Flight Safety
AUSTRALIA

CONQUERING THE SOUTHERN SKIES
CENTENARY SPECIAL

• Glass cockpits come to GA • When you can't dial 000 • Sleepy, strung-out, dry, hungry pilots

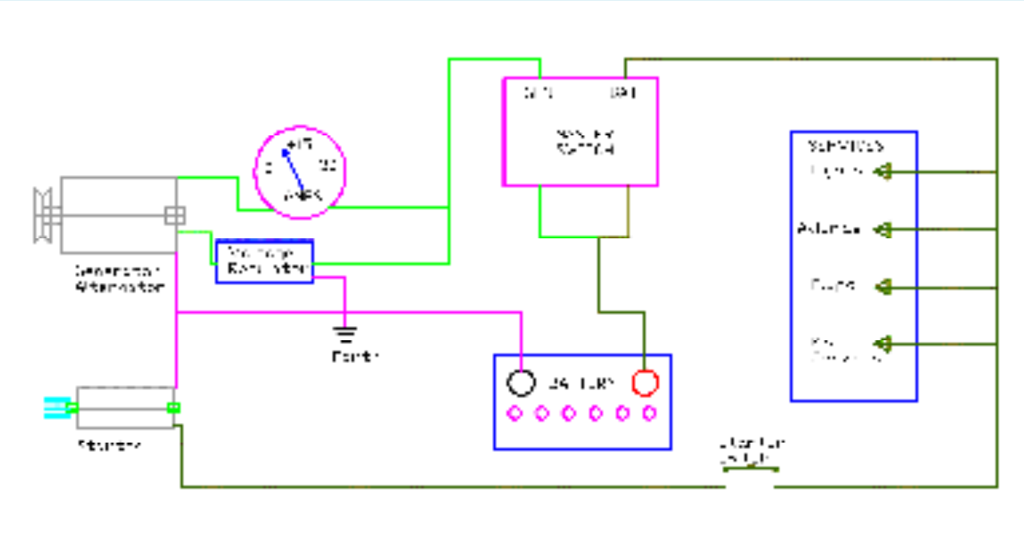
Heat and warning lights

THE ANALYSIS of the Twin Comanche accident featured in “Free of charge” (*Flight Safety Australia* November-December) generated much heat, on issues ranging from training to warning lights.

It sparked debate over the difference between circuit diagrams and electrical system schematics. It even polarised pilots and LAMEs, shattering the peace and goodwill that normally exist between the two groups.

Following are some of your comments on an article shaping up to be as controversial as the Archibald Prize.

We include response from its author and a rejigged diagram showing the main electrical system components on a single-engine light aircraft. The Australian Tribe of the International Comanche Society has its say in the “What went wrong?”section on page 25.



Idiot lights

The aeroplane in the article, “Free of charge” had one ammeter and, as your article stated, “ammeters can be difficult to interpret”.

The pilot is getting a lot of blame here. Ultimately, he is responsible, but as a low-hour twin pilot he has enough to think of without having to be an inflight auto electrician.

I might point out that one of the passengers was also a pilot and he didn’t figure out the problem either. Some responsibility here should be pointed to the regulators of aviation. Why was there no voltage gauge in that aeroplane or all aeroplanes, for that matter? If there was a voltage gauge with green and red markings,I am sure that the pilot in command would have picked it up straight away.

We could take this one step further and install flashing LED “idiot lights” above every gauge in the red,increasing safety, especially for low-hour pilots, at very little extra cost.

That little incident could have cost four lives.

John Corbishley
Putney, NSW

More hurry, less safety

The November-December issue of *Flight Safety Australia* had an article about a Twin Comanche loss of electrics. Over the last 40 plus years of GA flying by myself,I have noticed that a majority of pilots starting engines on light piston twins seem to be in a hurry to get both engines started and running almost simultaneously.

Maybe it is an example of their dexterity with their hands flashing around the cockpit.

By doing so, they miss the opportunity to confirm that each separate engine instrumentation is operating correctly.

In cold weather, it is possible that they could have both engines running with zero oil pressure on both gauges for upwards of 30 seconds or so. Most light twins also have the engine instrumentation over on the starboard side of the panel, with most system switches either in front of the pilot or on a left side panel.

Makes for a very wide scan with eyes going like “shot gyros”. I do not remember anyone telling me that getting both engines turning and burning as quickly as possible was a sign of good airmanship! Night-time starting with nav lights, beacons, cockpit lights all on and maybe cabin lighting, have all taken a considerable amount of power from the battery.

By waiting a minute or so before starting the second engine, the charging unit on the engine which is running is able to replace some of the energy already used. It also allows time to check all the running engine parameters before starting the second engine.

Geoffrey Wordsworth
Cooktown,Qld

Old planes should meet new standards

Your analysis accompanying the article“Free of charge” misses the real fault in GA aircraft electrical systems: that current requirements are not imposed on aircraft with outdated certification bases.

You say: “It seems odd that a component whose failure can have life-threatening implications does not have to be fitted with some sort of warning system – but that’s just how it is.”

No, it is not. That’s how it was in the Dark Ages. The current airworthiness requirement in FAR Part 23, para. 1351 (c) (4) says: “There must be a means to give immediate warning to the flight crew of a failure of any generator …”

You also say that on the Twin Comanche the “ammeter shows the combined output of both alternators”. Examination of the electrical system diagram in the Twin Comanche owner’s handbook shows that the ammeter measures the current flowing between the battery on one side and the generator(s) and most of the loads (except the undercarriage and flap motors) on the other side.

FAR Part 23 para.1351 (d) (1) now requires:“For normal, utility and acrobatic category airplanes with direct current systems,an ammeter that can be switched into each feeder generator may be used ...”

If the Twin Comanche complied with current airworthiness requirements,the oversight that led to the reported accident would have been detected immediately.

The problem is that the certification basis of the Twin Comanche is CAR 3,the primitive predecessor of FAR Part 23,and the aircraft type is not required to be modified to meet current requirements.

One can understand that requirements might be frozen for structural design and performance, but not requiring that amendments to requirements for such systems as the electrical system be complied with seems to be positively dangerous.

Alan Fien
Prunevale,NSW

It's what you know that counts

The pilot [featured in "Free of charge"] had 800 hours [single engine endorsement] when he sought the twin endorsement.

While CASA recommends a minimum of seven hours for an initial twin endorsement, it does not necessarily follow that a pilot should not be certified as competent to fly in command in less hours.

Until recent years, the minimum dual recommended by CASA was five hours and many sound pilots have completed the endorsement in that time.

It is competency that counts not numbers. Why then does your writer describe a five-hour endorsement as a cheap endorsement when CASA was happy with five hours just a few years back?

Has the addition of two hours addressed any real lack of competency or has competency been ignored? In many cases I think that is exactly what has happened and the panacea is seen to increase the "hours requirement" as a means to cast responsibility onto the instructional world and assume competency will automatically be achieved under this training regime.

In any case, engineering technical knowledge is mainly learned from reading a manual, not from repetitive asymmetric circuits and long cross-country flights just to make up seven hours or more.

Inadvertent wheels-up landings have happened to high- and low-hour pilots alike. There is a popular myth that teaching students to call "wheels down and locked" when flying fixed-undercarriage aircraft will reduce the chances of future wheels-up landings. If this was true, the military would have done this years ago.

John Laming
Melbourne, Vic

LAME has a go

I was amazed by the article on aircraft electrical systems.

This schematic was obviously designed to try to clarify in simple terms how the basic charging /battery /bussing/starting on aircraft (work) in the "scheme of things".

This schematic shows the battery in "series" with the alternator/generator and the bus bar. It has a "master switch" in the schematic that just does not fit. It also has the starter motor "unswitched" running from the bus (plus various more confusing components and where they don't fit).

Pilots are confused people already without this adding to it.

Gary Roberts
Dubai

At the time of the accident there was no requirement for the aircraft to be fitted with a warning light or voltmeter. While subsequent regulations call for a warning system on newer aircraft, there is no requirement to modify older ones.

Certainly quality training would have included the correct use of written checklists and the alternator switches would not have been overlooked.

Also, another two or three hours of training would have increased the pilot's familiarity and knowledge of the type, and reduced pilot stress levels, perhaps to the extent that he would have noticed the electrical problem, and recognised its consequences and the solutions.

Training organisations can enhance their training at no extra cost by encouraging students to spend time sitting in the aircraft on the ground, while going through procedures, checklists and studying the POH.

Jim Davis

Mobile message spreads

After reading "Switched off" (*Flight Safety Australia*, September-October), I filed a disturbance report to Swedish "CASA" (Luftfartsverket) concerning my experience with cell phones.

Reading the comments in the November-December issue made me think that I should share my experiences with you.

I have an old hand-held GPS. Lately, it has sometimes had problems getting a fix on satellites. Every time I've thought, "so, now it's had it". Every time so far when I get home and test it, it works.

But this summer, we were out flying. I took off from a small airfield, noted the GPS was searching. During our climb we came into controlled airspace and continued there for approximately 30 minutes. Coming into free air and having more time to focus on other things, I started studying the GPS. It was still searching!

I found the GPS got a signal from one satellite, searched for the next one and when it had found that one it lost the first one.

I started talking about this with my passengers and one of them said, "I wonder ifI turned off my cell phone". She took a dive into the luggage compartment and found her phone switched on. No messages or calls had come. She turned the phone off and within 30 seconds the GPS had a fix and everything worked perfectly.

I note that on previous occasions I have always had passengers, and in the last years, as I presume it also is in Australia, cell phones have become very common.

Sten Lang
Örebro Sweden

Flare-up over diesel story

I enjoyed the aircraft diesel engine article as brief as it was and omitting a number of advanced projects regarding the diesel.

For many years, I have been convinced that diesel engines are going to be the answer to light aircraft power plants.

Now that light alloys and improved technology have reduced the weight of the diesel comparable to the avgas ones, I can see the diesel not only being fitted to new aircraft but retrofitted to existing ones.

When one goes through the cost of fuel, it is easy to see the savings, providing manufacturers keep the cost of these units at a comparable level.

I was flabbergasted to read in the article that the contamination of diesel into an avgas powered engine could seriously damage the engine, whereas the

The Diamond DA 42, powered by twin diesel engines.

misfuelling of a diesel with avgas is unclear.

Anyone who knows the basic principles of diesel engines would know that such a misfuelling would result in a completely wrecked engine in a matter of seconds.

The introduction of avgas designed for engines with a compression ratio of some 9 to 1 into a 17/19 to 1 diesel would at the very least result in bent conrods, probably a broken crankshaft, possibly a blown headgasket, if not a blown-off head.

Diesel into an avgas engine will almost certainly stop it, with perhaps small damage to the engine.

Avgas into a diesel will guarantee its destruction.

Len Paggi
Carnarvon WA

We recognise there are other excellent diesel engine projects either under development or already operating in the sport aviation market. The article, however, was centred on existing certified engines and programs undergoing certification.

