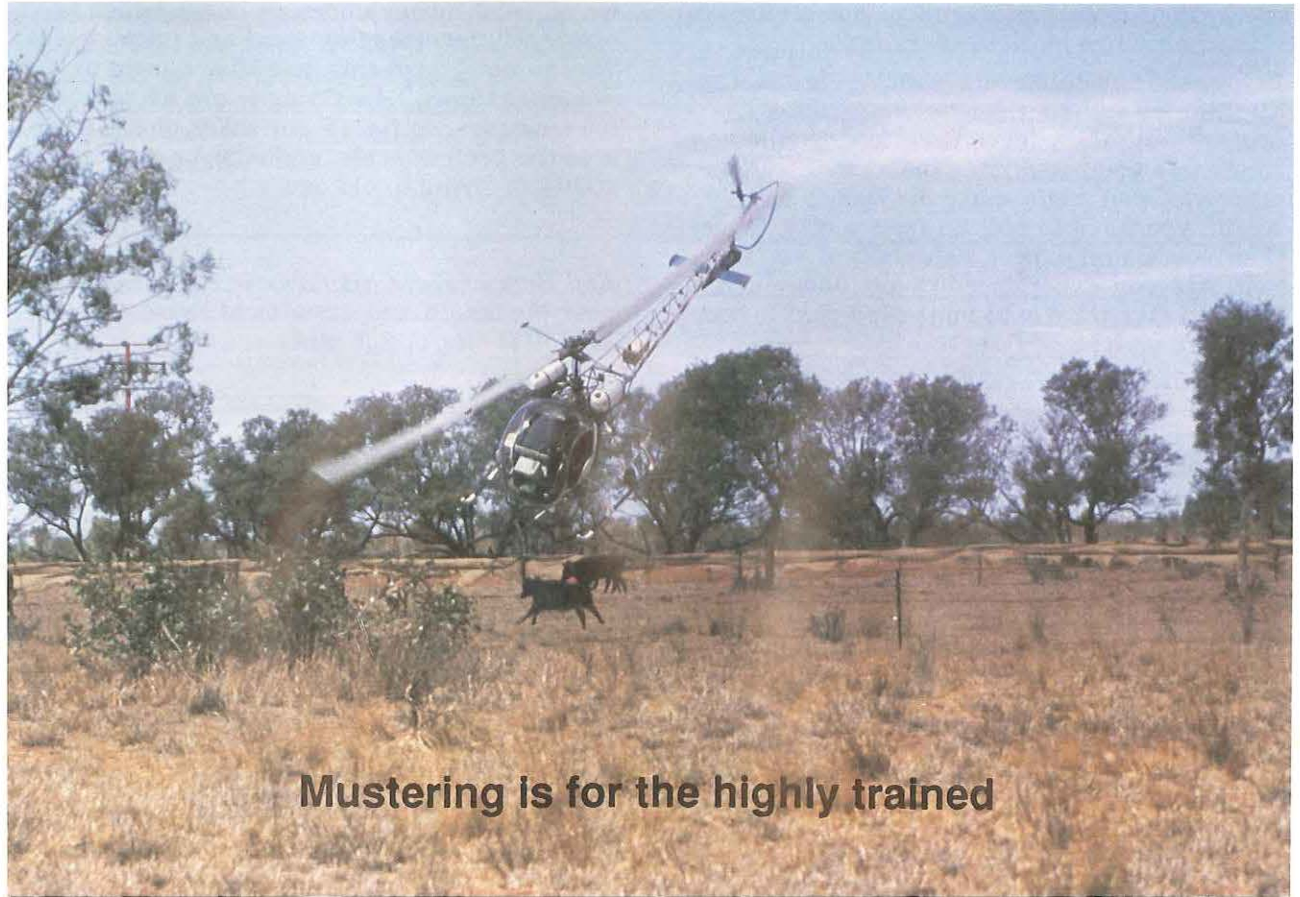
Flying at low level is dangerous, even for the trained and qualified pilot. It introduces a number of new and pressing problems. Here are a few:

The **altimeter** is useless for indicating height above the terrain. The usual setting we use on the altimeter below transition altitude is QNH. This setting enables the altimeter to indicate height above mean sea level within a limited area, and takes no account of the elevation of the surrounding earth or water surface (lakes are rarely at sea level). It can be difficult to judge your height above the terrain, because the size of surrounding objects can deceive. What you think is a large tree can on occasion turn out to be a small salt bush. This is particularly a problem in reduced visibility and where there is no clearly defined horizon.

