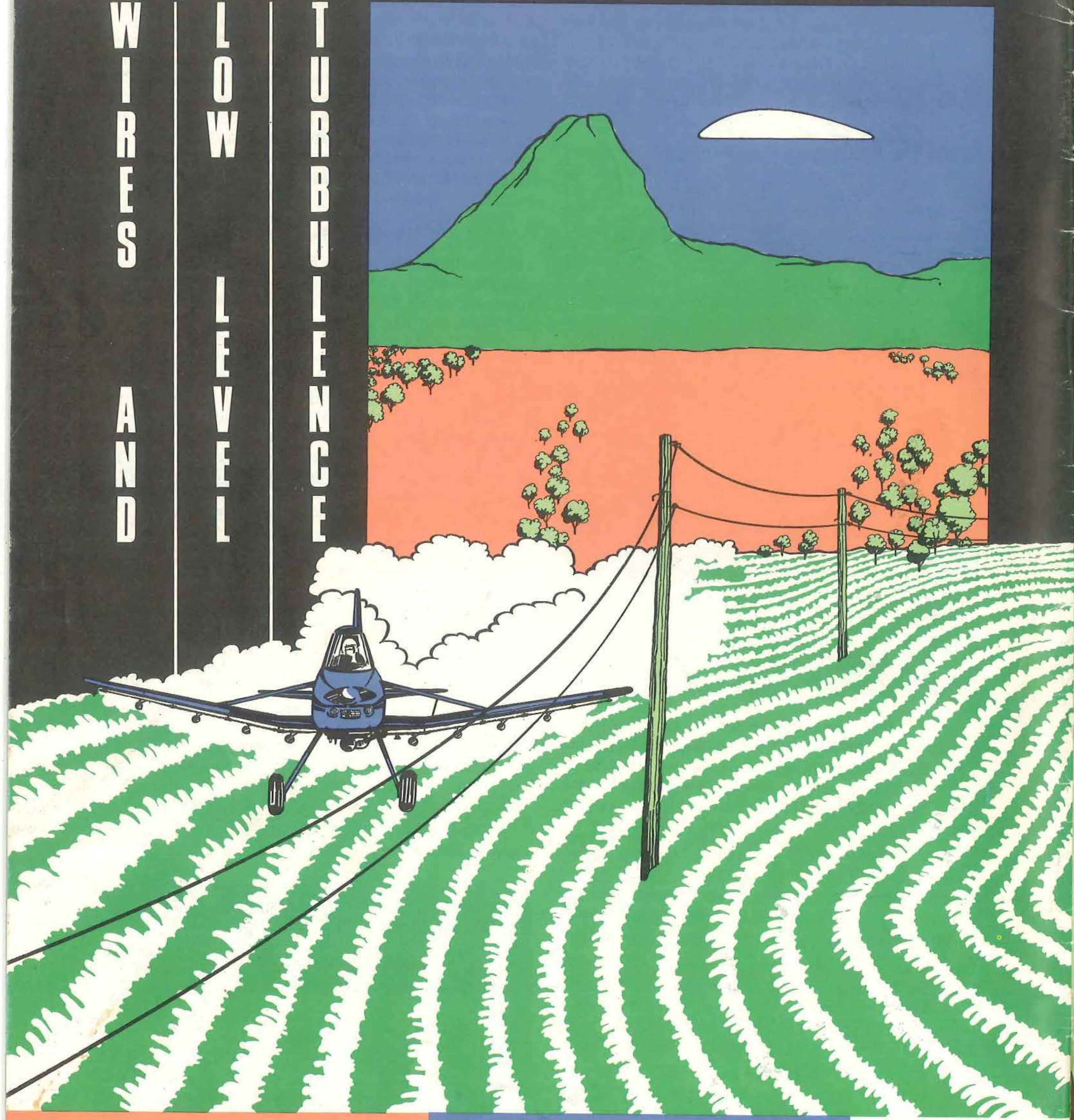
WIRES AND LOW LEVEL TURBULENCE



W - wind direction and strength
I - identification of treatment area
S - sun position
H - hazards, treatment and manoeuvring areas

S - susceptible crops
T - terrain
A - access for markers
N - nuisance: people and stock
D - direction of treatment
E - emergency landing areas

PLUS:
X - extra hazards check before clean-up or recommence

CIVIL AVIATION AUTHORITY AUSTRALIA

AUSTRALIA

Aviation Safety Digest

ASD 142

SPRING 1989

CIVIL AVIATION AUTHORITY AUSTRALIA

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

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Contents

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Photographs:
P4 Bureau of Meteorology
P5 Terry Walls
P17 Al Bridges
P20 BASI
P23 Warwick Budd

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Cartoon: Gary Clarke

Statement by Phil Bowen

Group General Manager, Airways Operations

THE AIRWAYS Operations Group is the commercial heart of the Authority. The Group has about 5,000 staff (mainly air traffic control, flight service, rescue and firefighting service, and professional and technical support staff), an annual turnover of about $500M and a capital budget of about $100M per year.

With the exception of about $3M per year from the Government for search and rescue, the Group's revenue is derived from industry charges.

The charter of the Airways Operations Group is to deliver high quality services which meet industry demand and safety requirements, whilst containing and if possible reducing charges.

The main objectives of the Group are to:

1. Streamline air traffic management procedures

In addition to progressing the initiatives to improve traffic management at Sydney arising from the recommendations of the team which recently examined air traffic procedures at certain North American airports, it is proposed to develop by 31 December 1989 a program for the review of airspace management Australia-wide. The aviation industry will be closely consulted in the development of this program and in particular in determining those areas which need priority attention.

2. Provide services to the aviation industry on a more commercial basis

There will be a closer focus on the services provided to industry with a view to ensuring that they meet the industry's requirements in a commercial way. A business proposal for the future provision of operational control services is nearing completion under the guidance of Captain Mike Terrell, formerly Operations Manager with Ansett.

It is proposed to adopt a similar approach to examinations of the other services provided by the Group. An important issue which will be resolved in this context is the provision of Rescue and Firefighting Service Units at capital city secondary airports.

3. Improve Productivity

Productivity performance indicators are being developed to enable the efficiency of the Group to be monitored and, where necessary, corrective action taken on an ongoing basis. In addition, the Group is continuing to progress, on a fast track basis, the major airways facilities modernisation program which, through such initiatives as consolidation of many flight service and some air traffic control units to major capital city centres, offers large productivity gains for the Authority which will be reflected in lower costs to the aviation industry.

4. Establish effective project management procedures

The successful implementation of the current capital investment program, including new radars for Sydney, Brisbane and Canberra and the rectification of the problems with the radar systems at Melbourne, Adelaide and Perth, rests heavily on having in place effective project management arrangements and adequate project management resources. The Authority is seeking outside assistance to help with this massive task and as a risk minimisation measure will, as a general rule, be acquiring only off-the-shelf systems already operating successfully elsewhere.

The key to achieving these objectives lies with the people who make up the Airways Operations Group. Operational and technical staff are being involved more effectively in the Authority's decision-making processes, in particular in the acquisition of new operational facilities. For instance, we consider the cost associated with sending a 10 man multi-disciplinary team overseas to look at possible options for new radars at Sydney, Brisbane and Canberra a small price to pay to get the decision right. The Authority is also embarking on a major increase in its staff development and training effort with particular emphasis on management and supervisor training and skills broadening.

In essence, we have recognised the need to become more people-oriented and trust this will be reflected in a high level of service and a high level of customer satisfaction.

PHIL BOWEN

Editorial

THERE ARE three major themes in this Digest: **Mid-air collisions; Spring fever** and **Low level hazards facing the agricultural pilot**.

The series of articles on mid-airs is designed to show how to avoid disaster, and the aim is to educate us all through lessons learned. Mid-airs are just too final for anyone to benefit from personal experience.

In Australia, Spring is a pretty active season. The sap may rise, right enough, but so does the cloud, and often it contains all sorts of nasties. Any type of weather is to be expected: Spring is a time for great care in pre-flight planning. Always allow plenty of time for your journey and you'll find the all-too-frequent sudden change in the weather won't catch you out.

A short paragraph in the yellow pages emphasises that far too often, alas, agricultural pilots fly into power lines. The accident highlights an article concerned with the disciplines necessary for successful operations close to the ground. The back-cover poster reinforces the message: at very low level wires and turbulence are major hazards. We have just released a video on this theme, too. It's called '**Going Ag...Grow**' and can be obtained or viewed at your nearest Field Office or major agricultural operation.

In the centre section is a complete index of Airworthiness Advisory Circulars. This very useful aid is provided not only for LAMEs, but for owners and pilots alike.

Finally, the Digest welcomes BASI's 'new look' Journal. This fills the gap between accidents and our analysis of lessons to be learned. The Journal gives the facts more fully than before — number four of Autumn '89 complements this Digest with excellent cockpit visibility diagrams on the back cover and a very relevant article on 'The Mid-Air Crisis'.

Al Bridges
Editor

Covers

Front: Entry in previous Photographic Competition taken by E. Mason

Back: Poster design and production by Soussanith Nokham

Spring — the season of change

Bureau of Meteorology

RECENT editions of the *Digest* contained articles on flying weather in the other seasons. Spring brings its own type of weather, and we will briefly refer to the changes which occur in different parts of the country and their implications for flying.

Southern Australia

As spring progresses showers and storms tend to replace the fog/persistent low cloud that characterises winter in many parts of southern Australia (see Table 1). There are a number of reasons for this change, including:

- An overall increase in low level heating.
- The increasing incidence of a trough in the easterly flow at Mean Sea Level along the West Australian and eastern coasts.
- Incursions of cold air from the Southern Ocean over southern Australia at middle and higher levels in the troposphere.
- The prevalence of sharp upper air troughs and southerly jet streams.

Table 1. Average frequency of thunderdays and fog days at Canberra in late winter and spring (indicates less than one)*

	AUG	SEP	OCT	NOV
Thunderdays	*	2	3	5
Fog days	5	4	3	1

The freezing level is usually quite low in springtime cold outbreaks and aircraft icing then becomes a very serious problem. The winter 1988 and winter 1989 Digests contained articles providing valuable information on airframe and engine icing.

Northern Australia

In northern Australia there is also a general increase in atmospheric instability as spring progresses (see table 2).

Table 2.Average frequency of thunderdays at various localities in late winter and spring (indicates less than one)*

	AUG	SEP	OCT	NOV
Darwin	*	*	7	13
Alice Springs	*	*	3	4
Croydon (Nth Qld)	*	1	4	7
Charleville	1	2	5	6

By late spring many features of the 'wet' season are usually evident in northern Australia and these present the pilot with a far different scenario to the southern storms. The summer 1988/89 *Digest* provided considerable information on 'wet' season flying, and is well worth rereading.

Behind all the events that led to the final catastrophic moments, is the fact that the pilot was inexperienced in the ways of the Nórth's wet season and the particular hazard it presents over featureless areas with great distances between emergency landing places. It is vital for all pilots to realise that weather conditions encountered in the North's wet season, particularly in the late afternoon, are a very different proposition to the storm-type weather normally encountered in southern Australia, and diversion action usually involves long flights over country where map reading is most difficult.