Misfuelling with Jet A-1 can have dire consequences, especially on high-performance engines. The drop in octane rating of the fuel is proportional to the amount of turbine fuel that has been added to the Avgas. Even a small amount of Jet A-1 can result in loss of power and severe detonation damage to an engine.

A few years ago, an oil company in the US accidentally mixed Jet A1 with Avgas, resulting in many engine failures and a massive lawsuit. The issue of misfuelling aircraft powered by diesel engines is not as clear cut.

CASA has raised the subject with manufacturers, the US Federal Aviation Administration and an oil company. No one has been able to give us a definitive answer.

We have been told that the European diesel specification EN590 can have up to 10 per cent gasoline added during the European winter to improve cold weather starting. In fact, we understand the Centurion engine has been operated on this fuel without ill effects.

An FAA fuels expert had this to say on the misfuelling question: "Not sure about the results of the misfuelling, however my guess would be not good ..." Our sentiments exactly! The practical answer is that there is probably a mixture of Jet A1 and Avgas that would not be detrimental to the diesel engine. However, the regulatory answer – and the CASA position until we are persuaded otherwise – is that the flight manual does not approve such a fuel mix. Therefore, the aircraft must not be operated on such a mix. CASA will continue to pursue the issue, and we urge readers with any information on the subject to contact us.


TOM KEATING

Sky droving yarn

REGARDING "Melbourne Cup: Flighty passengers take to the air" (November-December 2003), on May 6, 1988, I was the captain of a B727 freighter from Auckland to Brisbane. Our payload was exclusively racehorses.

Approximately one hour out from Brisbane, an ashen-faced vet came into the flight deck to inform us that one of his expensive charges had managed to climb out of his box and was standing in the open space between his pallet of boxes and the one in front of him.

The said horse was content in this situation and it appeared being confined in the box is what had caused the distress.

The vet and the handlers placed a halter on him, and with the handlers standing either side and the vet very close by with the dreaded needle, we proceeded to Brisbane.

The remainder of the trip was uneventful, although, once parked, they did have some problems persuading the escapee back into a box to get him off the aircraft.

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Sydney GA airports sold


MERRAN WILLIAMS

THE SALE OF THE Sydney Basin's three general aviation airports – Bankstown, Hoxton Park and Camden – was announced in mid-November.

BaCH Airports Consortium, comprising Toll Holdings, the Commonwealth Bank and the James Fielding Group, has bought the airports at a cost of $211 million.

Under the terms of the sale, BaCH Airports will produce a draft master plan for the airports within a year. Bankstown will remain Sydney's main general aviation airport but will undoubtedly see extensive non-aviation commercial development within its boundaries. Camden will continue largely as a centre for sport aviation as it is regarded by most commercial operators as being too far out of Sydney for extensive business/GA use. Hoxton Park will eventually close.

Operators based at Hoxton have been fighting to save the aerodrome, but by late December all but one had accepted a compensation offer to move out.

The sale requires Hoxton to remain an operating airport for only five years, after which the freehold title will pass to the owner of the lease. As a result, Hoxton, considered a piece of prime real estate, is likely to undergo redevelopment as an industrial or residential area.

There is one issue to be resolved at Hoxton Park. As the last WWII "satellite" airfield in the Sydney basin, it was proclaimed a heritage site in early 2003, but some opinion suggests this applies only for as long as it is owned by the Commonwealth.

The sale of the three airports marks the end of the Australian Government's airports privatisation programme.

QantasLink Orders Dash 8s

QANTASLINK HAS ordered six Bombardier Dash 8 Q300 regional turboprops and placed options on two more. The new 50-seaters will replace earlier 36-seat Dash 8-100s on services to major regional centres.

QantasLink says the new aircraft will operate in New South Wales, the ACT, Queensland, Victoria and Tasmania, allowing more seats to be made available at peak times on routes such as Sydney to Canberra, Coffs Harbour, Port Macquarie and Albury plus Melbourne-Canberra, Melbourne-Devonport, Cairns-Townsville and Cairns-Hamilton Island.

QantasLink already has more than 20 Dash 8s of various models in service

Virgin Blue floats

VIRGIN BLUE LAUNCHED its long-awaited public listing on the Australian Stock Exchange on December 8, with the offer ten times oversubscribed.

The prospectus's indicative listing price had been put at between $1.80 and $2.25 per share, but the oversubscription resulted in the top figure becoming the starting point.

The shares opened at $2.40 on the first day's trading and closed at $2.43, remaining at around that figure for the next few days. This values the gross proceeds of the offer at about $600 million plus more than $400 million in new shares.

Including stock retained by Patrick Corp and the Virgin Group, the airline is valued at more than $2.5 billion.

Since launching services in August 2000, Virgin Blue has grown to capture 30 per cent of the Australian domestic market and is now carrying almost as many passengers as Ansett immediately before its demise.

By late 2003, the airline had more than 30 Boeing 737s in service and flew to some 20 destinations.

GEOFF COMFORT

Qantas launches JetStar

AAP

FOLLOWING ITS October 2003 announcement that it would go ahead with its planned low-cost carrier, Qantas on December 1 formally launched the airline and revealed it would be called JetStar.

Operations will start in May, initially using 14 Boeing 717s currently flown by QantasLink. These will be joined from June 2004 by the first of 23 Airbus A320s ordered by JetStar, which will eventually fly only the A320. The last of the order is scheduled to be delivered in mid-2005 and further A320s will be acquired as the airline grows.

JetStar will target the price-sensitive leisure market, which accounts for more than 60 per cent of all Australian domestic passenger traffic. Its route network will be announced early this year. The A320s will be fitted with 177 seats in a high-density layout.

JetStar will be based in Melbourne and operate under the auspices of Impulse Airlines, which Qantas acquired in May 2001 and which is currently the QantasLink operating entity.

Qantas has reorganised its full service domestic airline into a two-class operation on all routes, using Boeing 737s and 767s, along with A330s. Five additional 737-800s have been ordered for the domestic fleet, to replace the last of the 737-300s. QantasLink will continue as the regional operation. Qantas CEO Geoff Dixon claims that JetStar will be "the lowest cost airline in Australia by some margin" and that it will be profitable in its second year.

Also in October, Qantas announced details of its mooted corporate reorganisation. The company will be divided into ten businesses, each of them a separate financial entity and therefore individually accountable.

There will be four flying businesses (Qantas Airlines, the main international and domestic operations, Australian Airlines, QantasLink and JetStar); two flying services businesses (Engineering Technical Operations and Maintenance Services, Airports and Catering); and four associated businesses (Freight, Holidays, Defence Services and Consulting).

Dixon says the reorganisation will enable the airline to "better meet the aviation industry's considerable challenges" by delivering a range of major benefits, including "increased accountability, greater speed and quality of decision making, and improved return on assets".

ETOPS Bizjets

THE US FAA HAS issued a notice of proposed rulemaking that will see extended range twin operations (ETOPS) regulations introduced to cover Part 135 operators. This includes business jet charter flights across the Atlantic and Pacific oceans.

The proposed rule will require aircraft flying more than 180 minutes from a suitable alternate airport to meet ETOPs requirements. If the aircraft complies it will be able to operate to an ETOPS limit of 240 minutes; if not, it will have to remain within 180 minutes flying time of an airport at single-engined cruising speed. These aircraft will have to take longer routes across both oceans, costing time and fuel.

Most modern business jets will comply with the proposed rules but some older ones with inadequate single-engine range do not and will be banned from undertaking such flights. Modern long-range business jets such as the Gulfstreams and Global Express are designed to meet ETOPS standards but not certified to them.

Fractional ownership companies operate to the new Subpart K of the Part 91 rules and their flights are therefore regarded at the moment as being private rather than charter.

As a result, they are technically not bound by the proposed ETOPS changes, but the FAA is planning to link Part 135 and Subpart K in this area, meaning that fractional ownership operations will also eventually be subject to the new rules.

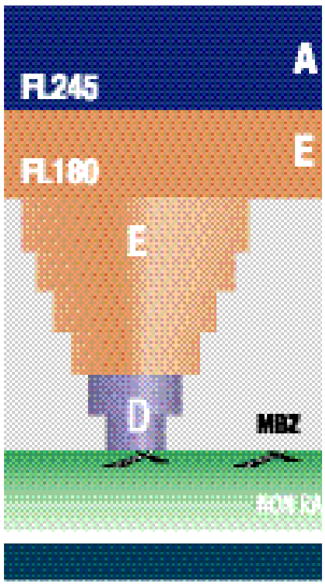
New airspace rules introduced

AUSTRALIA'S NEW AIRSPACE rules were introduced on November 27 amid controversy generated largely by disinformation fed to the mass media.

The basis of this part of the airspace reforms (stage 2b) is a substantial increase in Class E airspace, largely replacing en route Class C.

The National Airspace System Implementation Group says the new system is being phased in at a measured pace to provide improved air traffic services and greater flexibility for IFR traffic, greater freedom of movement for VFR flights and procedures closer to international practice.

The next stage of the reforms is scheduled to take place next November. MBZs and CTAFs could be replaced by US-style CTAFs. Radar airspace could also see additional Class E areas introduced.



Farewell Concorde

BRITISH AIRWAYS

AN ERA THAT WILL NOT be repeated in the foreseeable future ended on November 26 when British Airways Concorde G-BOAF made the type's final landing at Filton, near Bristol, returning to its place of manufacture as the last of 20 Concordes jointly produced by the British Aircraft Corporation (BAC) and France's Aerospatiale.

After leaving London Heathrow with 100 BA staff on board, the aircraft headed out across the Bay of Biscay, overflying Bristol at altitude before performing a final supersonic dash. The last landing was performed by BA's Captain Les Brodie accompanied by Captain Paul Douglas, who had made the final take-off from Heathrow.

Nearly 30,000 enthusiasts and invited guests, including 3,000 prizewinners and families of the employees of Airbus and Rolls-Royce, were at Filton to witness the landing. Concorde completed its landing roll to the end of the runway, and while returning, stopped in front of the welcoming crowds, lowering its nose in a bow.

Also on board the flight was Captain Mike Bannister, chief Concorde pilot and general manager Airbus, Boeing 737/757/767 and Concorde fleets for BA. He presented G-BOAF's technical log to the Duke of York on behalf of the local community.

G-BOAF recorded its maiden flight on 20 April 1979, subsequently logging more than 5,500 supersonic flights and carrying more than 300,000 passengers.

Five of BA's seven Concordes have been flown to preservation sites – Filton, plus the Museum of Flight at Seattle, USN Intrepid Museum in New York, the Grantley Adams International Airport in Barbados, and Manchester International Airport in Britain.

Two others remain at Heathrow: one will be incorporated within the new Terminal 5 complex, and the other is to be dismantled and moved to the Scottish Museum of Flight early this year. Air France's remaining Concordes have also been sent to museums for preservation.