Changes of contour can be very deceiving and you can rapidly run out of airspeed as the aircraft climbs up a gradient you had not detected. For the average light aircraft, you will be surprised how shallow that gradient is.

Because of the **lack of visibility** it is not difficult get lost when flying at low level. This is always embarrassing and can be more than slightly fatal.

Wind can cause problems. If it is strong it can cause turbulence downwind of obstacles, even a line of trees will do. This turbulence could result in loss of control, to the extent that your aircraft might even hit the ground. Remember some of the hairy approaches to land you have made in windy conditions? Well, they are not as exciting as the conditions you will find attempting to fly at really low level.



Mustering is for the highly trained

Turbulence can be severe, especially near rising ground. A downdraft over a mountain can reduce your maximum rate of climb to zero or even a descent. When the ground in front of you is rising this is not good. Is there enough room to turn around before you hit the ground? Have you been practising maximum rate or minimum radius turns lately? You may need this skill if you find yourself trapped in a valley.

Drift becomes very apparent at low level, your aircraft points in one direction but goes in another and so you could be caught out when trying to avoid an obstacle. The larger problem, though, is that of perceived speed. At low-level, there is a strong tendency to judge your speed by movement of the ground below, rather than reference to the ASI. An aircraft flying into wind will seem slow. If you then accept this slow speed as normal flying *downwind*, or indeed when making a turn, you may well stall. Groundspeed and IAS are not the same. How is your low level stall recovery technique? You have probably never seen such a manoeuvre, let alone received any instruction in the art. Your first stall could be the last!

Another problem associated with **perceived speed** is that you seem to be going faster the lower you fly. We certainly have a dangerous mix here. Turning adds more problems, drift during the turn, apparent slip or skid, and inertia.

Aircraft inertia is interesting. Because your aircraft has mass and motion it responds to Newton's laws. One of them says 'a body continues at rest or in uniform motion unless acted upon by an external force'. Therefore, your aircraft will continue along its path in both the horizontal and vertical planes until acted upon by a force, in this case the aircraft controls. However, the effect of control input is not instantaneous, and although aircraft inertia is not evident at higher altitudes, it is a vital consideration when close to obstacles.

Before the controls overcome this inertia, the aircraft for a short time continues along its original path. Low-level, therefore, you have to commence your avoidance manoeuvre early, otherwise you might make Sir Isaac's day. Again, you have to pull up from a dive sooner than you would expect, especially if you are fast. Are **you** experienced in just how much extra to give it? Would you — *do you?* — bet your life on it?

Flying over **large stretches of water** at low level is also fraught with danger. It is extremely difficult, (ask Bluey) if not impossible to judge height when flying over calm, glassy water, particularly in hazy conditions where there is no clear horizon. Climb to the top of a high diving board and look down at the pool below. If the water is still you will see the problem, or rather you won't see (check diving competitions on TV and you'll note the jets of water that ensure the surface of the pool is ruffled). Real pilots would never fly below 500 ft over water without a radar altimeter, preferably with some sort of head-up warning. Is your aircraft thus well-equipped?

There are other problems related to flight below 500 ft — **engine failure** and **forced landing, turbulence** due to thermal action, **aircraft fatigue, navigation problems,** the difficulty of seeing **wires** until it is too late and many more. This short article cannot deal with them all and is not intended to. It is rather to persuade you not to try unauthorised low flying, for your life's sake.

Flight at low level in contravention of CAR 157 means flying in an environment in which you have no training or recent experience. A lack of either makes you incompetent for the task. You are putting yourself and your passengers at risk, and endangering the lives of people on the ground. You almost certainly will be causing an unnecessary disturbance, and in my opinion it is one of the occasions when use of the full force of the law is justified.

In the last two years in Australia at least eight people have died and a further eight have suffered severe injury in nine accidents caused because the pilots decided to break the law. This sad toll was totally unnecessary, the result of bravado and incompetence. As an industry, we all must labour under an image which is constantly tarnished by fools and incompetents. We can not afford this, in either human or economic terms. Low flying is not an activity for amateurs, so for all our sakes please leave it to the professionals, and enjoy a higher probability of living to old age.

Rod Bencke spent his formative (flying) years over the length and breadth of Europe at 450 kt, 250 ft day/600 ft night

Leave LOW FLYING to The Professionals

STOP PRESS !! *In the last six months, there have been reported 32 accidents concerning low - flying. Eighteen people (25 if you include the Bell 206 on March 2) have lost their lives.*

Advanced air traffic systems agreed

by John Wright
Assistant General Manager
Airways Transition Program

IN THE PREVIOUS Autumn issue of the *ASD*, it was mentioned that the AMATS proposals were subject to extensive consultation with industry and that some of the detail contained in the articles had been overtaken by events. The major focus of the debate has been the services and procedures appropriate to airspace which is currently uncontrolled.