— Extract from *Aviation Safety Digest* No 55.

A special type of cloud worthy of mention occurs on some spring mornings in the vicinity of the southern Gulf of Carpentaria — this is 'the morning glory' cloud phenomenon and is manifest as a mobile low level roll cloud. (A photograph of the morning glory is on the cover of Digest No 123). Turbulence typical of that associated with any 'rolling' cloud is present and pilots are advised to give it a wide berth.

Overview

Pilots must particularly heed the latest forecasts and warnings in spring because:

- The heavy showers and storms often contain many of the hazards of hail, downdrafts, gust fronts, microbursts and reduced visibility.
- The weather typically changes very quickly.
- Discontinuities (eg upper air troughs) are usually sharp.

To complement the forecasts, pilots are advised to look for the visual clues that often indicate the rapidly changing conditions, and exercise all the skills of weatherwise flying (which will be the subject of an article in a later *Digest*) ☐

Wire survival

by John Freeman, Examiner of Airmen, Civil Aviation Authority

THE DEATH of a young agricultural pilot the other day prompts me to write this article. This young man had a promising career ahead of him in agricultural aviation. I flight tested him in May 1987 for issue of his agricultural pilot rating and found him to be at a good standard; an above average pilot, careful, meticulous and mindful of his training.

He hit a wire during a clean-up run. The wire was hard to see with a long span between poles. However, the pole run was quite obvious.

Where did he go wrong and what could have prevented the accident?

Agricultural flying training sequences now carry great emphasis on wire location and avoidance. Budding ag. pilots are shown how easy it is to use clues to the wire runs so that they may locate the wires themselves. They also have hammered into them the requirement for an extra 'hazard check' to be fully completed before carrying out those potentially dangerous clean-up runs. The current issue of the Agricultural Pilots Manual has been updated by me to include a very large segment on wires, their location and avoidance. In that publication it is said that if the Air Force can carry out an extra 'check wheels' check on final approach to avoid wheels up landings, so surely agricultural pilots should likewise carry out the extra 'hazard check' prior to carrying out clean-up runs.

Its all a matter of professionalism. Even so, how does it happen that a young, recently trained pilot hits a wire, particularly in a clean-up run?

Well, for starters, this is not the first time, and personally I'm tired of seeing fellows, with whom I have flown and come to like, disappear in a pall of smoke!

When the pilot is going through his agricultural flying training he is taught the basics of survival in agricultural flying, just as a child is taught how to cross the road. If the pilot takes notice of those basics, proper wire location, extra hazard checks etc, only until he feels that he has set up his own approach to the problem then ceases to 'think', he is as long for this world as the child who forgets to look to the right, to the left and to the right again, before crossing the road.

The brutal fact is that, with a possible career spanning 20 years and thousands of wire-strewn paddocks to be treated, unless the basics are followed the ag. pilot is going to be pretty lucky to survive.

There are many ag. pilots who have grown up in the current situation where coping with wires is a many times a day occurrence. They do this day after day from the time that they go out into the world with their new rating, and they don't hit wires. They are doing something right. The only way to join them is to remember the basic rules -

1. Carry out the WISHSTANDE check (see below) before commencing the treatment.
2. Locate all wires within the treatment and manoeuvering areas.
3. Leave ground-borne distractions on the ground and concentrate only on the job being carried out.

And your final life insurance.

4. Carry out an extra 'hazard check' before clean up runs.

There's nothing quite as delightful as an old ag. pilot, and nothing quite as sensible as a dedicated ambition to become one.

W — wind direction and strength

I — identification of treatment area

S — sun position

H — hazards, treatment and manoeuvring areas

S — susceptible crops

T — terrain

A — access for markers

N — nuisance, people and stock

D — direction of treatment

E — emergency landing areas ☐

Mid-air!

MID-AIR! The media love it, all those great human tragedy stories with lots of good pictures of smoking holes and twisted wreckage. But what of ourselves? We wonder what went through the minds of those involved, how do their loved ones feel now...how did it happen, could it happen to me?!

Every pilot, every member of an aircraft's crew and every Air Traffic Service Officer has a personal interest in avoiding mid-airs. Obviously those in the aircraft may well be killed. But the effect on those left behind, ATS, can be equally devastating. Overseas controllers have suicided after observing a mid-air on their screen.

Doctor Liddell, the CAA's Aviation Medicine Director, has written our first article on mid-airs. He describes in terms we can all understand the capabilities and limitations of the human eye. The second article describes the mid-air collision of a DC-9 and PA-28 over a large city, a scenario which could happen in Australia if we do not follow procedures correctly and fail to apply common sense to our aviation. The third article then describes two Australian mid-airs and summarises the lessons from each of these articles.

Well clear, near miss or mid-air!

Understanding Seeing! *Dr Robert Liddell, Director of Aviation Medicine, Civil Aviation Authority*

A week rarely goes by without an article in the press about a near miss between two aircraft somewhere in Australia. All too frequently there is a mid-air collision with its almost inevitable destruction of aircraft and loss of life. As a pilot, understanding the act of seeing will increase your chances of remaining clear of other traffic.

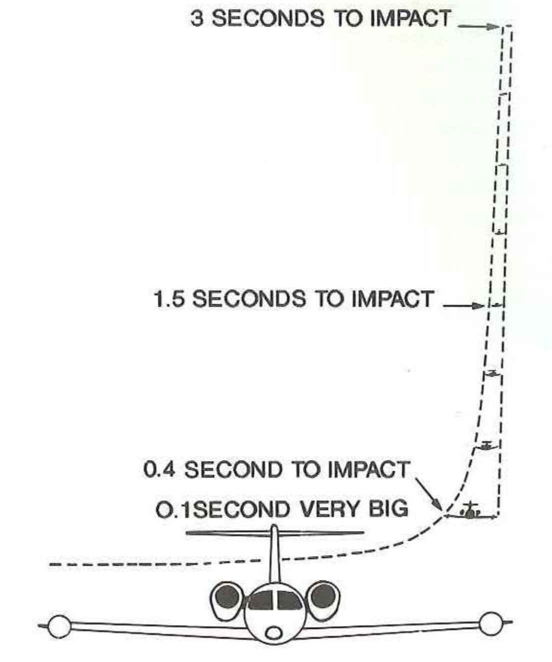
The act of seeing can readily be broken down into three distinct areas; physical, physiological and psychological.

Physical

Physical relates to the properties of the other traffic (the target) and the physical environment surrounding the target.

The most obvious factor is size. A 747 viewed from 100 metres cannot escape attention. However, the same aircraft at eight km will not be so obvious. Yet at jet aircraft closing speeds of 1000 knots or one mile in four seconds the observer has only 20 seconds to see the other aircraft, decide that there could be a conflict and take avoiding action. In light aircraft with closing speeds of 200 knots (one mile in 15 seconds) there is more time available to see another aircraft; however, the target size is much smaller especially if the aircraft are approaching head on. (Refer to Figure 1).

The contrast with the surrounding environment will have a marked affect upon visibility. The white contrails from jet engines seen against a blue sky are highly visible. However, set against a backdrop of white overcast the contrails virtually disappear. Equally, trying to sight another aircraft below the horizon can be extremely difficult as it becomes lost in the background of earth colours or the shapes and confusion of suburbia. Combat pilots are trained to realise the importance of the sun; targets between the observer and the sun are virtually invisible because of the extreme contrast caused by the sun's brightness. Pilots must appreciate that their aircraft is invisible to any traffic 'down sun' from their position.



CLOSING SPEED 1000 KNOTS

THE RETINAL SIZE OF THE COLLIDING AIRCRAFT REMAINS RELATIVELY SMALL UNTIL VERY SHORTLY BEFORE IMPACT

FIG.1

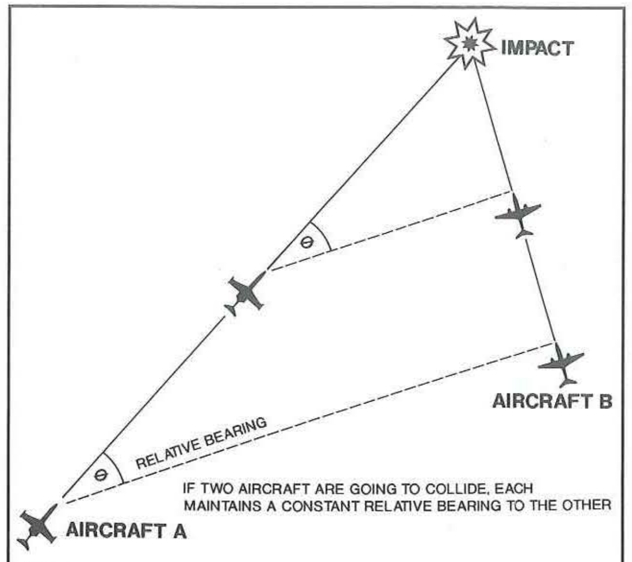


FIG.2

The greatest enhancement to contrast exists with the flashing strobe light. This light makes use of two mechanisms to attract attention. The first is the contrast of the light's colour against the background. The second relates to the apparent movement of the light as its brilliance expands and contracts with each flash.

Movement is the most important physical property in the visibility of targets. Objects which move across the visual field stimulate more nerve endings in the eye and are noticed sooner. The unfortunate aspect of this is that a target which moves relative to the observer is not generally a collision risk. If two aircraft flying on a constant heading and at constant speed are going to collide, they will maintain a constant relative bearing to one another and appear to remain stationary in the windscreen. Thus one of the most important cues for visual target acquisition (movement) is missing on the very target which poses the greatest threat. Figure 2 illustrates the constant relative bearing situation.

Surprisingly many pilots ignore one of the aspects of vision with the simplest solution. There is little point searching the sky for the small dot which threatens to become an aircraft on collision course if the windscreen is covered in small dots of dead insects and dirt. In today's aviation environment the pilot must take every step available to improve the possibility of seeing traffic, and pristine clean windscreens and glasses are a good place to start.

Physiological

The optics of the eye determine how clearly the eye can focus distant objects. The standard for normal distant vision is 6/6. This means that an individual can see clearly the 6/6 line of a chart at a distance of 6 metres. 6/9 or 6/12 vision means that the subject sees clearly at 6 metres what the normal eye sees at 9 or 12 metres. The visual standards allow for vision as poor as 6/12 for private pilots and 6/9 for commercial pilots. This should be considered the worst case and if by wearing glasses or contact lenses an individual can improve the visual acuity to normal (6/6) or better then that should be done. The difference in visual ability between 6/6 and 6/12 could mean the difference between seeing an aircraft in time to take avoiding action or a 'mid-air'!

The technique to overcome this effect is to make a conscious effort to push the point of focus out to infinity by focusing on points away from the aircraft such as the ground, the wing tips, distant clouds or stars. This refocusing must be done repeatedly as over a few minutes of looking at empty space the point of focus will move in again.

Psychological

The best vision in the world is of no value if it is not used. The pilot who does not look out of the cockpit will never know about the traffic until the sound of impact.