Wrong engine shut down

THE INVESTIGATION into the crash of a Binter Canarias Casa CN-235 twin turboprop on final approach to Malaga, Spain has revealed that the crew inadvertently triggered the fire extinguisher system of the only operating engine.

The series of events that led to the crash began when a fire warning for the port engine sounded. The crew followed proper procedure by shutting down the engine, feathering the propeller and setting off the extinguisher's first shot.

Despite this, the fire warning remained active, but was later revealed to be the result of a malfunction in the system.

The fatal mistake occurred when the captain – hoping to extinguish what he thought was a still-burning fire in the port engine – attempted to trigger the second extinguisher shot but instead accidentally set off the system for the still-running starboard engine. This caused the engine to flame out.

Now without power, the CN-235 came down about 700 metres short of the runway. Three crew and 44 passengers were aboard. The impact of the aircraft striking a road embankment killed the captain and three passengers and severely injured the first officer, flight attendant and 16 passengers.

The investigators blamed a lack of crew coordination as a contributory factor to the accident and recommended clarifications in the operating manual. They also noted that the same pilot should carry out all the engine fire drill and checklist actions.

Rubbery figures

P MARKMANN

THE INTERNATIONAL Air Transport Association has had to adjust its predictions radically downwards for the world airline industry's 2003 international scheduled services performance. But it conditionally says an upturn can be expected from 2004.

IATA's original predictions for 2003 could not foresee the war in Iraq and SARS.

It anticipated a 7 per cent increase in international scheduled passenger traffic rather than the 1 per cent drop it now expects to occur.

International airlines between them lost $US3.8 billion in 2002 and the 2003 figure is expected to be considerably worse – a deficit of $US4.9 billion.

IATA's current forecast for 2003–07 cautiously predicts an average 4.7 per cent annual growth in passenger numbers but with some unusual figures within that.

From 7 per cent growth in 2004–05,a reduction in growth to 5 per cent in 2006–2007 is anticipated and IATA has warned that these figures may well be optimistic.

In other words,nobody is really sure what will happen,illustrated by the enormous variation in IATA's anticipated combined financial result for the airlines in 2004, which ranges from a loss of $US1.9 billion to a profit of $US5.4 billion, "depending on the extent of cost cuts and traffic recovery".

FAA approves RVSM

THE US FEDERAL Aviation Administration (FAA) has published the final rules covering reduced vertical separation minima (RVSM) which will come into effect in the USA in January 2005.

The FAA says that domestic RVSM – which reduces vertical separation between aircraft from 2,000 feet to 1,000 feet for those flying between 29,000 and 41,000 feet – will generate fuel savings and reductions in delays worth about $US5.3 billion to operators by 2016. The cost of the programme is estimated at $US870 million including $US530 million to fit aircraft with the more accurate altimeters and autopilots necessary for RVSM operations.

Operators of older and out-of-production aircraft – mainly business jets – have been arguing for a delay in the introduction of RVSM, claiming there is insufficient time to modify their aircraft. Non-RVSM aircraft will be forced to operate below 29,000 feet with resultant substantial fuel consumption penalties. Most bizjets are certified to operate at 41,000 feet or higher.

The issue of updating older aircraft in time is a potentially serious one. Cessna has so far modified only about 300 of the 1500 Citations potentially affected by the new rules and says operators have been holding off having the upgrades performed as they wait for a reprieve.

The company notes that now the deadline has been finalised, the number of aircraft still needing to be modified could exceed the capabilities of avionics suppliers and modification centres to meet demand.

A300 survives missile strike

AN AIRBUS A300freighter operated by Brussels-based European Air Transport on behalf of DHL survived being hit by an SA-7 Grail portable surface-to-air missile shortly after departure from Baghdad International Airport on November 22 last year.

The aircraft was able to return to the airport and land safely despite severe damage to its port wing outboard of the No 1 engine.

The wing continued to burn until emergency services could extinguish the flames on the ground.

The crew of three escaped uninjured but DHL's European arm suspended operations into Baghdad after the attack.

The missile was fired by a group of about ten terrorists located just outside the airport boundary. They later released a video of the attack showing the launch, the missile impact and the subsequent return of the aircraft to the airport with its wing burning.

At least eight missile attacks on aircraft operating at Baghdad have been recorded, but before the A300 incident only one had achieved a hit, bringing down a US military helicopter. This was the first attack against a civilian aircraft.

The A300's three hydraulic systems were damaged, resulting in compromised flight control, braking and anti-skid function. The port aileron was destroyed and the aircraft touched down at high speed with flaps and slats retracted, overrunning the runway but eventually stopping safely.

The only other airline operating freight services into Baghdad – Royal Jordanian – temporarily suspended flights after the attack. Early assessments indicate the A300 is probably repairable because damage was limited to the port wing.

Dream closer to reality

THE BOEING BOARD of directors on December 16 gave the company's commercial airplanes division the go-ahead to begin offering the planned 200- to 300-seat 7E7 Dreamliner widebody twin to potential customers.

This "marketing launch" is the first step in a process that might see the production go-ahead, or formal launch, take place this year if sufficient airline interest is generated.

The 7E7 is being offered in two long-range versions capable of flying up to 8,300 nautical miles (15,375km) with either 200 (baseline) or 250 (stretch) passengers in two classes.

In addition, a short-range model for 300 passengers in two classes and with a range of 3,500 nautical miles (6,480km) is planned.

If built, the 7E7 will be the world's first airliner with its primary structure (including wings) built from composites.

Boeing

Boeing claims the 7E7 will be "more efficient, quieter and have lower emissions than other aircraft", that a market for 2000-3,000 airliners in its class exists over the next 20 years and that there is "tremendous customer interest" in it.

Assuming the 7E7 is formally launched in 2004, the baseline and short-range models will fly in 2007 followed by first deliveries in 2008. The stretch will probably enter service in 2010, depending on market conditions.

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Boeing 777 makes first 330 min ETOPS flight

David Karonidis

A DEVELOPMENT Boeing 777-300ER completed the longest engine-out demonstration flight in mid-October in support of extended twin operations (ETOPS) certification, when it flew for 330 minutes with one of its two GE90-115B engines shut down.

The test was performed during a 13-hour sector between Seattle and Taipei, part of the overall 777-300ER test and certification programme, which has involved two aircraft flying to various parts of the world.

Other 330-minute shutdowns were performed during the flights.

One of the 777s visited Australia in early November as part of a trip that started and ended in Seattle, travelling via Singapore, Dubai, Mauritius, Perth, Sydney and Recife (Brazil). Much of the Perth–Sydney leg was flown on one engine.

The 777-300ER typically carries 365 passengers in three classes over a range of up to 7,200 nautical miles (13,335km). First delivery will be to Air France in April.

FedEx first with EVS

FREIGHT CARRIER FedEx Express will become the first airline to equip its fleet with an enhanced vision system (EVS). The carrier has selected the Kollsman infra-red (IR) sensor and Honeywell head-up display (HUD) to equip 200 Airbus A300/310 and McDonnell Douglas MD-10/11 freighters from 2007 under its Magic Window programme.

The EVS is scheduled to be certified on the MD-10 in the last quarter of 2006, followed by the other types at six- to nine-month intervals. FedEx has ten Airbus A380-800F freighters on order and these will most likely be delivered with the HUD and EVS already installed.

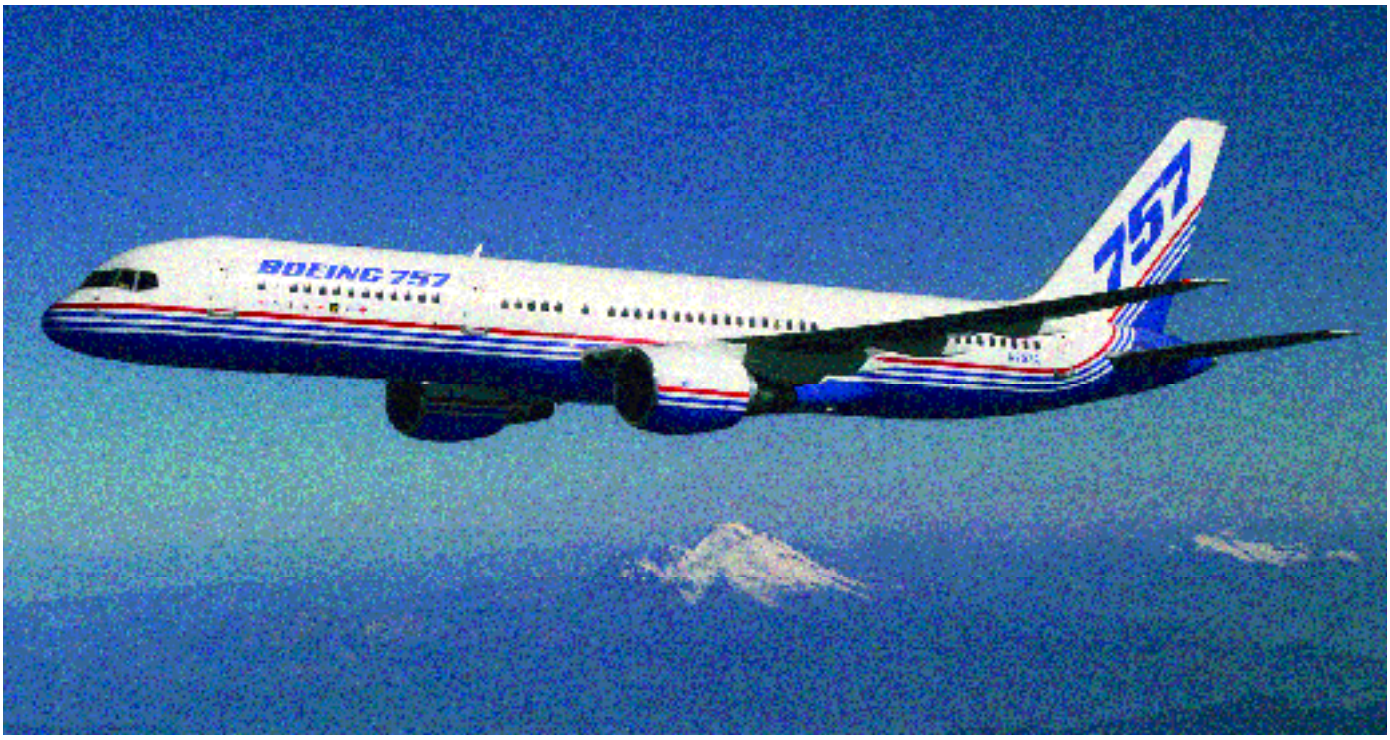
EVS provides enhanced situational awareness for flight crews in darkness and poor visibility during the landing and taxiing phases of a flight. The IR sensor presents an image that is projected onto the HUD or to another display on the aircraft's main instrument panel.

Once experience is gained with the system, FedEx will work with the US FAA on reducing landing minima.

The FAA is already close to releasing a notice of proposed rulemaking on EVS that will probably see these minima reduced, possibly including a decision height as low as 100 feet above ground level, provided the runway is visible to the crew through the EVS.