Taking account of the views of industry, the CAA was able to announce during April that the international airspace classification system would be adopted. When the new system is fully implemented a separation service will be available to pilots flying under IFR in areas that are currently uncontrolled and there will be vastly improved services for aircraft in busy areas through the extended use of radar. The airspace management plan and the two centre system will be known as The Australian Advanced Air Traffic System (TAAATS).

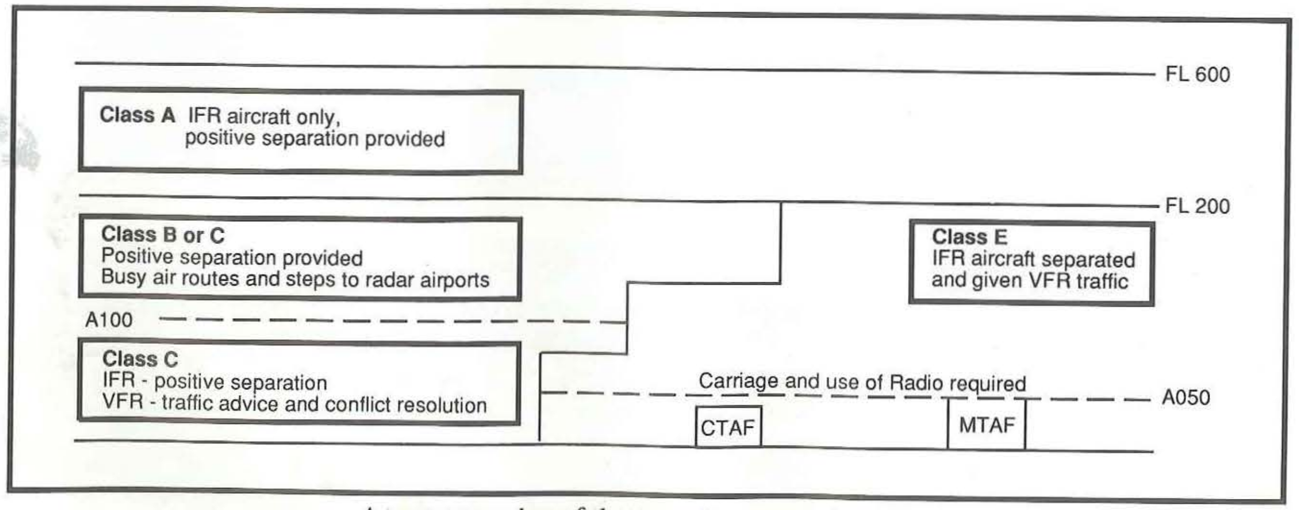
It is now planned that the Class E separation service will be provided by ATC throughout Australia by June 1994. A Flight Information Service will be available to all across the whole country involving similar VHF and HF coverage as offered today but not including a traffic information service.

The CAA intends that the introduction of The Australian Advanced Air Traffic System will take place progressively from December 1991 until the end of 1995. We also fully appreciate that we will need to provide timely information to pilots on the changes prior to introduction. The next issue of the *Aviation Safety Digest* will contain a selection of articles relevant to the first changes which are scheduled to come into effect from 12 December.

Among the changes planned for December 1991 are:

- the base of the control area over Australia will be lowered from FL245 to FL200;
- the ICAO hemispherical table of cruising levels will come into effect;
- traffic information (other than information about VFR flights) will continue to be available to IFR flights outside controlled airspace;
- full reporting will no longer be available to VFR flights. SARTIME will be;
- radar advisory services will be introduced as staffing and facilities permit;
- all VFR aircraft (except gliders) will be required to carry radio and be prepared to use radio when flying above 5 000'. Gliders will be expected to comply whenever possible;
- all VFR aircraft will be required to carry and use radio when within the prescribed distance (usually 5 000' and 15NM) from an airport with a Mandatory Traffic Advisory Frequency (MTAF);
- a Common Traffic Advisory Frequency (CTAF) will be notified for all other licensed airports;
- new VMC minima will be notified; and
- VFR GA flights will not be required to submit flight notification to the CAA other than for flights in controlled airspace above 10 000'.

The *Aviation Safety Digest* will be a valuable source of information for pilots but I would ask pilots to consider the benefits of ensuring that they have access to other documentation particularly Class 2 NOTAMS, AIP/MAP and ERSA.



A summary plan of the new airspace and services