Seeing involves looking and looking involves expectation; the expectation of finding a target. If you think you are the only aircraft in your airspace, then you will not see the other traffic.

Finally, ask yourself how can you help to make yourself more visible to your fellow pilots.

Be aware of your position in relation to the sun, radio your position and intention to all traffic in uncontrolled areas, slow down and use strobes, beacons and lights in areas of high traffic density; and keep a good lookout.

The technique used for searching the skies for traffic is important. The optics of the eye are such that to see a small target such as a distant aircraft the eye must be looking straight at the target. This is especially important if the target is not moving relative to the observer i.e. on a collision course. To achieve this the eye must scan each area of the sky in a systematic fashion so that all quadrants are covered. Nothing will be gained by sweeping the gaze rapidly across the areas of search, as the eye only sees when it is stationary. When the eye is moving from one point of fixation to the next it is functionally blind. The technique then is to divide the sky into quadrants and move the gaze across the quadrants stopping every few degrees of eye travel for a moment to search that area for traffic.

Myopia is a term used to describe short-sightedness. Empty field myopia is what happens to all individuals when looking out of a cockpit at the empty sky. As there is nothing at infinity on which to focus, the eyes focus at a point 1-2 metres away. This is made worse by the effect of window frames and posts as they tend to contribute to dragging the focusing point in from infinity. The effect of this is that whilst searching the empty sky the eye may be focused on a point 1-2 metres outside the aircraft with the result that a target at a distance will at best be blurred and probably invisible □

Mid-air collision over Cerritos

At about 1140 am a PA-28 departed Torrance, just south of Los Angeles International Airport (LAX), on a VFR flight to Big Bear, about 60 miles to the east and at about 6,000 feet up in the mountains. At 1120 an Aeromexico DC-9 had departed Tijuana for LAX. These aircraft collided over Cerritos, a suburban city of Los Angeles, at about 1152, both aircraft falling to the ground. The three occupants of the PA-28 were killed in the collision; 58 passengers and six crew in the DC-9 were killed by ground impact forces and 15 people on the ground were killed.

The NTSB determined that the probable cause of the accident was the limitations of the ATC control system to provide collision protection. Factors contributing were the inadvertent and unauthorized entry of the PA-28 into the Los Angeles Terminal Control Area (TCA) and the limitations of the see and avoid concept to ensure traffic separation.

The PA-28 route was planned to keep it well south and east of LAX climbing to 9,500 feet. The PA-28 pilot did not activate his flight plan, nor was he required to. The transponder was set correctly to the VFR code and does not give height information. The pilot, flying from the left seat, was familiar with the area. He had two passengers, one seated in the front right seat.

The DC-9 was on an IFR plan and was cleared to approach from the south at 7,000 feet. The aircraft was then cleared by approach control's arrival radar controller to reduce to 190 knots and descend to 6,000 feet. Just over one minute later the two aircraft collided at about 6,500 feet. Both pilots of the DC-9 were familiar with the area and the captain was very experienced.

At the time of the accident the controller considered his workload to be 'light'. He had responsibility for several aircraft and was also checking two different scopes for conflicting traffic for two flights and taking a change of details for the DC-9 from the arrival co-ordinator. A traffic conflict also demanded his attention when a Grumman Tiger requested a clearance. The controller informed the pilot he was in the middle of the TCA and suggested that 'in the future you look at your TCA chart. You just had an aircraft pass off your left above you at 5,000 feet and we run a lot of jets through there right at thirty five hundred'. He then noticed the radar no longer tracking the DC-9 and could not establish radio contact.

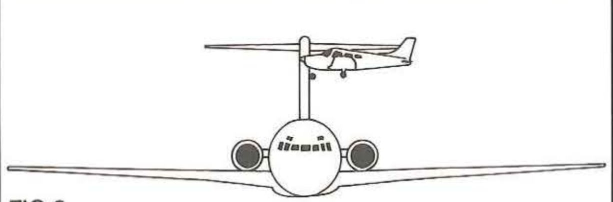


FIG.3

Weather at the time was clear with visibility of 14 miles and no cloud. The sun was high in the sky behind the DC-9 and about the two o'clock position on the PA-28.

The radar recording, the DC-9 Flight Data Recorder and the PA-28 altimeter witness marks from the mid-air impact, all indicated the collision occurred as the DC-9 was descending through 6,560 feet. It was tracking north west and the PA-28 was tracking east, crossing the DC-9 track from left to right. The collision damage on the DC-9 was confined to the vertical and horizontal stabiliser, the horizontal stabilizer separating from the DC-9.

The engine of the PA-28 struck the left side of the DC-9's vertical stabilizer. The left horizontal stabilizer sheared the roof off the PA-28 cabin, the damage indicating the PA-28 was in an almost wings level attitude at impact. Figure 3 shows the relative positions on impact.

The arrival radar controller stated that the PA-28 '... was not displayed. It is my belief that he was not on my radar scope'. He testified that, with regard to TCA intrusions, the number varied and 'it could be anywhere from zero to 10 or 15 a shift that I will observe'.

Seven months after the accident a DC-9 reported, as it was happening, a near miss with a Cessna under similar circumstances. The controller re-checked his radar display which did not depict the Cessna. He had another controller confirm the Cessna was not depicted.

Despite the absence of a return on the smaller aircraft in each incident, when the radar recording was played back both the PA-28 and Cessna were depicted. Numerous tests were conducted in an attempt to resolve this anomaly. A satisfactory solution was not reached.

A visibility study was conducted to determine the physical limitations to visibility from each of the pilot seats. The time histories of both aircraft flight paths and attitudes were combined with binocular photographs of the cockpits. The binocular photographs are taken by a camera with two lenses, the spacing between the lenses being equal to the average distance between human eyes. The viewing angles for each aircraft were then calculated and plotted at five second intervals in relation to the design eye reference (DER) points for each windshield (Figure 4).

The study showed that for about the last 90 seconds of controlled flight, the PA-28 was about 15 to 30 degrees left of the DER point on the captain's windshield and the first officer's windshield. This meant that the PA-28 was primarily in an area where the captain could see it with both eyes. From the first officer position, the PA-28 was in the DC-9 centre windshield and in an area, for about 50% of the time, where he could see it with both eyes.

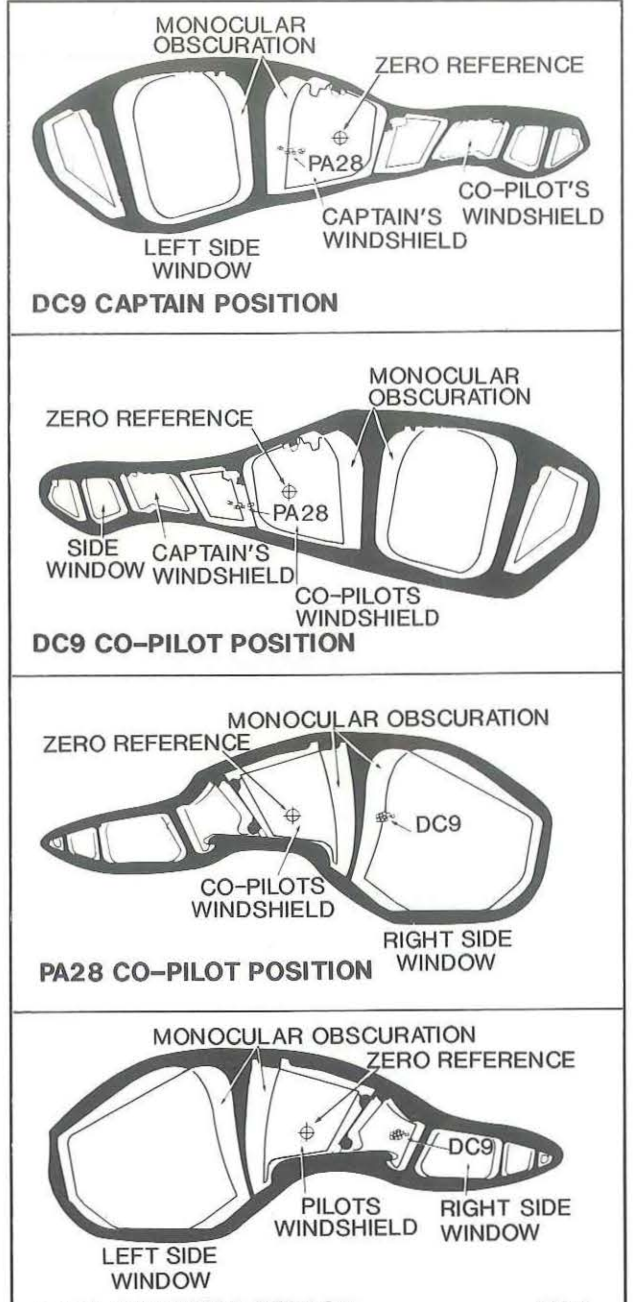


FIG.4

For the PA-28 pilot, the DC-9 was about 50 degrees to the right of the DER point and could only be seen by him on the far right side of the co-pilot windshield. From the front, right seat of the PA-28, the DC-9 was about 55 degrees right of the DER point and would have appeared at the left edge of the right side window.

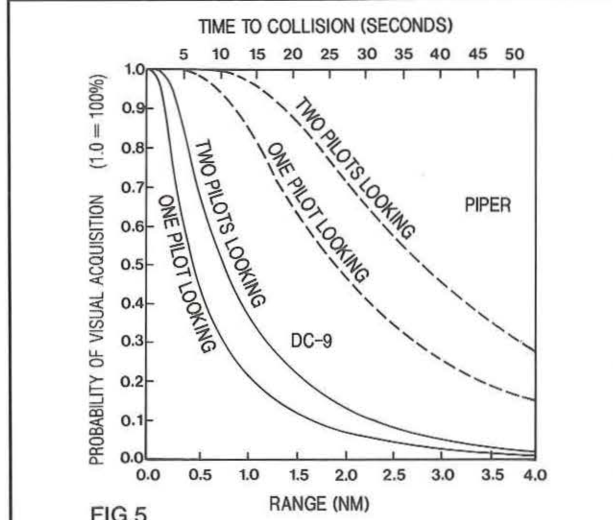


FIG.5

Previous studies by the Massachusetts Institute of Technology had been conducted to determine target acquisition parameters for pilots. Sixty four tests were conducted with pilots who did not know the test objectives. Intercepting aircraft were flown head-on, at 90 degrees and 135 degrees, predominantly from the left, and visual acquisition was achieved in 56%, the median range being 0.99 miles. The greatest acquisition range was 2.9 miles.

A further 66 tests were conducted in a TCA with the pilots aware of the test objectives. Visual acquisition was obtained in 86% and the median range was 1.4 miles.

Using these tests and pertinent data from the Cerritos mid-air, Figure 5 was constructed. These graphs do not allow for limitations such as cockpit structure or the monocular regions.

The NTSB probability of visual acquisition graphs indicate the PA-28 pilot had an 80% probability of seeing the DC-9 15 seconds before the collision and the DC-9 pilots a 30% probability. These graphs attempt to allow for aircraft size, relative positions, closure rates and other factors.