EVS has already been approved for use on the Dassault Falcon 50EX and Bombardier Challenger 600/601/604 business jets.

Other business aircraft approvals in the pipeline as *FSA* went to press include the Bombardier Global Express, Dassault Falcon 900 family, Gulfstream IV, Beech King Air family, Learjet 35 and Pilatus PC-12. EVS approval for the Bell 212/412 and Sikorsky S-76 helicopters is also imminent.



Boeing axes 757 production

INDUSTRY SPECULATION that Boeing would shortly end production of the 757 narrow-body airliner was confirmed in October when the company announced that the last 757 would be delivered late this year.

The aircraft has recently been selling slowly, with only eight (net) orders logged in the 12 months before the announcement,at which time the backlog was down to just over 20 aircraft.

The decision to axe the programme was hastened by Continental Airlines, which changed an order for three 757-300s to 737-800s.

The 757's market has been eroded by competition from the bigger 737 models and the Airbus A321. The last 757s will be for Shanghai Airlines, bringing total deliveries to 1,046 aircraft, assuming there are no more cancellations or adjustments.

The 757 emerged from several proposals to find a larger successor to the 727 trijet in the 1970s. Initially dubbed 7N7,it was formally launched in 1978 with orders from Eastern Air Lines (21) and British Airways (19). The prototype first flew in February 1982 and Eastern launched services in January 1983.

Europe's single sky

THE EUROPEAN Parliament has reached draft agreement on landmark plans for the Single European Sky (SES) air traffic control.

The agreement includes the framework and basic rules covering the provision of air navigation services, organisation and the use of airspace. It has taken four years of planning and negotiation to achieve. The idea of SES is to redesign European skies to increase future air traffic capacity.

The first tangible product of the new agreement will be a continuous, Europe-wide block of upper airspace above flight level 285 (28,500 ft) that will be known as the European upper flight information region.

This will eventually cover an area ranging from the Atlantic coast in the west to the Ural mountains in the east, and from the northern coasts of the British Isles and Scandinavia south to the Mediterranean.

This block of airspace should be operational by the middle of 2004, but restructuring of the lower levels into "functional airspace blocks" will take longer to implement because of complexities such as the influence of national boundaries.

The function and design of the blocks will depend largely on precisely how the appropriate regulations are written.

747-400 blank screens

THE US NATIONAL Transportation Safety Board (NTSB) has issued a recommendation that Boeing 747-400 operators adopt a new checklist procedure in the event of an abnormal situation created by failure of the aircraft's integrated cockpit display systems.

Singapore Airlines (SIA) has suffered two failures of all six EFIS/EICAS units (EIUs) – the primary and secondary flight displays – while in flight, the first in November 2001 and the second in January 2003. In both cases the EIUs came back on line after being recycled but the cause of the failures has not been determined.

Boeing issued an operations manual bulletin after the second SIA incident,stating that if all six display units went blank, the left and centre EIU circuit breakers should be cycled,from which the display units "may recover". Cycling an EIU involves pulling it out of its mountings and then pushing it back in.

The NTSB says that Boeing's advice is "a reasonable temporary action until a permanent solution is determined" and advises airlines to incorporate the procedure as an abnormal situation checklist for ease of reference.

Forgot to carry the one!

A SEVERE TAILSCRAPE suffered by a Singapore Airlines Boeing 747-400 on take-offfrom Auckland Airport in March 2003 resulted from a take-off weight transcription error that in turn led to a low thrust setting and excessively low take-off reference speeds.

On rotation, the 747's lower rear fuselage struck the runway and scraped for 490 metres before the aircraft staggered into the air very close to stalling speed. The crew returned to Auckland and performed an overweight emergency landing with no injuries to the 390 passengers and 20 crew.

The load sheet for the aircraft had its takeoff and landing weights listed as being almost the same – 247.4 tonnes and 247.0 tonnes respectively. This anomaly was missed by the captain,first officer and another first officer who was on the flight deck. The actual takeoff weight was exactly 100 tonnes more – 347.4 tonnes – indicating a simple arithmetic error involving not "carrying the one" somewhere along the line.

The lower take-off weight resulted in much lower reference speeds being set.Rotation speed was calculated at 130 knots, 33 knots slower than required for the actual takeoff weight. Extraordinarily, despite this figure being much less than normal, none of the three pilots in the cockpit queried it. The result was a premature attempt at rotation and a lengthy tailscrape before the 747 finally became airborne. The 747's lower rear fuselage suffered substantial damage as a result.

The report into the incident notes that the aircraft moved close to the edge of the runway during the take-off roll and the pilots did not respond correctly to a stall warning. Had the 747 moved offthe runway or stalled, "a more serious accident could have occurred". The aircraft was almost at stalling speed as it lifted off. The stick shaker was operating, but none of the crew called for extra power.

The pilots did not carry out the required independent comparison checks when the weight and speed calculations were made, and then failed to recognise seemingly obvious anomalies.

The captain, who has since left the airline,had 12,475 total flying time but only 54 hours on type; the flying first officer had 1309 hours in total and a modest 223 hours on type; and the additional first officer was the most experienced on the 747-400, with about 3,400 hours on type.

Union blocks safety recommendation

LUXEMBOURG OPERATOR Luxair is in dispute with its pilots' union after the union prevented implementation of a key recommendation resulting from the fatal crash of a Luxair Fokker 50 in November 2002.

The F50 came down while on final approach to Luxembourg Findel Airport during daylight but in foggy conditions. Of the 22 people on board, only the captain and one passenger survived.

The investigators found the captain and first officer to be "disorganised", "unprepared" and probably suffering from "get-home-itis". The captain put the F50's power levers into the beta range while attempting to maintain glideslope from above after starting a go-around because of the poor visibility. He then reversed his decision without communicating with the first officer. The captain had also begun what should have been a Category II ILS approach without briefing the first officer.

The report states in part: "The initial cause of the accident was the acceptance by the crew of the approach clearance although they were not prepared for it, namely the absence of preparation for a go-around. It led the crew to perform a series of improved actions that ended in the prohibited override of the primary stop on the power levers.

"All applicable procedures as laid down in the operations manual were violated at some stage of the approach ... [creating] an environment whereby privately designed actions were initiated to make a landing possible."

Investigators also criticised Luxair's hiring and training practices and noted that the design of the F50's power levers did not prevent the selection of beta range (or ground idle) in flight.

Most of the criticism was levelled at the crew, but the key recommendation – that an operational flight data monitoring program be introduced – has been opposed by the Airline Pilots Association of Luxembourg (ALPL) on the grounds that it would violate pilots' privacy. Luxair cannot implement the recommendation even though it wants to.

Flight data monitoring programmes are widely used elsewhere. Luxair's Boeing and Embraer aircraft are fitted with the necessary equipment but it is not used because of objections from the ALPL.

AAP

Air NZ wants new widebodies

AIR NEW ZEALAND HAS issued a request for proposals covering the potential purchase of new widebody airliners to replace some of its Boeing 767s. The airline currently operates three 767-200ERs and nine 767-300ERs.

The RFP has been issued to Boeing and Airbus – naturally – although the precise number of new aircraft required had not been revealed by early January. Variants of the Boeing 777 and Airbus A330/340 families will be evaluated for the competition. Air NZ uses its 767s both on long and medium haul operations.

In 2003 the airline informally evaluated the A340-600 and 777-300ER as potential replacements for some or all of its eight Boeing 747-400s, although it has now decided to retain these in service and is about to begin a major interior refurbishment program,including the installation of flat-bed seats in business class and in-seat personal televisions.

Bendora Dam JetRanger report inconclusive

Courtesy of The Canberra Times.

THE ATSB HAS released its report into the crash of a Bell Jet Ranger into the Bendora Dam near Canberra during bushfire water bombing operations on January 13 last year. The helicopter came to rest inverted in the water with the pilot unconscious inside, with serious head injuries. He was rescued and resuscitated.

As there were no witnesses to the accident and the pilot could not recall any aspects of it, the ATSB was unable to establish any definite causes. However, several issues were raised.

The JetRanger was found to be operating within weight and centre-of-gravity limits and there were no apparent mechanical problems, including with the engine. The fuel was free of contamination and the pilot had 6,487 hours total time, including 2,916 on the JetRanger. He was highly experienced in firefighting and long-line operations.

The helicopter had a "Bambi Bucket" Model 1012 slung under it via a 24-metre steel cable at the time of the accident. The ATSB noted that the operating company's operations manual did not list the 455 litre Model 1012 bucket for use and instead mentioned the 545 litre Model 1214 for water bombing operations.

Neither were recommended for use on a JetRanger by the manufacturer and examination of the bucket found some areas of non-standard construction, but there is no evidence that this contributed to the accident .

The possibility of a loss of tail rotor effectiveness (LTE) was examined. The Bambi Bucket manufacturer's operations manual warns pilots not to execute 90-degree pedal turns when the helicopter is close to water and towing a bucket. The warning highlights the danger of bucket suspension lines becoming caught on the rear of a landing skid, resulting in a dynamic rollover when lifting the bucket.

The US FAA has described the conditions under which LTE can occur, including high all-up weight, out of ground effect (OGE) hover, low forward airspeed, high power settings, and wind direction from the left or rear of the helicopter.

Other pilots reported that, on previous sorties, the JetRanger pilot had been lowering the bucket vertically into the water to fill it from an OGE hover and then lifting it clear vertically before transitioning to forward flight. This reduced the likelihood of the helicopter suffering a dynamic rollover resulting from LTE as described by the bucket manufacturer.

The ATSB notes that, despite this and the fact the JetRanger was operating near its maximum weight and in reported variable winds, the pilot's experience in long-line and water bombing operations should have mitigated the risk.

While the ATSB recognises that in this accident the pilot was rendered unconscious and therefore unable to exit the helicopter without assistance, it draws attention to the benefits of helicopter underwater escape training (HUET).

In its recommendations to CASA, the ATSB asks the authority, in conjunction with the relevant industry associations, to assess the desirability of a requirement for HUET for specialist aerial work operations such as water bombing in support of firefighting operations.

It also recommends that CASA highlight the safety benefits to helicopter pilots and crew of wearing personal protection equipment such as helmets and personal flotation devices when flying this type of mission.

Rest in pieces

An exhausted helicopter pilot finally gets some rest – as he waits for rescuers to extract him from the mangled wreckage of a Bell 206 JetRanger. Name withheld.

I DON'T KNOW HOW LONG I lay there with my face in a pool of Jet A1 fuel, and an upside-down Bell JetRanger sitting on top of me. I was aware of a whistling noise from somewhere behind me, and a fellow asking me if I could move.

I was the manager of a remote helicopter base. We had started out with two aircraft, three pilots, an engineer, an apprentice and an office manager. We had a mixed client base including a port authority, several mining companies, and a number of small survey organisations.

There was plenty of competition for the available work, and margins were tight. The first casualties of economic rationalism were the office manager and the apprentice, followed shortly by the third pilot and the engineer.