Regardless of this, however, both aircraft were operating in visual flight conditions and were required by FAA regulations to see and avoid each other, even though the DC-9 was under radar control in a TCA on an IFR flight plan. The failure to see and avoid must be considered in relation to the limitations of angles of closure, target sizes, conspicuity of targets and the physiological capabilities of the eye.

Of particular interest, the probability of acquisition graphs indicate that had the controller seen the PA-28 and been able to provide altitude information as well as range and bearing to the DC-9, the DC-9 crew's probability of acquisition would have risen from 30% to 95%. In any case, some avoiding action would have been initiated.

The major NTSB findings were that:

- Both pilots were required to see and avoid. There is no evidence that either pilot attempted an evasion.
- The PA-28 pilot was not cleared to enter the TCA but his entry was inadvertent.
- Both aircraft were displayed on the arrival controller's radar but that the PA-28 primary target may not have been displayed or displayed weakly.
- The arrival controller did not see the PA-28 radar return.
- The Los Angeles area was not equipped with an automated conflict alert system. (Board tests had indicated that such a system would have alerted the controller.)

The NTSB probable cause was the limitations of the ATC system to provide collision protection. Contributing factors were the inadvertent and unauthorized entry of the PA-28 into the TCA and the limitations of the see and avoid concept. □

Could it happen to me?

Over a 10 year period, the Bureau of Air Safety Investigation has recorded over 1,000 breakdown in separation occurrences. Of these, over 600 were in controlled airspace. For the 10 years to 1989, BASI recorded 22 mid-air accidents. Five of these involved General Aviation aircraft operating in or near aerodromes and not engaged in display type flying.

Near the busier aerodromes, particularly when constricted by lane of entry requirements, the need for lookout is paramount. The following example illustrates the dangers.

A Beech 50 was cleared through the Melbourne control zone at 2000 feet to Moorabbin. After leaving controlled airspace, the aircraft probably descended to 1500 feet before calling Moorabbin tower.

A Bell 47 helicopter was tracking from Keilor, abeam Essendon, to Moorabbin at 1500 feet. Although initially well ahead of the Beech which was cruising at about 150 knots, the helicopter was cruising at only 60 knots. In addition, the probable tracks of both aircraft were closely parallel with the helicopter crossing the Beech track at two points.

Before either aircraft called Moorabbin Tower but after both pilots had set the Tower frequency, the aircraft collided. All five people were killed in the accident.

A weak cold front had passed through the area about 30 minutes before the accident. As a result, the cloud base was about 2500 feet with lower patches. Visibility was in excess of eight kilometres. The accident happened at about 2.17pm. Both anti-collision beacons on the helicopter were working and the upper beacon and probably the lower beacon on the Beech were working at the time of the collision.

Initial contact was between the Beech's right propeller and the helicopter's main rotor. The right wing of the Beech was between the helicopter's main rotor blades and the transmission gear box. The wing was then severed when it impacted the rotor mast. Finally, the rotor severed the tip of the Beech's fin. The helicopter lost a rotor stabiliser tube and weight and the outboard section of one rotor blade, as well as sustaining other substantial damage in the collision.

It was concluded that the flight paths of the two aircraft were converging at about 40 degrees, with the helicopter ahead and to the right of the Beech. Together with the relative speeds, this would result in the aircraft approaching each other along a constant line of bearing of about 20 degrees to the right of the Beech and 120 degrees to the left of the helicopter.

It was estimated that the pilot of the Beech would not have been able to see the helicopter until under six kilometres in ideal conditions. The conditions were considerably below ideal. The maximum distance at which a standard anti-collision light can be seen under these conditions is less than two kilometres.

It was determined that the collision occurred outside controlled airspace while both aircraft were operating VFR. The probable cause was that the pilot of the overtaking aircraft, the Beech 50, did not see and avoid the helicopter.

Within the circuit area also demands a good lookout. Jandakot, Archerfield, Bankstown and Parafield as well as Moorabbin have all had their share of mid-airs. A Parafield accident illustrates how easily a mid-air can occur in the circuit.

A Cessna 172M was returning from the training area and extended the base leg, probably to get spacing on the preceding aircraft. A Piper PA-28 was conducting circuits at the same time. The aircraft collided at about 250 feet altitude on finals, all five persons being killed.

At the time of the accident (12.16pm), visibility was good, although there was 7/8 of cloud at 3000 feet. Positioning of each aircraft in relation to the other, may have meant that each aircraft had ground features behind it which made it less conspicuous. During its turn onto final, the Cessna would have appeared to the Piper's pilot in a constant position in the Piper's right windscreen, about 40 degrees to the right. Unless he looked directly at it, it is unlikely that the Piper pilot would have seen the Cessna.

About 23 seconds before the collision, the Piper began a 30 degree left bank turn onto finals. It would then have been impossible for the Piper pilot to see the Cessna. About 10 seconds before the collision, the Piper commenced to roll out on final and the Cessna should have been theoretically visible to the Piper pilot. The Piper was then overtaking by at least eight knots from above and to the left. However, as no avoiding action was taken, it is assumed that the Cessna was too low for the Piper pilot to see it. The Cessna pilot would have had extreme difficulty in seeing the Piper.

The aircraft collided while the Piper was overtaking and above the Cessna. The Piper's propeller cut through the Cessna's cabin roof and the right flap scraped down the leading edge of the Cessna's fin. The Piper locked together with the Cessna, positioned with its nosewheel against the Cessna's left inboard flap, right wing root on the Cessna's tail cone and forward of the tail and the right wheel on the right side of the Cessna's fuselage. The aircraft fell to the ground locked together.

The investigation was unable to determine if the anti-collision beacons on both aircraft were operating normally. Due to impact damage, it was also impossible to determine without doubt the radio frequencies set and the volume control position of the VHF radios. However, no evidence was found of any defect or malfunction in either aircraft which might have contributed to the collision.

The Tower Controller observed the two aircraft turning base, but the substantial longitudinal separation would have appeared to the controller to have been more than adequate. On finals, he instructed the PA-28 to go around on three occasions, 14 seconds, 7 seconds and 2 seconds before the collision. His first transmission was partially over transmitted by another aircraft. As no action was taken by the PA-28 pilot and as the runway appeared clear, it is probable that this pilot did not hear or did not appreciate the urgency of the situation.

Due to a combination of the wind on final and the extended base leg, the Cessna took just over three minutes to fly from the point where the pilot reported base to the collision point. The PA-28 took just under two minutes to fly from its base point to the collision point. The Piper pilot would, therefore, probably not have considered the Cessna to be a traffic hazard. The pilot of the Cessna would probably have not been aware of the Piper. Both pilots positioned themselves to give adequate spacing on the preceding aircraft, another PA-28.

The chain of events leading to this accident commenced when the Piper turned onto base inside the Cessna, each pilot apparently positioning himself behind the preceding PA-28. The accident could have been averted if either of the pilots had adequately scanned the airspace to the left and right of their aircraft. The base leg is a principal area of the circuit where pilots must position their aircraft relative to one another; it is also the area where aircraft are at a considerable distance from the controller.

The cause of the accident was that, whilst operating in those areas of the circuit pattern where confliction could have been detected, neither pilot exercised the degree of vigilance necessary for the avoidance of the collision.

It is the mid-air that brings down a big jet which really catches media attention. In 1978 144 people died when a DC-9 and Cessna 172 collided in the circuit at San Diego. *The BASI Journal* number 4 describes a near-miss incident over Sydney between a Boeing 747 and a Piper PA-28. The Journal also describes the collision between two Cherokees over Moreton Bay, an area where every pilot should be aware of possible traffic and on the lookout.

Most of us fly the little aircraft and it is in these that we are most likely to encounter a mid-air. Why? There are more of them, they are found just anywhere and their pilots are often overworked and underexperienced (remember what it was like when you were a student?). Studies indicate that most near misses and mid-airs involved overtaking aircraft and only a *minority* from head on. Most also occur near aerodromes and below 3000 feet.

Doctor Liddell discussed physical, physiological and psychological considerations when using the eye for lookout. He described how to make yourself more conspicuous — aircraft size, the use of radios and the use of lights, particularly strobe lights. He warned of the lack of relative motion with the aircraft you are about to hit and suggested the best form of attack is a pristine clean window. He suggested that to find and see a distant target we need to focus our eyes on a distant object first. And, finally, he made the most important point — all this is lost if you do not look outside.

The Cerritos accident demonstrates the possible limitations of the radar system and its operators. It is possible, for various reasons, that the controller may not see a target on the scope or may, consciously or subconsciously, ignore the target. The introduction of mandatory use of mode C to give altitude readouts to the controller will certainly help in Australia. Outside controlled airspace, it certainly helps to make you more conspicuous if you go full reporting.

These accidents not only show the limitations of radar but also the limitations of the eye. Lookout and good scan technique are the only real answers. Keep vigilant in areas where you least expect other traffic; that is, in controlled airspace and the back of beyond. Back this vigilance up with a sound knowledge of where you are in relation to likely busy spots — small airfields, glider areas, hang glider jump-off spots — and listen for other traffic on the radio.

Pilot lookout is the only present method available to overcome the shortcomings of radar. A pilot operating in the Bankstown area on a Sunday will have all available eyes outside. Will the same pilot be as vigilant 10 miles away on approach into Sydney or 1000 miles away approaching Ceduna? Studies have shown that you are much more likely to see traffic if you are expecting traffic and are looking out. If you are not really expecting to see another aircraft and are just 'gazing into space' you will not see the traffic. Each of these accidents show that mid-airs do occur with the sun high in the sky and the weather fine and beaut.

The only good that comes out of horrific accidents like these is the lessons learned to prevent a recurrence. Apply the lessons to yourself and stay alert, aware and alive □

Accident response

Cessna TU206-A, 18 February 1988

After 207 minutes of flight with a calculated endurance of 300 minutes, the engine began to surge and stopped. Emergency procedures, including auxiliary fuel pump on 'LO' with short periods of 'HI', failed to remedy the situation. A successful forced landing was executed, although the aircraft received substantial damage in a ditch. The left wing fuel tank had partially collapsed, reducing the amount of fuel but still indicating full fuel.

BASI recommendation

The instrument panel placard should clearly indicate that the auxiliary fuel pump should be set to 'HI' as the first action following fuel flow fluctuations.

CAA action

The CAA does not agree with the recommendation. The various configurations of the auxiliary fuel pump control on the Cessna 200 series can only adequately be covered by good system knowledge. In all cases, the potential for a second failure only seconds after power recovery is very high.

Cessna A188-A1, 10 May 1988

On the second day, the pilot completed spraying area two. During the clean-up run, the aircraft struck a power line. The pilot's attention had been on avoiding accidentally spraying a near-by crop.

BASI recommendation

The CAA should continue to publish warnings on power lines and the importance of aerial inspections.

CAA action

This *Digest* contains another article on power line hazards as well as a poster. The video 'Going Ag...grow' has recently been released.

Cessna 210E, 14 May 1988

The engine failed in the cruise following detachment of the oil filter adapter. The right gear collapsed on touch down as the pilot could not fully pump the gear down because the emergency gear extension handle had inadvertently been moved slightly inward.

BASI recommendation

The CAA should alert maintenance organisations to the dangers of thread failure if proper torquing is not carried out. Information on the use of emergency gear extension handles in Cessna 210 aircraft should be publicised.

CAA action

Due to the magnitude of this problem, an Airworthiness Directive is being prepared. Full details on the use of the emergency gear extension system are published in the Owners Manual.

Hughes 269C, 26 May 1988

While in the cruise at 100 feet AGL, the belt drive clutch control tension spring assembly failed, resulting in loss of power. The helicopter hit a tree during the autorotation and rolled onto its side.

BASI recommendations

The CAA should re-emphasise the need wherever possible to operate at heights which provide increased safety margins. The CAA should also review this type of failure to determine if a special service life is justified.

CAA action

An article will be prepared for the *ASD* on this topic. It is considered that the schedule of cable inspections — 50 and 400 hours — is adequate. Cable failure history indicates only one failure in 32,000 hours.

Hughes 269C, 26 June 1988

While mustering cattle, the number one connecting rod failed and penetrated the engine crankcase. An autorotation was carried out onto unsuitable terrain and the helicopter rolled over.

BASI recommendation

The CAA should consider replacement of connecting rods at overhaul or reduce the time between engine overhauls for helicopters used in the mustering or similar roles.

CAA action

The accident was caused by the failure of a connecting rod bolt. These bolts are subject to the requirements of AD/LYC37 amendment 6. As the defect report indicates that the standard and extent of maintenance at overhaul may have contributed to this failure, no action as recommended is justified.

If you are not eligible for a free issue, or if you would like additional copies of the Digest:—

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For over thirty years, the *Aviation Safety Digest* has been an integral part of Australian aviation.

In July 1986, responsibility for the *Digest* was transferred from the Bureau of Air Safety Investigation to the Flight Standards Division of the then Australian Department of Aviation (now CAA). This move reflected the perception that civil aviation may have reached the limit of accident prevention through regulation and that the way forward is through increased emphasis on safety education in general, and the 'human factor' in particular. Rather than just draw lessons from accident investigations, the *Digest* will increasingly seek to influence pilot behaviour by positive reinforcement of sound techniques. It will examine all aspects of piloting and publish formal results as well as 'the tricks of the trade'. The 'crash comic' will become a 'how not to crash' comic.

Anyone with an interest in aviation will benefit from tapping into this unique source of the accumulated wisdom of the profession and the latest research into aviation safety in Australia. Indeed, anyone with an interest in high technology and the roles and limitations of the human operator will find this publication enlightening.

AIRFLOW

Feeling a little query?

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

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

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Yours sincerely, ...

Name: ....

Address: ....

Details to be published? ☐ *No name* ☐ *Initials okay* ☐ *Full name okay*

Airworthiness Advisory Circular Index to 209

The Civil Aviation Authority, Continuing Airworthiness Section receives many enquiries about airworthiness subjects. Many of the questions have been previously discussed in the 1 000 or so articles distributed by the Authority since the introduction of the Airworthiness Advisory Circulars (AAC) in September 1966.

The AACs were introduced as a vehicle to pass on items of general interest on airworthiness subjects. Many of these articles give helpful guidance on airworthiness matters, whilst others draw attention to potential technical problems.

The main purpose of these articles is to inform people interested in aviation related matters of the latest airworthiness trends and keep them aware of recommended but not mandatory items.

To assist those who may be interested in the information contained in the published AACs, the articles and their identification numbers are listed below. Should anyone wish to receive a copy of an article, they should first approach the Airworthiness Office at the major airports in each State Capital City or contact the Authority by telephone, facsimile or letter addressed to:

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Continuing Airworthiness
Civil Aviation Authority
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CANBERRA ACT 2601
Attention: Documentation

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PARTS

PNEUMATIC

PROPELLERS

RADIO

WHEELS/TYRES

AG PILOTS V POWER LINES

Your urgent attention is drawn to the article on page 5, relating to the need for an extra hazard check to be carried out before commencing clean-up runs.

Yet another tragic accident within the last few weeks emphasises this requirement.

No matter who you are, how good you undoubtedly are, or how experienced you are, if you neglect to carry out a comprehensive re-check and re-location of wire hazards before commencing clean-up runs or re-starting treatment on a field that you have been away from for an hour or so, you put yourself at great risk.

The extra hazard check is of utmost importance for you as an ag. pilot — more so even than the pre take-off drills, which no one ignores.

For your sake, your family's sake, the operator's sake, and for the good of the industry as a whole

CARRY OUT THE EXTRA HAZARD CHECK BEFORE CLEAN-UPS OR RECOMMENCING AFTER A BREAK — NOW AND FOREVER!

MEA CULPA, MEA CULPA

ASD 141 carried some significant inaccuracies, for which we apologise, and explain thus:

(1) On page 5 we invoked Captain Murphy, who promptly, and retrospectively, upstaged us. There are, to the best of our knowledge, no Twin Comanches equipped with magneto switches functioning as battery or alternator master switches. Therefore, for 'magneto' read 'alternator and battery master switches'. The photographs should, of course, have been centred upon the battery/alternator switch system. It seems unfair to single out the PA-30 for obloquy — most light aircraft can be flown on battery alone.

(2) On the back cover, top diagram, the pilot has neglected to state his position — 'Racetrack'. At position 2, 'Descend to circuit height' is redundant. The aircraft needs wheels.

In the bottom diagram he certainly would have made the Tower Controller's day by calling '36 right', then proceeding, without pause, it seems, to 36 *left*! The picture shows him initially calling 'Tower' — normally at GAAP airfields 'Ground' is the first call, in which case the ready call should be prefixed by station identification.

These errors are being corrected on the poster, and no, we didn't put them in merely to start you talking; that way lies editorial suicide.

Aviation Regulatory Proposals

Aviation Regulatory Proposals (ARPs) are an important means by which the Authority consults with industry about proposed changes to operational legislation and requirements. Copies of all proposals are circulated to relevant organisations, and occasionally to individuals for information and comment. The comment received provides a valuable source of advice which greatly assists the Authority in the development of the completed documentation.

Each edition of the *Digest* contains a listing of those ARPs circulated since the previous edition.

Should you wish further information about any of the ARPs, please contact your industry organisation.

Number	Subject	Status
89/1	Amendments to CAO 20.7.1B — Aeroplane weight and performance	Responses assessed by 31/8/89
89/2	Provision and use of oxygen and protective breathing equipment	Completed CAO 20.4 redrafted and in approval chain
89/3	Amendments to CAR 157 and CAO 20.7.4 — single engine aircraft operations	CAO 20.7.4 amended CAR 157 amdt with AGs
89/4	CAR 214 Maintenance Training (Airworthiness)	Not yet circulated
89/5	Review of operating limitations — CAO 101.55, 95.32 and 95.10	Responses assessed by 18/8/89
89/6	Removal of the limited IFR procedure	Replaces 87/17. To be circulated
89/7	Review of procedures for the administration of standards for international parachute descents	Replaces 88/14. To be circulated August 1989
89/8	Follow on Review Reg 191	Follow on 88/9. Responses due 31/7/89
89/9	Review of standard passenger weights	To be circulated August 1989
89/10	AGA-7 Review	To be circulated circa 31/8/89

AERONAUTICAL INFORMATION SERVICE AUSTRALIA

NOTICE

CURRENT DOCUMENTATION & PLANNED NEXT ISSUE

Document	Current Issue*	Planned Next Issue*
DAP(E)	24.08.89	19.10.89
DAP(W)	21.09.89	16.11.89
AGA 0-1-2	04.05.89	03.05.90
Aerodrome Diagrams	21.09.89	16.11.89
ERS A	24.08.89	14.12.89
AIP (book)	24.08.89	14.12.89
VFG (book)	24.08.89	14.12.89
AIP/MAP	29.06.89	14.12.89
VFG/MAP	29.06.89	14.12.89
DAH	29.06.89	14.12.89

*dates quoted are effective dates

Note:CLASS I & CLASS II NOTAM ARE TO BE CONSULTED WHEN USING ANY OF THE ABOVE DOCUMENTS

ISSUE: 7
DATE: 21 SEPT 89

Aerospatiale AS 350B, 29 July 1988

An untested strop was used to lift an external load. The rope of the strop slipped through the whipped section of the eyelet, releasing the load, and recoiled into the rotor. One blade was damaged and one horizontal stabilizer was ripped.

BASI recommendation

The CAA should consider the implementation of a standard for the construction and testing of helicopter sling equipment.

CAA action

The CAA Standards Development Division will be requested to draft a CAO Part 103 to specify external load carrying support to comply with Australian Standards requirements.

Aerospatiale AS 350B, 20 August 1988

The jack type earthing cable was left attached to the helicopter and part of the cable and the clip were severed by the tail rotor. The earth cable was removed and, as only superficial damage was noted, the flight was continued. Minor damage was sustained by a tail rotor blade but the tail rotor gear box was removed for overhaul.

BASI recommendation

The CAA should remind pilots of the dangers of operating helicopters with what may appear to be only superficial damage. The CAA should examine positioning of the earth cable jack point or ways of making the cable more conspicuous.

CAA action

Alternative earthing points have been examined but none are suitable. It is normal practice to make such cables as conspicuous as possible and the CAA recommends that operators follow such procedures.

Grumman-Frakes G73T Turbo Mallard, 25 August 1988

During takeoff on the open sea, number two engine failed due to sulphidation attack on the compressor turbine. The prevailing conditions resulted in loss of directional control and the aircraft stopped on a sand bar. The left float and pylon and three metres of the left wing were torn off.

BASI recommendation

The CAA should introduce compulsory 200 hourly borescope inspections of turbine engines operated in marine environments.

CAA action

The accident is considered to have resulted from inadequate maintenance. The responsible maintenance organisation has been subjected to a review.

Cessna 172, 11 September 1988

The student parachutist's main parachute deployed prematurely. The risers became entangled in the horizontal stabiliser, damaging it and locking the elevator. Both students and the instructor evacuated safely and the pilot made a safe landing on a salt lake with the parachute still attached.

BASI recommendation

The pilot's actions in saving the aircraft should be publicly commended in the *ASD*. A second recommendation on single pin, low deployment pull parachutes was directed to the parachute manufacturer and the Australian Parachuting Federation.

CAA action

This response constitutes public acknowledgement of the pilot's actions.

Piper PA28R-180, 17 October 1988

A cleaner reported significant damage to the landing gear and wing spar. The damage indicated a vertical descent onto the left wheel first, followed by the right wheel. Upper skin damage was evident to the left wing. All six pilots who had been involved with the aircraft over the preceding two days denied any knowledge of an incident.

BASI recommendation

The unethical action of not reporting this accident and the dangers of flying an aircraft with such damage should be publicised.

CAA action

An article will be prepared for the *ASD* illustrating the hidden dangers with heavy landings and the need for adequate preflights.