The workload reduced to a degree but we were still on 24-hour standby for the port authority. It's difficult to run such an operation with two pilots, but I was assured the authority (then the Department of Civil Aviation) knew about it and thought it was OK.

To complicate matters, our commercial manager had stressed that we were not to reject any potential jobs – after all, money was tight.

I suppose I should have closed the office, left the stocktaking to someone else, delegated more duties to the second pilot, given the base car to someone else to fix and taken more time off, but I was trying to give the impression that it was business as usual and that I was coping.

A regular client had a slingload of radio equipment to go to an island off the coast and I tasked the second pilot for the job, making sure that he carried the EPIRB and had the chin mirror fitted.

A week later our client called to request a pickup the following day, which was a bit of a nuisance as it was the second pilot's day off and I was looking forward to a free day myself – but I couldn't knock the job back.

I got to the island and picked up the slingload but realised that I had forgotten to fit the chin mirror. On the return trip, the EPIRB (which I *had* remembered) fell off the hat rack and onto the floor – I'd neglected to secure it. That was two strikes.

When I returned to the airfield, I just wanted the trip to end. I didn't notice the marshaller who was there to direct me, so I placed the load on the ground and moved to the right of it to prevent the clevis from damaging the radio equipment when it was released from the hook. I pressed the hook release and kept moving to the right while looking underneath the helicopter for the released clevis (a mirror would have been nice).

Strike three: the clevis wasn't there, the hook had failed to release. That was when a bad day turned *really* bad.

The sling, which was attached to the load, was about two metres long. When I moved right it became taut and jammed in the throat of the hook, keeping it closed while the sling lifted the left skid.

The hook remained fixed in space while the helicopter proceeded to enter a classic dynamic rollover. There was nothing I could do but accept my fate.

When the noise stopped, all I could think of was how nice it was to have a rest.

In hindsight, it is easy to see what happened: I didn't question my superiors, I didn't obey the law, and I didn't get enough sleep. I was complacent and even overconfident. I thought I could handle fatigue, but it beat me.

Fatigue is insidious. It crept up and clouded my judgement without my knowing. There were signs, but I didn't recognise them. That's why the rules are there: to protect us from ourselves and from those who would take advantage of us.

I learned a lot about flying from that accident. Here are some pointers that will hopefully stop any of your days from turning really bad:

- understand the causes and effects of fatigue
- plan ahead (even the simplest activities may have elements of risk that can be reduced)
- know your equipment and its limitations
- don't be afraid to seek advice and assistance from others – mortals cannot do and think of everything.

I was incredibly lucky to survive. In fact, I returned to flying within a week of the accident. I lost an aircraft, a client and an incredible amount of self-esteem, but I will never take safety for granted again.

Analysis Don't fly tired

FATIGUE HAS LONG been recognised as a serious threat to aviation safety. Since the 1950s, Australian aviation law has prescribed maximum flight duty times and minimum rest periods, with the aim of protecting pilots and their passengers from the effects of fatigue. These restrictions are detailed in Civil Aviation Order 48.

Variations to CAO 48, in the form of exemptions, often provide for even greater rest periods when arduous duty periods are expected or the potential for sleep disruption exists.

Fatigue risk management systems (FRMS) are gaining acceptance as an effective way of tackling fatigue. FRMS take a holistic approach and look at, among other things:

- hazard identification and mitigation
- education
- fatigue measurement
- rostering
- management commitment to FRMS.

Fatigue risk management acknowledges that, despite our best efforts, fatigue can never be completely eliminated. Therefore, organisations need to establish defences to reduce the consequences of fatigue. Typical defences might include extra checklist requirements, more-stringent procedures or a requirement for additional crew members during high-fatigue periods, such as in night operations.

In 2001, CASA began a trial of fatigue risk management systems with 16 general aviation organisations comprising fixed-wing, helicopter and balloon operators.

The University of South Australia's Centre for Sleep Research evaluated the trial and found that "approximately 90 per cent of managers, and 85 per cent of flight crewmembers perceived the FRMS had a positive impact on operations".

Although most operators recognised the benefits of FRMS, including increased flexibility and safety, there was concern about difficulties in implementing the systems and "significant upfront costs".

No system is perfect and it's important that pilots, whether they operate under CAO 48 or an approved FRMS, use prescribed rest periods to obtain adequate sleep. The only way to reverse the effects of fatigue is to sleep. Learn to identify the signs of fatigue, and, above all, do not fly if you are tired.

Before

Senior managers must recognise the dangers of stretching resources and adopt appropriate strategies to minimise and defend against fatigue.

Whether it was intended or not, the management of this company created a culture in which the pilot thought it would be better to fly exhausted than to reject the flight. In the end, the commercial manager's instruction "not to reject any potential jobs" turned out to be very costly.

Mal Walker is a flying operations inspector and member of CASA's Fatigue Management Committee. For more information, visit the CASA website at casa.gov.au/avreg/ business/fatigue

After

The night the world went mad

An everyday head cold turns a private pilot's world upside down, writes Shelly Rushworth

THIS INCIDENT HAPPENED in another era and another country, but the laws of physics and human performance have not changed.

I was based in South Africa in the mid-sixties. I was an aviation junkie, but soon after I got my private pilot's licence I found myselfshort of funds. I used to hang around the airfield at weekends and do odd jobs, mostly cleaning aeroplanes or cars, in exchange for a chance to sit in the back seat of anything that was going anywhere.

You can imagine how excited I was when one of the guys whose car I had washed a couple of times invited me to go with him on a business trip the next day. We were to go from Pretoria to Kimberley and back (about two hours each way) in his Aero Commander 500. Not only could I go for the ride but also, as he had an instructor rating, he generously said I would be able to fly the aircraft from the left-hand seat.

At the time,I had 60 hours on Piper Cubs and one hour in a Chipmunk, so this was going to be something special. The Aero Commander seemed like an airliner to me.

That night I was too excited to sleep. I kept running through the flight in my mind and worrying that the weather or a mechanical snag would prevent us from going. By morning, I was tired and had a cold coming on, but I wasn't going to let a little thing like that spoil my day.

The outbound flight was great. Because we left early in the morning the air was beautifully calm, and we were able to cruise at the relatively low altitude of 6,500 ft. By the time we started back in the late afternoon it had become hot and bumpy, so we climbed to 10,500 ft to find smooth air.

Thirty minutes from our destination it was completely dark. This was the first time I had ever been in an aircraft at night, let alone flown one in the dark.I kept thinking my friend would want to take over, but he seemed quite happy to have me flying his fancy aeroplane in the dark. Actually, it was not difficult, because we were flying over the Johannesburg-Pretoria area, which is lit up for a hundred miles.

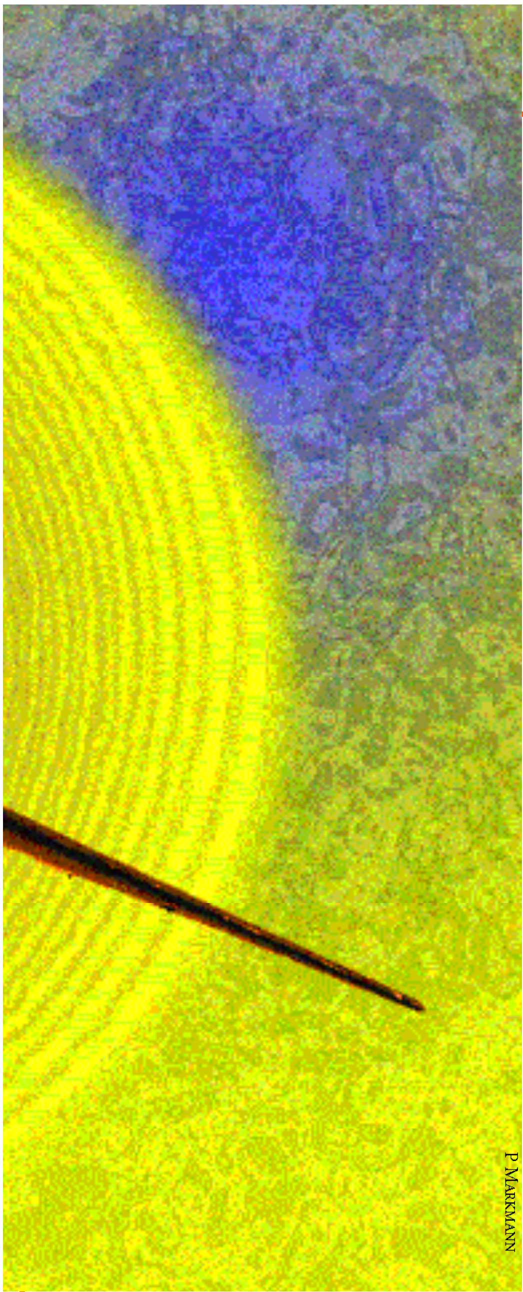
Soon after we started our descent into Wonderboom airport, which is at 4,100 ft, I began to experience a bit of pain in my ears. The pain became steadily worse and I found I was unable to clear it by swallowing. I didn't want to mention this to my friend in case he used it as an opportunity to take the controls. By the time we were on long final the pain was extreme. I tried to clear my ears by holding my nose and blowing.

Next, the world went mad. The horizon, which consisted of city lighting, tilted violently and then the runway lights started rotating in the windscreen. I called to my friend to take over, shut my eyes and buried my head in my chest – the pain was excruciating and my world was tumbling around me. I know that if I had been on my own I would have crashed.

I was totally incapable of flying, and barely able to stand up some 10 minutes after we had taxied in and shut down.

This incident did not put me off night flying but it taught me two things. First, that most rules are there for our own good and that if you disobey them you do so at your own risk. And second,that you should never go flying with a cold. Everyone knows we are not meant to do it, but few realise it can be a killer.

Analysis Just a cold?



FLYING WITH A COLD, or any illness for that matter, carries huge risks. Shelly's cold caused her to experience a disabling condition that might have had fatal consequences had there not been a second pilot on board.

Shelly's initial pain was caused by her inability to clear her ears. When you're healthy, clearing your ears on descent is usually a simple matter of yawning, swallowing, chewing or performing the Valsalva manoeuvre (the medical term for holding your nose, closing your mouth and blowing, thus forcing air up into your middle ears).

However, when we have a cold the Eustachian tube, which normally allows air into the middle ear via the nasal passage, can become blocked. As the aircraft descends, the pressure inside the middle ear remains the same while the outside air pressure increases. Unless the pressure equalises, enormous stress is placed on the eardrum, causing acute pain, hearing difficulties and, in the worst case, damage to the eardrum and middle ear.

And the tumbling sensations? Shelly almost certainly experienced alternobaric or pressure vertigo, a condition reported to affect around 10 per cent of pilots. Alternobaric vertigo occurs when the pressure in one ear is markedly different from that in the other. A simple example is when one ear "pops" and the other doesn't.