Bell 206B, 4 December 1988

While attempting a landing at night on a medical evacuation, the helicopter encountered considerable turbulence and wind shear. The loss of airspeed and high rate of descent probably resulted in a vortex ring condition and the helicopter hit the ground.

BASI recommendation

The CAA should publish an article in the *ASD* to remind pilots to weigh the urgency of evacuation against the possibility of an accident.

CAA action

An article will be prepared for the *ASD* illustrating this point □

NIL DEFECTS

Dirty fuel revisited

Would you purchase dirty or contaminated fuel for your motor car?

Fuel associated problems are still plaguing today's motorists despite the increased use of in-line fuel-filters. Why, then, would you want to take a chance in a less forgiving environment than your local highway by putting contaminated fuel in your aircraft? The in-line filter has not cured the root cause of the problem for the motorist, although it has reduced the incidence of such events. A similar problem exists in General Aviation.

The Latin phrase 'caveat emptor', let the buyer beware, sums up the situation. The only alternative is for the owners/operators/pilots to go to great lengths to assure themselves of the quality of the product they are using. The casual check for water in a soft drink bottle is about as far as most pilots are prepared to go. To suggest that a pilot should be required to carry water detecting paste is fairly impractical as well as being so onerous that it would not be observed.

CAO 20-9 details the responsibilities of a pilot with regards to fuel and refuelling. It is clearly established in the CAO that pilots engaged in RPT operations are required to obtain a Release Note for aviation fuel and other necessary fluids such as oil and hydraulic.

A Release Note is not just a receipt or invoice, it confirms that the fuel/fluids meet the manufacturers specifications. Vendors of fuel and other aviation liquids who are unable to provide a Release Note should be treated with caution and the standards of such things as storage assessed prior to purchase.

By obtaining fuel and other liquids under cover of a Release Note the purchaser is ensured that what he has purchased not only meets the stringent controls instituted by the oil company during manufacture to agreed specifications, but continues to be preserved in a fit and proper manner for dispensing into an aircraft.

Oil companies ensure the continuance of the product's quality by appointing agents who regularly monitor for compliance under the procedures specified in their organisation's Quality Control Manual. Only such appointed agents can issue a Release Note on behalf of an oil company.

As we are all aware, most aviation fuel purchased at GA airfields around Australia is obtained in less formal circumstances. Distribution systems for non-authorised 'agents' vary from bowsers and trailers (often not inspected) to the more usual 200 litre drum. Release Notes cannot be obtained from such sources and contamination is a known problem.

The storage and handling of aviation fluids from delivery at the aerodrome to dispensing into an aircraft is our area of concern. CAO 20-9, subsections 3.3 and 3.4, contain notes on some simple safeguards which should be observed. CAO 20-9, subsection 4, details precautions to be observed during aircraft refueling.

When obtaining fuel from any source it is recommended that you request from the vendor a Release Note. If one is provided, you may reasonably assume that what you receive is what you expect and have paid for. No release note — caveat emptor!

FUEL DISPENSING FROM A DRUM — FUEL DRUM STORAGE

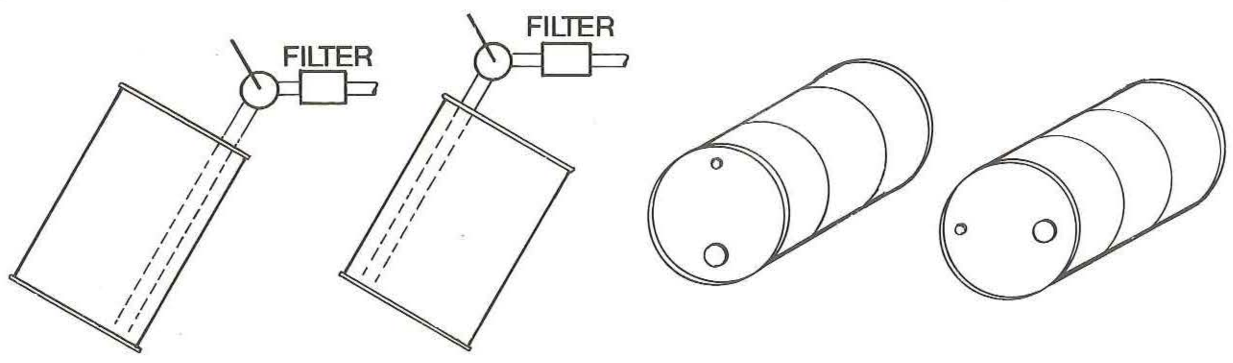

FIG.1 INCORRECT — FIG.2 RECOMMENDED — FIG.3 INCORRECT — FIG.4 RECOMMENDED

NIL DEFECTS

Vendors of aviation fluids are recommended to institute some system of control. It need not be too sophisticated or involved, but it should show such items as delivery dates, water checks and persons performing duties.

When refuelling from drums, remember that the drums should always be bonded to the aircraft before a fuel hose is allowed to touch the aircraft; a little spark can cause a big fire. Always ensure an in-line filter is installed between the drum and the aircraft's tank and that the drum is tilted slightly away from the pump. (See figures one and two). Fuel drums should be stored as in figure 4 to keep both bungs covered □

Helicopter hoist hooks

A recent review of incidents which occurred during hoisting operations has shown the need to assess the acceptability of some hoist hooks.

There have been at least two reported cases where the load on the hoist disengaged from the hook. In both instances the load rested on a protuberance (skid, footrest) outside the helicopter door sill, thus relieving the hook of the weight of the load. With no weight on the hook, it was easy to twist the 'D' ring up the hook to rest on the safety latch. When the load was reapplied, it slipped through the safety latch.

This is just one way the load may disengage from the hook. Our assessment has shown that hooks are susceptible to three modes of failure:

- Load relief. As already described; the hook is relieved of the weight of the load allowing the 'D' ring to travel up the hook and disengage when the load is reapplied.
- Torsion. The 'D' ring-hook throat torsion causes the 'D' ring to ride up the throat and subject the keeper to a side load. The keeper, being unable to react to torsion, fails under excessive side load.
- Load jolt. During a jolt to the load, the 'D' ring jumps up around the keeper and rests against the keeper on the tip of the hook. As with case one, when the load is reapplied the keeper allows the 'D' ring to slip through.

In general, operators should:

- Pay close attention to the selection of hook/'D' ring combinations; and
- Exercise care when attaching the 'D' ring to the hook □

Will it save your life?

Item: Life jacket RFD Type 102 Mk 1.

Malfunction: Life jacket deflated during pressure test.

Nature of defect: Life jacket material porous. Known problem for this model and age jacket.

Comment: This jacket was owned by a private aircraft owner who was not aware of the AD/EMY/2 amendment 4 requirements, although he has imposed his own 18 month test period. There are probably hundreds of private aircraft owners with their own life jackets who are *not* aware of test requirements or who do not know that life jackets have a finite life. Many of these jackets have probably *never* been tested.

These details were taken from a defect report prepared by the CAA earlier this year. The suppliers advised that the jacket was manufactured in January 1976 and that the average life of a jacket is approximately 10 years.

All safety equipment are forms of insurance — you hope you will not need it but, if you do, you are glad — relieved even! — it is there and works.

For particular operations, safety equipment is mandatory. CAO 20.11, for example, requires that aircraft engaged in RPT and charter operations over water should carry life jackets. However, any pilot operating over water (including lakes, bays and harbours) would be wise to carry a life jacket for each occupant.

Equipping your aircraft with life jackets (and other safety equipment) is part of the solution. Ensuring that the equipment remains serviceable is the other vital part of the solution.

The pearls of wisdom that led you to purchase the equipment in the first place should also lead you to maintain that equipment in a serviceable condition. Folded and stowed life jackets are quite vulnerable to deterioration. Manufacturers issue maintenance instructions for their products. The CAA has issued Airworthiness Directives — AD/EMY/2 amendment 4 for life jackets and AD/EMY/4 amendment 5 for life rafts. These can be found in the CAO 107 series.

If you fly over water, a life jacket is good insurance.

If you carry life jackets, ensure they are serviceable — just in case □

Aspartame — not for the dieting pilot?

ASPARTAME is a synthetic compound of two amino acids (aspartate and phenylalnine) bonded by methanol. So what? Aspartame is a widely used food and drink sweetener, particularly used in place of sugar. And evidence from the United States suggests that for some people aspartame produces reactions which pilots would rather not have.

The issue appears to have been hotting up throughout the 80s in the States. A number of pilots have informed the FAA of various symptoms which they attributed to the use of aspartame. Some of these symptoms were bad enough to result in loss of licence.

A pilot report this year to the FAA followed a night flight before which the pilot had drunk two cups of hot chocolate artificially sweetened. He stated: 'During the final night leg of the flight, I found myself unable to see the instruments clearly because of blurred vision. I remember the controller asking me my airspeed. I was confused and unable to read or interpret the instrument, so I gave him my DME digital readout which was in large, bold numbers. I maintained altitude by keeping the big white needle straight up and down on the altimeter. I felt apprehensive, insecure and 'way behind the airplane'. I knew that if I had a real in-flight emergency I would be unable to handle it, since I was already in an overload condition'.

Some of the symptoms reported include: severe continuing headaches; nausea; vertigo; blurred vision; memory loss; gastro disorders; seizures; hearing loss; rashes; and numbness. Some of these reactions have been severe enough to result in suicidal depression and loss of limb control.

Neither the company which manufactures aspartame, nor the United States Food and Drug Administration (FDA) nor the FAA have acknowledged the reported symptoms as being caused by aspartame. Both the manufacturer and the FDA have indicated that other causes could result in the reported symptoms. The FAA has not yet made a definitive ruling on its position.

Although these symptoms are not officially ascribed to aspartame, a growing number of people, including some doctors, believe that aspartame does cause these symptoms in some people. Cases have been reported in which a person has gone onto an artificial sweetener for the first time, suffered adverse symptoms and finally recovered after stopping the use of the artificial sweetener.

If you regularly use an artificial sweetener containing aspartame and have had no adverse reaction you probably have nothing to worry about. But if you are an occasional user of these products or about to use them for the first time, monitor your reaction and do not fly until you are sure you suffer from no ill effects.

Reference material supplied by Texas Aspartame Consumer Safety Network □

Yes, I usually make a high and low recon before I land in a strange area but I had to get down real quick. My stomach was acting up pretty badly and I didn't think I could make it to our destination. No, I don't usually see the doctor for an upset stomach. Anyway, he wouldn't give me my usual medicine which I ran out of yesterday. I don't suppose you could call it a real forced landing, though. There wasn't anything wrong with the helicopter until the skid dug in and it rolled over.

Taken from an old accident report.

Frontal weather

Bureau of Meteorology

A FRONT is a major weather signal. By its very nature it separates air masses of different properties and may be associated with many kinds of weather.

The most frequent form of front experienced in southern Australia is a cold front; this occurs when an airmass moving from higher latitudes sweeps across the continent. The cold front is associated with changes, which may occur rapidly, in wind, weather, temperature and humidity. It extends into the upper atmosphere and slopes westward with height, a typical frontal slope being of the order of 1:100. Its speed of movement may vary, with an extreme value of the order of 60 knots being observed on Ash Wednesday 1983. Cold fronts tend to lose their characteristics if they intrude into low latitudes, where the cold air following the front rapidly becomes modified by moving over the warm tropical surface.

Pilots must be concerned with:

- The wind changes across the frontal boundary.
- The cloud. In spring and summer particularly lines of cumulus and cumulonimbus cloud may form up to some hundreds of kilometres ahead of the surface position of the front.
- Other hazards, eg visibility reduction, turbulence (which may be particularly severe if associated with convective cloud), wind shear etc.

The structure of the cold front itself may be quite complex in terms of the changes in wind, temperature and cloud; consequently careful attention to detail is required if traversing a frontal zone. The following points are recommended for consideration:

- Prior to flight determine whether any fronts may be in the vicinity of your selected flight route; if so, check the location, speed of movement or expected position, associated cloud, weather, visibility and the magnitude of the wind shift.
- If flying through a frontal zone it is usually best to fly the most direct route (provided VFR conditions permit for these flights).
- Be conscious of the impact of the wind change on navigation.
- Plan for alternatives if penetration is too dangerous.
- Convective turbulence associated with a cold front is particularly severe and can extend well outside the cloud.
- Be extremely wary of flying through mid level cloud ahead of a cold front, as there may be embedded cumulonimbus cloud. In these circumstances icing can occur suddenly.

One type of front worthy of special mention is the 'southerly burster' (more commonly referred to now as the 'southerly buster' and once even called the 'brickfielder'!) along NSW coastal area. This fast moving cool change may bring low cloud and thunderstorms or be experienced as a sharp wind change without cloud. There are a number of features of the southerly burster of which the pilot must be aware:

- It has an extremely turbulent edge.
- It frequently accelerates when traversing the NSW coast.
- Its movement inland may be retarded by the mountains, with the surface position assuming a 'bent-back' configuration.
- It may develop ahead of a Southern Ocean front □

AIRFLOW

Dear Sir,

I refer to Pilot Contribution 'Flying to the Black Stump' (ASD 140) an excellent, albeit thinly-disguised, lecture on outback flying.

As informative as the article may be, I fear it may tempt the inexperienced adventurous types to follow suit.

I occupied the right hand front seat on a trip to the Birdsville races in 1985. We departed from Townsville, North Queensland, and I would loosely estimate that about 75% of the journey was flown over fairly barren territory. Although he did not make a big issue of it, I am reasonably sure that our own pilot, Frank, an experienced and competent holder of a CPL, was glad to have another pilot (or experienced navigator) checking his navigation while he concentrated on the workload of flying the aircraft — on course — over that nearly featureless land.

I firmly believe that no-one but an experienced Outback pilot should undertake that type of cross-country flying unaccompanied by another pilot or at least a skilled navigator. The Outback is a Hell of a place in which to get lost.

Yours faithfully,

Denis Myles Lewis

The contribution was definitely not a lecture. It was meant for discussion. Thank you for discussing it and passing on all your ideas.

Dear Sir,

Reading 'Traps for Young Players' (ASD 139), Trap 1 reminded me of an incident that occurred several years ago while still a student pilot. My instructor also used the 'mixture control to idle/cut off' technique for simulating engine failure, as I had the habit of keeping my hand firmly on the throttle to overcome his annoying habit of constantly closing it.

After a session of solo circuits one afternoon, I taxied to the apron, parked the aircraft and commenced the shutdown checks. As I pulled the mixture to idle/cut off, there was little resistance and several inches of cable appeared from the instrument panel. The engine stopped (just) and I went in search of the Chief Engineer.

Needless to say, after relating the incident to my instructor, he never used the same technique for simulating engine failures. Had the incident occurred in the training area, it would definitely have been a case of 'Taking over!'.

Yours sincerely,

Geoff Williams

Simulated is simulated, not 'for real'.

Dear Sir,

Re: Recency/currency

Reading ASD 139 has reminded me of a problem that pops into mind from time to time.

Having just renewed my restricted licence for the first time since obtaining it, I checked to see the hours I have flown. I was very surprised to see that I held less than ten hours total flying time since 1987.

The surprise was not as you would expect at how little I had flown but that people in the same situation as myself are not put to more stringent tests. At this point I should point out that my financial burdens have been increased by marriage and the purchase of a house.

As I could not be considered proficient in the fields of recent experience, aeronautical experience, knowledge and skill, should I be reissued with a licence to fly an aircraft? I may be burying myself with these comments, but I would really like to know the general opinion of other pilots.

I do not see my situation changing in the near future, but justify renewing my licence on the grounds of:

- my love of aviation,
- a hope to obtain and fly under full PPL, and
- that I don't see myself jumping into an aircraft and taking off into the wild blue yonder, without first being fully proficient.

Discussion on this topic, be it good or bad for me, would be appreciated.

Yours faithfully,

C.P. Hird

I, too, would like to hear other opinions.

Dear Sir,

Time and time again I have noticed media and amateur photographers, when taking aviation type photos, have this desire to have pilots and people touching, leaning on or entwined around propellors.

In my private pilot days, it was standard throughout Australia to drill all concerned that ALL contact with propellors was dangerous and unnecessary contact was extremely foolhardy.

I wonder when this 'hands on' technique will become a 'hands off' event.

Yours faithfully,

R E Baird

Agree. I once shooed a group away from the propellor of a homebuilt when I noticed the keys in the ignition were still on — and the engine was very warm!

AIRFLOW

Dear Sir,

In response to your article 'Beyond the call of duty', I do have a couple of points to make.

Firstly all commercial pilots should belong to the Australian Federation of Pilots. Should a pilot be sacked for not flying outside CAO 48.1 then he could obtain full representation by the AFAP to secure his position back again.

Secondly and even more to the point is the CAA's toothless tiger approach to deal with companies breaching CAO's. If a pilot is sacked because he won't breach flight time limitations, fly overweight aircraft and unserviceable aircraft, then a full investigation by CAA should be made and, if necessary, the full weight of the law brought down on the company involved.

If pilots could be assured of companies being charged for breaching such CAO's by CAA, then we wouldn't have to worry about being sacked for not breaching them ourselves to get the task completed.

I will bet you the company involved with your story has not been charged for obviously rostering a pilot outside 11 hours duty and thus breaching CAO 48.1.

I believe this is where you must start. Make companies aware of their responsibilities and discourage profiteering outside the CAO's.

Yours faithfully,

Bill Hobday

Dear Sir,

REF: 'Beyond the call of duty' ASD 140

I recall hearing of a similar occurrence from an acquaintance who was asked to phone his employer after landing at about midnight, following a very strenuous couple of days flying. He was given details of another charter flight to be commenced immediately. His protests about fatigue, flight times etc. were met with the question:'Do you want your job or not!'.

In both these instances, MANAGEMENT problems were off-loaded onto the pilots as OPERATIONAL problems, and in both cases the assent of the pilots was necessary for this 'off-loading' to happen. No doubt, any consequent accident would have been headlined as 'pilot error'.

I suggest that any pilot, finding himself in a similar situation, should cast his mind back to his initial visual navigation exercises, where great emphasis was placed on 'seeing the big picture' instead of trying to navigate 'from crossroad to creekbed'. The same emphasis needs to be applied here, — that is, think of the problem as a whole, and throw in a few 'what ifs' for good measure. Don't think merely of how to get from 'A' to 'B' while fatigued/out of hours/hungry/depressed/frustrated/angry/lonely!

There are situations where even the most stable and loyal pilots need to call on the added weight of their industrial 'union' or 'federation' when pointing out to managers what their legal obligations are: NO pilot should fear for his job if placed in one of those 'damned if you do and damned if you don't' situations. There is enough stress in the occupation already.

Yours faithfully,

J P Gammon

Dear Sir,

I think it's about time somebody said something!

It appears to be a regular thing these days to see single engined aircraft takeoff and have their undercarriage retracted at an altitude of ten feet, with three to five THOUSAND feet of runway still in front of them (CAA included).

When I learned to fly, it was one of the BASICS that you didn't tuck your wheels away until they were no longer of any use to you.

Although reliability of engines has improved greatly over the years,as far as I am aware, engine failures do still happen occasionally.

Maybe they are all just twin-drivers who forgot they only had one throttle lever this time, but even so, who wants to struggle around the circuit on one engine in an aircraft which may or may not climb, when they could easily shut both down and land safely straight ahead on the remaining runway?

A final note for the 'it will never happen to me' pilots — just remember the non-current pilot who went around in a Cessna 210 (power up, gear up, flaps up) and promptly sank back onto the gravel strip, with lots of nice loud scraping sounds from underbelly and prop ...

Yours faithfully,

Marcia Hremeviuc

Aquaplaning

'AIRCRAFT (PA-31) overran runway on landing. Aircraft landed in heavy rain, plus crosswind, and aquaplaned on wet runway, overran end of runway and came to rest in a drainage ditch. DAMAGE: Minor.'

Part of the BASI initial report. Unfortunately, the ditch was full of water and the aircraft was extensively water damaged.

Aquaplaning (or Hydroplaning) is something many of us have learnt to live with after the phenomenally wet season on Australia's east coast. If nothing else, then, maybe this article will persuade the rain to go away!

Aquaplaning in an aircraft is the same as water skiing along the runway. It affects aircraft of all weights and sizes. The tyre is lifted clear of the hard surface and a layer of water prevents direct contact with mother earth. The tyre may slow to a stop, it may even reverse direction; it may not, on initial 'touch down', break through the water surface and so not spin up to speed. Aquaplaning comes with three hats: viscous, dynamic and reverted rubber.

Viscous aquaplaning usually occurs on very smooth runway surfaces. As little as 0.025 mm of water depth is needed to help viscous aquaplaning along the way. Major danger areas are the runway thresholds, where painted surfaces and rubber deposits will aid the onset of viscous aquaplaning.

Dynamic aquaplaning is usually brought on by a high aircraft speed and relatively deep standing water. Runways without adequate water run-off are most susceptible, as are runways in areas where heavy rainfall can be expected. Even a runway with a high crown may have standing water if the wind is strong enough to prevent water run-off.

Reverted rubber aquaplaning can occur when a locked tyre is skidding along a very slippery wet or icy runway. It is usually the result of locked brakes and can continue until the aircraft stops. It normally follows after either viscous or dynamic aquaplaning. High temperatures are formed which result in the rubber reverting to its original state, losing the tyre tread (a flat spot) and filling tread with molten rubber.

The speed above which tyre aquaplaning is most likely to start is found from the formula: $V = 9\sqrt{p}$ where 'V' is the aircraft velocity above which the tyre will commence to aquaplane and 'p' is the tyre pressure in p.s.i. For tyre pressures in kPa, the formula is: $V = 3.43\sqrt{p}$. If you are landing on a very wet runway and the wheels are not rotating before touchdown, the aquaplaning speed is much lower. In this case, the psi formula becomes: $V = 7.7\sqrt{p}$ and the kPa formula: $V = 2.93\sqrt{p}$.