The condition sometimes occurs after a forceful Valsalva manoeuvre, when a pilot, typically with a cold, tries very hard to equalise middle ear pressures. The sudden change in pressure, or the introduction of unequal pressures between the ears, produces vertigo. (The reasons why the pressure change causes vertigo are complex and poorly understood.)

Pilots commonly report extreme and disabling tumbling and rotational sensations, just as Shelly did. The symptoms are usually temporary, typically lasting between 10 and 15 seconds, though in some cases the symptoms continue longer.

Another issue that can cause pressure vertigo is the rate at which pilots clear their ears. In Shelly's case, it is significant that she did not perform the Valsalva manoeuvre as soon as the pain started. Because of the exponential relationship between atmospheric pressure and altitude, pressure changes are more pronounced closer to the ground, meaning that pilots must clear their ears more frequently in the later stages of descent. If the pilot delays equalising middle-ear pressure until they experience pain, and a significant pressure differential (greater than about 90 to 120 mmHg) develops, the Eustachian tube will effectively lock in the closed position.

In some cases, forceful Valsalvas may clear one or both ears but, as we have seen, it can also cause alternobaric vertigo. The problem can be minimised by using the Valsalva manoeuvre as soon as you experience the sensation of fullness in either ear. If you wait until you feel pain, it might be too late.

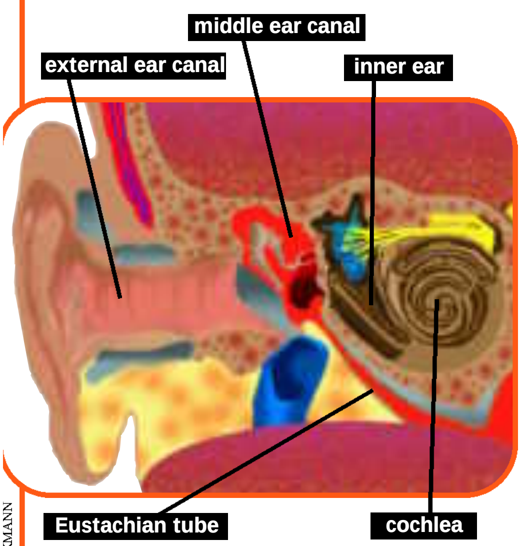
There are other reasons why flying with a cold is a bad idea. A cold invariably leaves you feeling unwell and fatigued. This has a detrimental effect on your performance, increasing the likelihood of errors and reducing your ability to make good decisions.

A cold will also make you more susceptible to decompression illness and hypoxia. For healthy people, hypoxia is normally only a risk above 10,000 ft. Cold sufferers are more likely than their healthy counterparts to experience hypoxia symptoms at a given altitude.

And the common viruses that cause colds can enter the fluid in the inner-ear balance organs, heightening the risk of spatial disorientation. In disabling cases, sufferers cannot stand or move about without extreme dizziness. The condition usually subsides spontaneously.

Flying is a demanding activity that is particularly unforgiving of human error. If you are ever in two minds about whether to go flying or stay in bed, ask yourself: what kind of landing would you make if you were in excruciating pain and the runway was rotating in the windscreen?

Dr David Newman is an aviation medicine consultant and the managing director of Flight Medicine Systems. (www.flightmed.com.au)

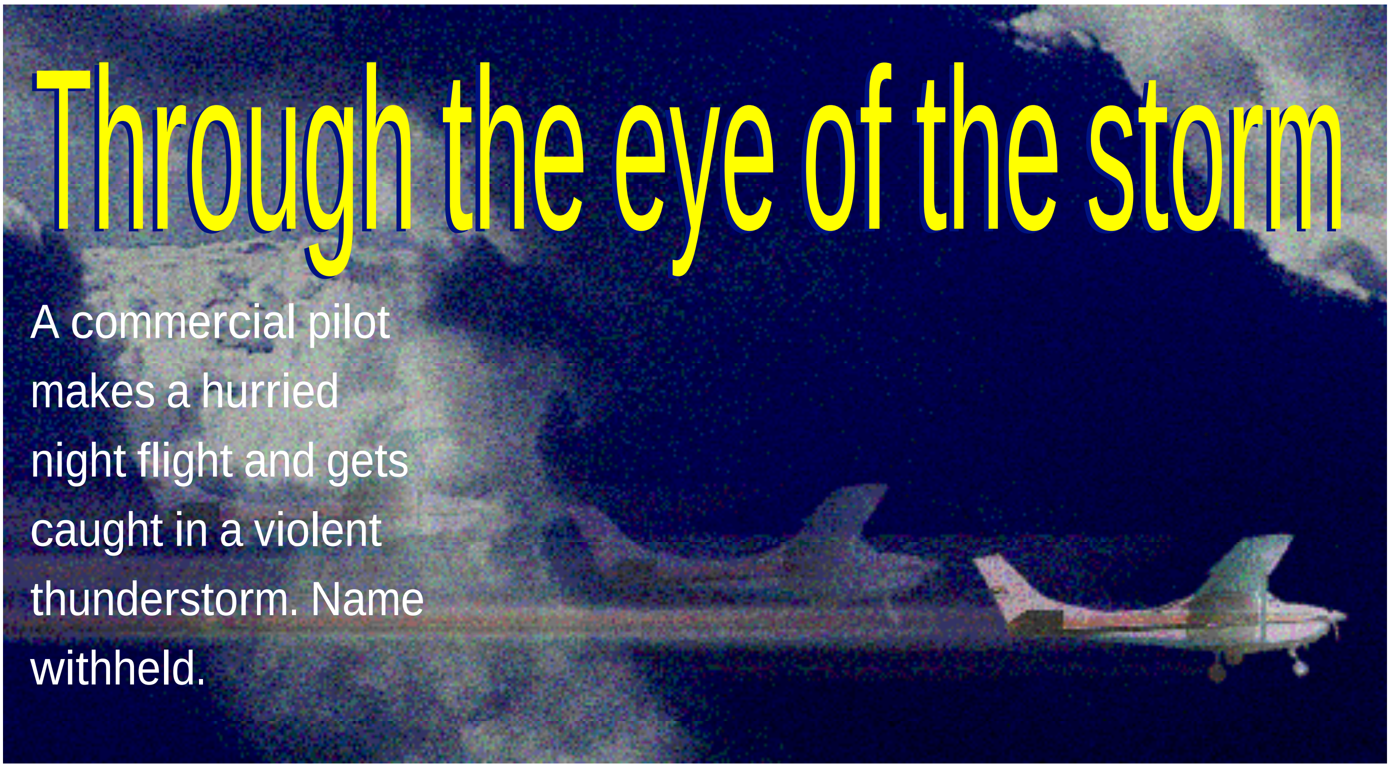


The organs of balance of the inner ear
When the Eustachian tube is blocked, disorientation results.

P Markmann

Through the eye of the storm

A commercial pilot makes a hurried night flight and gets caught in a violent thunderstorm. Name withheld.



I'VE ALWAYS CONSIDERED myself a careful and competent pilot, but on one flight several years ago, I made a series of bad decisions that nearly got me and my passengers killed. I hope that this story will help other pilots avoid my mistakes.

At the time I was employed as the skydiver driver at a local parachute drop zone. I'd been in the job for a while and I was really getting to know the little Cessna 182, which so loyally and reliably lugged us up and back to the flight levels every day. I had about 500 hours and I was pretty chuffed because I'd just completed my night VFR rating.

On this day, I was flat out trying to keep up. It was a constant cycle of refuel, run-ups and off we go again, each time with a new load of adrenaline-pumped passengers.

A full day of successive skydiving sorties wears you out – physically and mentally. About half an hour before last light I was starting to think about a cool, relaxing beer when I was more or less told that I would be flying a group of skydivers to an airfield near Sydney, for a Christmas party that evening.

I was tired and unprepared, but it seemed a great opportunity to chalk up my first night-command hours. There was also the subtle threat of "do it or you might lose that precious flying experience that you have the privilege of working here for!" Besides, commercial pilots should be able to plan, prep and go at a moments' notice.I decided to do it: my first big mistake.

I jumped into action. Last light was 20 minutes away and the strip had no lights. Things to do before departure:

- organise personal items for the weekend trip and feed the cat
- plan the flight (make sure I have all the maps)
- submit a flight plan (no worries,I'll radio it through when I'm airborne)
- prepare the aircraft ("Can you guys refuel the plane for me?")
- brief the passengers (they know where the door is and have parachutes anyway!)
- pat yourself on the back for being so good at organising everything!

It was the worst bit of flight planning I have ever done:mistake number two.

After much rushing about, my three passengers and I got airborne as the sun sank below the horizon. I felt rather proud and in command of the situation,having achieved such a mammoth departure effort in minimum time.

I now shiver with regret when I recall how underprepared I really was and that I was still drawing lines on maps while passing through 5,000 ft in the climb.

It was dark – *very* dark – but we were on track, established in the cruise and I was thrilled to be making my first night flight as pilot in command.

The passengers were quite relaxed on a floor mattress, tucked in and secured by single point restraints.

I was relaxed too, until I read the weather forecast, which I'd hastily torn off the fax machine in the chaos of departure. Thunderstorms, rain and showers, in a line from the coast to the western ranges, were forecast to be at Armidale at about the same time as me – hang on! I am abeam Armidale and there is no sign of any of this! It must be wrong.

"I now shiver with regret when I recall how underprepared I really was."

I decided to press on (mistake number three). I don't recall how much further we continued on that track but it wasn't long before blue flashes began lighting up the otherwise pitch-black sky. My eyes bulged like a whippet peering through a couple of milk bottles, and I was suddenly aware of the need to divert.

Instead of diverting back to Armidale (mistake number… what are we up to?), I ran the gauntlet and diverted east over water.

The ADF was spinning, the altimeter was jumping between 6,000 and 10,000 ft, and the VSI was off the scale at both extremes. As for a horizon and ground features, they had disappeared half an hour before. All I could do was concentrate on holding a level

attitude and a stable heading – let alone navigate! I was very aware of the extreme danger of my predicament and I was petrified.

After what seemed like an eternity, we suddenly popped out into clear air on the coastline. Below me, the brilliant sparkle of city lights seemed quite surreal; almost like a dream.

I made my first sensible decision: land as soon as possible!

There was just one problem: I was lost. I contacted Sydney Flight Service and requested a DME check out of Port Macquarie. The operator could obviously smell that something was wrong and dutifully asked me to confirm I was visual. She gave me a distance and I consulted the ERSA for the pilot-activated-lighting frequencies in that region. What a beautiful sight to see the runway lights of Kempsey come to life and offer us an invitation to land.

I flew the circuit and on final approach I was given one last challenge: a night crosswind landing. I had to hold off about 45 degrees of drift due to the gust front of the now fast-approaching hail cell just to the west.

After an involved arm wrestle of an approach, we finally landed. I taxied in and shut down the engine – just as the buckets of rain started pelting the aluminium wings of our little bird again. No amount of money in the world would have got me back in the air that night – despite the complaints of my three passengers.

Analysis In the dark

LIGHT AEROPLANES ARE NOT designed for the appalling weather conditions described by the author, and he and his three passengers are lucky to be alive.

During the storm, it's quite possible that the aircraft operated below lowest safe altitude on occasions. This aspect is frightening enough on its own, but worse when you consider the pilot was fatigued, uncertain of the aircraft's position, inadequately prepared for the flight, and not trained to operate in instrument meterological conditions.

When night VFR operations were first approved around 36 years ago, it was intended that pilots would still fly predominantly in daylight. However, the new rating would give them the flexibility to land just after last light, or to take off just before first light. This was never legislated.

I know of pilots who have delayed departure, or departed early, so they can log as many night hours as possible. I have no reason to doubt that this practice is relatively common. In contrast, most experienced pilots would not conduct a night, cross-country flight in a single-engine aeroplane (piston), especially over inhospitable terrain, unless there were reasonable grounds to do so.

You should not depart on a night VFR flight unless you are sure that you can remain clear of cloud by at least 1,500 metres horizontally and 1,000 ft vertically. As you will not always see cloud at night, do not depart if forecast or reported meteorological conditions indicate you may encounter *any* cloud on your proposed route or alternate.

Meticulous flight preparation is essential for these operations. This is particularly true in single-pilot operations without autopilots.

Place all essential detail – including headings, tracks, time intervals, lowest safe altitudes, radio frequencies, diversion details and aerodrome data – on a "mud map". By doing this you can reduce or alleviate the need to refer to different documents during the flight and minimise the chance of disorientation.

Remember, a superior pilot uses superior knowledge and airmanship to avoid using superior skills.

Steve Tizzard, CASA flying operations inspector.

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Twin Comanche Tribe speaks

The Australian Twin Comanche Tribe weighs into the debate over an article featured in this section last issue.

THE "FREE OF CHARGE" article in the November-December issue of *Flight Safety Australia* reported on a serious accident in a Twin Comanche that resulted in a gear-up landing, but, fortunately, no injury, following fuel starvation in a serviceable aircraft.

The article highlighted several of the important issues regarding quality of endorsements and systems knowledge on these relatively simple aircraft. With the support of QBE Insurance, our type club, the International Comanche Society, has developed a pilot proficiency program to address these issues, which are occurring far too frequently. We offer the following comments on your excellent article.

Part of the analysis in "Free of charge" concentrated on the difficulty of reading the installed ammeter. However, there were a number of other factors possibly contributing to this accident beyond management of the electrical system and the difficulty of reading the ammeter.

The account of the accident seems to reveal a considerable lack of knowledge of the aircraft's fuel, undercarriage, flap and electrical systems by a newly-endorsed pilot, as well as deficiencies in flight planning, and a lack of knowledge of the aircraft's mandatory fuel management requirements.

The author advises that he departed with the main tanks about a third full, the auxiliaries empty and the tips "brimming". Given that the mains hold a combined total of 207 (useable) litres, this suggests that there were around 65 to 70 litres or one hour's fuel in the mains.

It is a published requirement for the Twin Comanche that take off, climb, descent and landing be undertaken on the mains. The author advises that he had been operating for about 50 minutes on the mains when his passenger drew his attention to the zero reading on the fuel gauges.

Quite apart from the electrical problems, the fuel in the mains was almost exhausted at this point and there was insufficient fuel available in the mains to complete a descent, circuit and landing with any reasonable margin, even if he had selected tips at this point and had not had the electrical issue. It seems that the pilot had not understood, or observed, this aspect of fuel planning and management in the Twin Comanche.

In addition, as mentioned in the article, tip tank fuel is accessible only via electrically-operated solenoids. This means that prudent fuel planning requires a flight be planned and operated so that it can be completed to a point of safe landing at any time in the flight on auxiliaries and mains. This means that the loading of fuel by the pilot, the planning of the flight, and the subsequent burn order were all inappropriate.

Electrical system There are several variants on the electrical system in the Twin Comanche – both generator systems and several variations of alternator systems.

It is appropriate to clarify the description. The ammeter does not "show the combined output of both alternators". In the Twin Comanche, it is switchable either by an original switch or via a switch fitted under an Australian AD, to show either the output from each alternator separately or the charge/discharge to or from the battery. This latter measurement is not the combined output from both alternators, but the combined output minus the bus load.

It is not a "loadmeter" like that fitted to certain other Piper aircraft and shown in the simplified single-engine aircraft sketch accompanying the article.

The warnings about offset zeros on ammeters are appropriate, and are compounded by the general insensitivity of these ammeter systems. The ammeter can be usefully supplemented by an after-market voltmeter either as part of a clock, GPS, an engine analyser, or a separate unit. This suggestion probably would not have helped in this instance, in which systems knowledge appears to be such a factor.

The alternators are not turned off like magnetos to test them, but their output can be individually checked using the ammeter switch. Of course, it may be necessary to disconnect a failed alternator – and this is done using the alternator switches – but this is not applicable in this account.

Most Australian-registered Twin Comanches have individual alternator/generator fail lights which, if fitted to this aircraft, should have been illuminated for much of the flight until the voltage went too low to keep them visible. Why this warning was not observed by the pilot is not clear.

The lack of bus voltage would also have been apparent from the failure of the turn coordinator/turn and slip power indicator, and the gear-up light, apart from all the radio failures.

After committing to the forced landing, the fact that the pilot then "discovered" that the electrically-operated flaps and undercarriage did not operate is almost incomprehensible, and underlines a lack of aircraft systems knowledge.

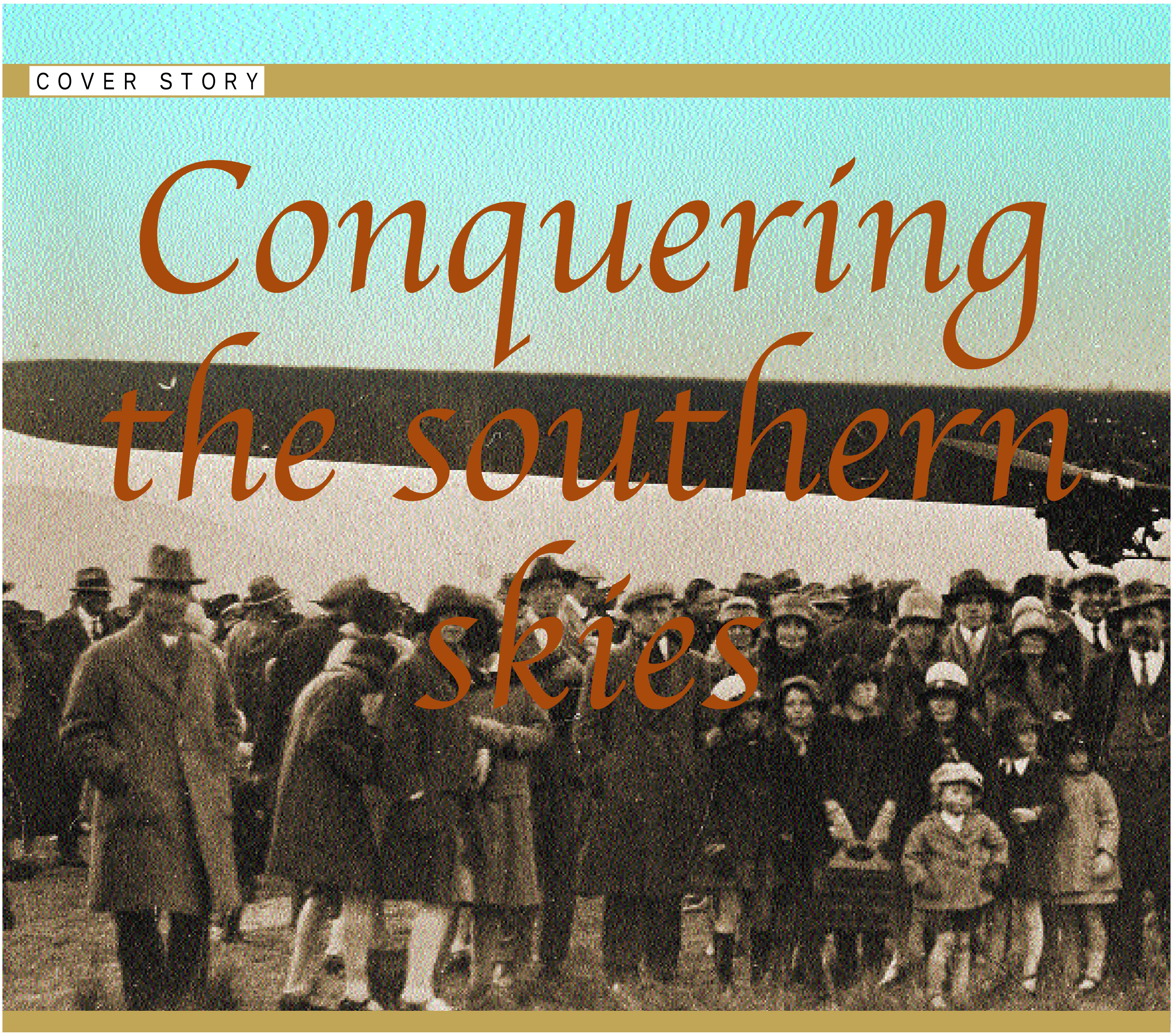
The analysis must include the need for any endorsement training to be undertaken by an instructor truly experienced in type and with full system knowledge.

On the credit side, the pilot continued to fly the aircraft into the crash, and it impacted the ground under control with no injuries. This lesson should not be missed.

Pilots should undertake both initial and recurrent type-specific pilot proficiency training in addition to basic endorsement training. These programs are available for many aircraft types, including the Comanche, Bonanzas/Barons, Mooneys and so on. These programs are well supported by leading insurers.

The Comanche proficiency programme (for single and twin Comanches) is conducted regularly by the International Comanche Society. For details, contact the registrar, Manfred Melloh, on (02) 9456 2719.

Congratulations to *FSA* for an excellent article highlighting some important and timely issues in the operation of our fleet.



Conquering the southern skies

A vast landscape and a small, collaborative population propelled Australia to the leading edge of aviation, writes Chris Huet in the winning essay in the CASA centennial essay competition.

Australia is, after all, mostly empty and a long way away. **Bill Bryson, *Down Under*.**

WITHIN BILL BRYSON'S flippant description lies the true importance of aviation to Australia. It remains relatively sparsely populated, its small population widely dispersed between a few key population centres. The majority of its inhabitants live on the opposite side of the world from their ancestors. Consequently, aviation was seen from an early age as vital to the country – to provide transport, survey the land, defend the country and deliver medical services. For this reason, Australia has been a more influential participant in the development of world avia-

Kingsford Smith's Southern Cross at Canberra, 15 June 1928.

tion than the size of its population would suggest;as Bryson goes on to state: "this is a country that is at once staggeringly empty and yet packed with stuff."