From the first formula, a small aircraft with main wheel tyre pressures of 25 psi would have a dynamic aquaplaning speed of 45 knots. At any speed above 45 knots you can expect to aquaplane. If you then run into pooled water on the runway, you may expect reverted rubber aquaplaning well below 45 knots. And if you then find yourself on the rubber deposits and painted threshold at the far end, you can expect viscous aquaplaning! Three ways to get you!

If we next consider the problems of crosswind, the aquaplaning theory becomes even more complicated and a safe landing much more difficult. As you slow down on the runway, the relative effect of crosswind will increase, tending to force you to the downwind side of the runway. If you are aquaplaning, you have no control below rudder effectiveness speed other than asymmetric power. Rudder is fine while it is effective. But beware when aquaplaning stops; you will not be pointing straight down the runway, and when those tyres suddenly grip you may be off the side of the runway before you know it. Playing with asymmetric power (reverse) is a last ditch resort.

Some considerations then:

- Smooth, flat runways with poor drainage, rubber deposits and painted surfaces are the worst. Runways with high crowns, textured surfaces or grooves are the best.
- Be wary of wasting runway. If you encounter viscous aquaplaning at the far end just before turning off, you may end up in the overrun. Therefore, avoid landing long, avoid excessive touch-down speed and do commence slowing down without delay.
- Tyre tread is important. During the preflight check the amount of tread. If it is low, be prepared to aquaplane.
- On landing, ensure the aircraft is pointing straight down the runway at touchdown and avoid 'greaser' landings. Lower the nosewheel without delay.
- Commence braking immediately, using the recommended technique for the aircraft. Raising the flap at this stage will put more weight on the wheels, but if you are already aquaplaning you will get more aerodynamic control by leaving the flap down. Check the recommended procedure for your aircraft type.
- Ensure speed is safe before turning off the runway.
- Be aware of the added hazards of crosswind and seriously consider landing somewhere else.
- Before takeoff, remember to consider the extra hazards and ground roll if an abort is necessary □

A sequence of events

Pilot contribution

DURING THE CAA/AOPA Pilot Awareness Seminar at Port Macquarie, I spoke briefly about an incident I experienced as the sole person on board during a Night VMC flight. As this incident had a dramatic effect on me personally, I thought the story may help others.

I am 41 years old and have held an unrestricted private licence for some 13 years with about 340 hours. I obtained my Class 4 rating several years ago. I am a firm believer that a successful flight is conducted by a thorough preflight on the ground before departure.

The intended flight was from Taree — Coffs Harbour (via Kempsey) — Port Macquarie — Taree. An area 20 weather forecast obtained from Coffs Harbour at 5pm dictated a change of plan due to enroute marginal conditions. I then planned Taree — Kempsey — Port Macquarie — Taree at leg altitudes of 5000, 5500 and 6000.

The flight plan was telephoned to Coffs Harbour Flight Service Unit. I nominated Port Macquarie as my alternate for Taree which I had nominated previously when flying this same route. The Flight Service officer would not accept Port Macquarie and insisted on Coffs Harbour as the alternate. I did not think to ask why, because he seemed so sure. I quickly rattled off a time interval and a distance off the top of my head without working it out or looking at a map.

The aircraft that I was to fly was an IFR equipped Cherokee 180 and was booked to depart Taree at 7.30pm. The aircraft is equipped Dual Nav/Com. On arrival at Taree aerodrome at 6.30pm I found that the aircraft had not yet returned from a VFR flight to Kempsey. I had planned to depart before last light to enable me to look at the weather and cancel if necessary.

WARNING BELLS were beginning to ring within myself but I did not recognise them.

- In 40 minutes I had to go to the toilet four times, each time passing considerable amounts of water. Body language I am aware of but did not recognise.
- As the time reached, and passed, 30 minutes before departure time with no sight of a returning aircraft, I became more on edge as my pattern was being upset.
- I made a telephone call to Coffs and amended my departure time to 8pm.

When I rang, the Flight Service officer advised me that he had corrected my time interval for the alternate, Coffs for Taree. After checking, I appreciated that the error, though small in space, could have been large in consequence if overlooked (68 nm and 42 minutes).

The aircraft arrived at 7.30pm. The pilot advised that the return altitude that he flew to remain VMC from Kempsey to Taree was 3500 and there was no rain about. This height was less than my planned altitude of 5000 but I decided that the cloud base may have been an isolated section. The weather forecast indicated scattered cumulus 2500/7000 with broken cumulus north of Port Macquarie, tops to 10 000, so I continued, departing Taree at 7.52pm and climbing to cruise at 5000 — AFTER LAST LIGHT.

The night was pitch black with reflections off cloud bases from towns along the coast. When abeam Port Macquarie at the planned time, I reported my position with intentions to leave 5000 for 3500 to remain VMC. The lowest safe Taree-Kempsey is 4200 with the highest point about 8 NM behind me, so I thought it OK to descend to the lower height to remain clear of the dreaded cloud that seemed to be threatening. At this time I engaged the automatic pilot to give me more time to watch outside. And then a SAL aircraft on the ground asked me to relay messages to Coffs Harbour.

The workload was building up: lowest safe, was I definitely clear of high ground, changing radio frequency, position confirmation, radio relays, cloud present, pitch black night, fly the aircraft (with the automatic pilot on), read the instruments, look outside, look for cloud, look inside, look outside etc, etc. Kempsey visual about 9-10 miles in front, where it should be — phew, good.

BANG — Nothing outside, only the noise of the plane and dull lighting inside.

IN CLOUD

My body went a deathly cold, the plane seemed to go very cold, no longer a friend. PANIC — What do I do, it's happened, caught in cloud.

For about 20-30 seconds everything seemed to stand still. Well, I thought, get a grip on yourself, leave the automatic pilot on, it does not know that you may be about to die and will keep the aircraft straight and level at least.

As strange as it may seem the thought crossed my mind at that time wondering what they would write in the *Aviation Safety Digest* about this crash.

I checked all the flight instruments to re-assure myself that everything was OK because the seat of my pants had the strange feeling that the aircraft was in a slight turn to the right with me leaning to the left. The instruments did not support this. Heck this feels terrible. Look to the left outside, instruments, front outside, instruments, right outside, instruments, above outside, instruments, still no lights or stars.

In a numbed state of mind, I did this all in a regimental manner as I used to in the army, even though it didn't seem to make sense as to why and what I was doing it for. I started to talk to myself and my maker and started to think what it would feel like when I hit the ground.

This lasted for four minutes and was possibly the longest four minutes of my life. Suddenly, a light to the left, several lights to the right, a group of lights in front — CLOUD GONE, almost over Kempsey.

Back into action again, I made a radio report and needed to dodge all the cloud I could now see 22 miles out of Port Macquarie. Coffs asked me to confirm my time Port Macquarie as 36. My answer, with all the deviations, was a guess and I amended to 42. I arrived over Port Macquarie at 36 exactly!

I entered the circuit at Port Macquarie and landed with one of the best approach and landings I have ever done. I did a slow turn-around and departed for Taree only for problems to occur as soon as I lifted off.

My little clip-on torch fell as I adjusted my position on the seat, lodging just out of reach near the right rudder pedal. To maintain orientation, I turned right towards Port Macquarie city to give me a horizon as I attempted to retrieve the light, without advising traffic. Another aircraft did ask me if I was turning right, which I confirmed. The torch was retrieved without problem and I set track to Taree.

I gave the departure report to Coffs with an amended altitude of 4600 (Non-Quadrantal) to remain VMC. The cloud base remained about 1000 ft above all the way to Taree. I arrived overhead Taree at exactly the planned time interval of 20 minutes, cancelled my Sarwatch, made another very good landing, put the aircraft into the hanger, completed the paperwork, locked up the club rooms and went and sat in my car. All of a sudden I didn't feel like going anywhere, even the two kilometers to my house. I had a tremendous headache which persisted for several hours after I arrived home.

The whole night leading up to the flight, the actual flight and aftermath will remain in my memory for a long time and is a night that prompted positive action on my part which will help me greatly in my future flying.

Several weeks of hard study occurred and I then sat for my Command Instrument Rating theory examinations. If successful, by the time this is printed I should have a Command Instrument Rating added to my licence.

For those who have been through similar incidents, and those who have not, please don't rate yourself in the category that it will not happen to me, because it can, as I found out, and it is a period of time that I never wish to repeat.

Call this article what you like, I can only call it hard-earned experience. Any comments that may be made on this particular occurrence can only be of benefit to me and my flying.

This story illustrates an area of the unknown for many of us. Keeping your cool and using the autopilot obviously saved this pilot. Planning for the future should prevent it happening to him again. But why voluntarily fly night VFR? If you wish to regularly fly at night, do as this pilot has done — get a command instrument rating □

Oh, dem sticky valves...

Pilot contribution by Warwick Budd

RECENTLY I realised a long-held ambition and, in company with two other pilots of rather more experience than my own, flew a Warrior around a large part of Australia. We had a magic trip and I'm willing to share our experiences with anyone who has a day or two to spare to listen and watch a million or so slides.

But there is one experience that I would like to share more widely and about which I'm willing to be brief enough not to bore people to death.

It all started when we lit the engine for our second day's flying. To say that it ran like a hairy goat would be charitable — but, after a minute or so of very lean running, it smoothed out and passed all the power tests with no trouble, so on we went, westward-ho!

The problem recurred several times, and always responded to the same treatment. We concluded it was plug fouling, and were reassured when some CPLs we consulted thought so too. Six plugs were changed during a 100-hourly inspection that was done in Perth but, alas, it wasn't long before we had the problem again.

So we continued as before — pay careful attention to leaning the mixture and be prepared to let the engine have a bit of time to settle down after being started.

Until the day it ran worse than ever and clearly wasn't going to come good. So instead of going to Ayers Rock we went to see a LAME. He looked at the engine and immediately pointed out the bent exhaust valve pushrod on number four cylinder. It turned out that three of the four exhaust valves were sticking and had to have their guides cleaned of accumulated carbon. 'Twas a wondrous thing to see the job being done with hardly any disassembly of the engine.

And the problem did then go away.

I like telling the story anyhow — perhaps it is like wanting to show everyone your freshly removed appendix, but in this case I'm telling the story because it might help others.

The important thing is that there was no reason to have gone so long without correctly identifying the problem. When doing the daily inspection on the day the problem first appeared we had noticed that only one cylinder had really good compression and that the others were very low. We just didn't take enough notice of the fact. Sticking valves will make the compression very low, and the difference after the engine had its operation was remarkable.

Apparently it is well known that the exhaust valves of Lycoming 0-360s tend to become sticky about 1100 hours from new or after a top overhaul. So, if your engine fits this description, has poor compression on a cylinder or two or three and runs roughly after a cold start, watch out for sticking valves. As it turned out we were lucky and the cam-follower was not damaged — if it had been it would have been necessary to remove the engine and split the crankcase to fix it.

Alice Springs is a nice place to spend a few days, if you've planned it that way □