Indeed, the story of Australian aviation has been one of the large and the small. A small population sought early on to harness the promise of aviation within a large country. As time passed, the efforts of this population produced an effect around the world that was out of all proportion with its small size. The story of Australia's contribution to aviation – from box kites to jet fighters over Iraq; through pioneer pilots, both male and female; of world-renowned airlines and innovative operations and engineering – is one of which the country can truly be proud.

The Hargrave Kite

If there be one man, more than another, who deserves to succeed in flying through the air, that man is Lawrence Hargrave, of Sydney. **Octave Chanute, September 1893.**

This story starts with Lawrence Hargrave. Arguably the person who made the largest Australian contribution to heavier-than-air flight, Hargrave was an inventor, explorer and astronomer. Born in England in 1850, Hargrave came to Australia when he was 16. His feats of exploration in Australia and New Guinea and his meticulous note keeping saw him elected as a member of the Royal Society of New South Wales. It was before the Royal Society that Hargrave presented the results of his scientific inquiries and his experiments.

A student of science and history, Hargrave researched and wrote on many topics. It was the pursuit of flight, however, that most interested him. Like many aviation pioneers, Hargrave studied birds and built numerous models, with both fixed and flapping wings. In the course of his experiments he discovered that curved surfaces provide more lift and that setting the wings at a dihedral angle provides greater stability. He also found that a kite constructed of several square cells – the 'box kite' – gave the greatest strength and stability. On 12 November 1894, Hargrave successfully used this box kite design to lift himself 16 feet into the air.

Hargrave also researched and tested numerous methods of propulsion,including screws, rubber bands, compressed air and clockwork, none of which was very successful. Greater success came in 1889, when he invented the rotary engine, a precursor to the French Gnome, Clerget and Le Rhone engines that were used in numerous First World War aircraft.

In the context of the late nineteenth

Hargrave experimenting with box kites in the 1890s.

century, Hargrave's experiments were amazing. But it was through his fastidious documentation and selfless correspondence that his true contribution to the worldwide quest for flight was made. Hargrave believed that the first successful aircraft would not be designed by one person, but would evolve gradually. To this end, he encouraged the "free use of all knowledge as soon as it is acquired". He refused to pursue any patents and actively encouraged other inventors to copy and improve on his work.

Hargrave presented all of his findings to the Royal Society in Sydney, but he also delivered papers overseas and maintained correspondence with other pioneers of flight in Europe and the United States. Although his work was recognised in the US by Octave Chanute, it was in Europe that Hargrave's influence was most evident. The Brazilian Alberto Santos-Dumont in 1906 made the first powered, heavier-than-air flight in Europe in an aircraft based on Hargrave box kites.

Hargrave was very pleased to hear of successful flights, first in the United States and then in Europe. While at no time did he seek any credit,his work was undoubtedly a considerable contribution towards these first forays into powered aircraft. Hargrave saw only peaceful uses for the aeroplane: in his mind "the flying machine will tend to bring peace and goodwill to all". For better or for worse,the beginning of the First World War proved him wrong. The war also took from him one of his chief assistants – his son Geoffrey – who died at Gallipoli in May 1915. Two months later, Hargrave himself passed away.

Qantas, world long-haul pioneer

The story of how a bush company came to town and eventually quartered the world.

Hudson Fysh, *Qantas Rising*.

Also serving at Gallipoli in 1915 were the forefathers of Australia's international airline: Paul McGinness and W. Hudson Fysh. Members of separate Light Horse units, they later joined as aircrew in No 1 Squadron, Australian Flying Corps (AFC). In Palestine, McGuiness became an ace and both men were decorated for their efforts.

After returning to Australia, the two men surveyed the Katherine–Longreach leg of an England–Australia air race in 1919. It was during this survey that Fysh and McGinness became convinced of the role that aircraft would play in linking the isolated towns of north-western Queensland. In his account of this trip, Fysh demonstrated his optimistic and visionary approach to aviation,saying "we could not help being struck by the natural advantages which favoured the establishment of an air service in the district". The "advantages" included the poor condition of the roads,particularly when seasonal storms turned the earth to sticky, black mud, and the lack of bridges over the flood-prone rivers.

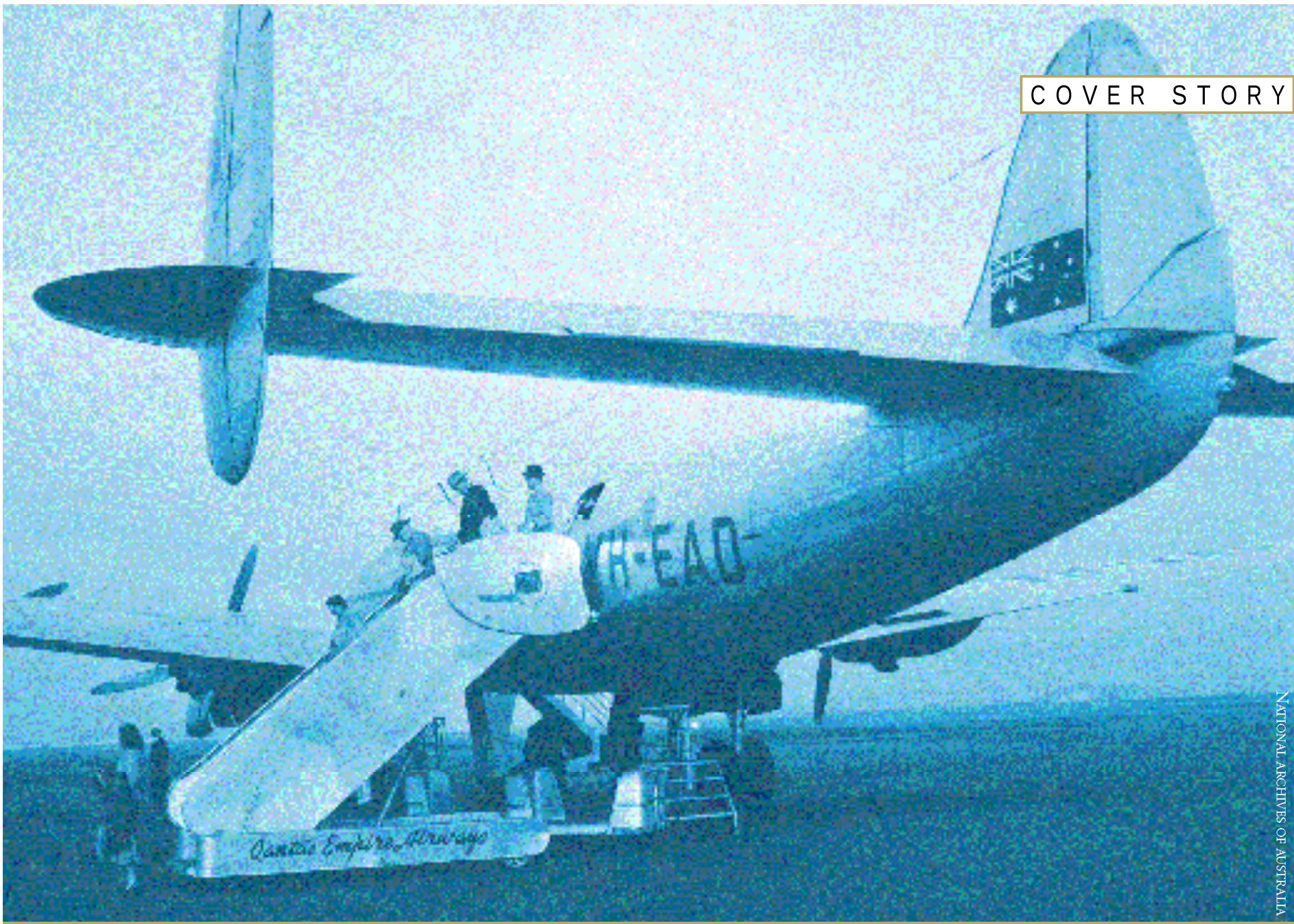
Fysh and McGuiness impressed their vision on two wealthy graziers – Fergus McMaster and Ainslie Templeton – and with their support formed Queensland and Northern Territory Aerial Services (Qantas) in Winton on 16 November 1920. With former flight sergeant Arthur Baird as aircraft mechanic, the airline began its initial operations in Longreach, offering joy rides, air taxi services and demonstrations.

Fysh and McMaster's good management and a share of good fortune took the airline through the troubled economic times of the 1920s. In January 1934, Qantas took a momentous step towards becoming a truly international airline. It combined with Imperial Airways' interests in Australia to form Qantas Empire Airways (QEA) and competed for the Brisbane to Singapore leg of the Australia–England air mail service. QEA won the tender and in 1935 conducted its first overseas flight from Darwin to Singapore.

Through the Second World War, Qantas built on its reputation as a reliable overseas airline. When the Japanese advance severed the traditional air route to England, Qantas began flying an alternate route to Ceylon. The Perth–Ceylon leg was the longest flown to that date, taking close to 30 hours to fly the 5,600 km. The crew were required to fly under complete radio silence and rely on celestial navigation over the long stretch of ocean.

At the end of the war, Qantas was firmly established as Australia's overseas airline. It was considered a vital national resource and in 1947 the Australian Government bought all of its shares. Under public ownership, Qantas continued to make the right decisions for its future. It forged closer ties with the United States and began purchasing the American aircraft that underwrote the airline's success in the second half of the century. In the year that the airline ordered its first Boeing 747, 1967, it removed Empire from its name to become Qantas Airways.

By necessity, Qantas led the way in many



Passengers disembark a Qantas Constellation at Canberra Airport, 1956.

aspects of long-haul air travel. Today it is one of the oldest and most respected airlines in the world. It has served as an example of a successful airline to other operators, particularly in safety, maintenance and training. Good luck and government subsidies played a role in Qantas's success, but it was the vision, drive and management of individuals, such as Hudson Fysh and Fergus McMaster, that propelled it onto the global stage and allowed the airline to make such a significant contribution to world aviation. Fysh ends his account of the early years of Qantas with the statement: "this story is uncompleted and Qantas still appears to be rising." Written in 1965, that statement applies today.

Smithy

Smithy was easily the greatest trans-world flier of them all. None of the others matched his courage or ability. What more can I say? **Hudson Fysh**

Some attribute the success of Hudson Fysh and Qantas to a foundation laid by one man: Charles Kingsford Smith. Born in Brisbane in 1897, Kingsford Smith, or "Smithy", served at Gallipoli before being accepted for pilot training with the Royal Flying Corps (RFC). Showing great foresight, he wrote to his parents: "I have already discovered one thing about flying, and that is that my future … is bound up with it. Flying has a great future. Just you wait and see."

Smithy ended the war with a Military Cross for gallantry in action with the RFC. In the initial post-war period he conducted aerial taxi and joy flights in England and flew as a stunt pilot in the US before returning to Australia in 1921. At home, he flew with newly formed airlines in New South Wales and Western Australia, impressing many with his piloting skill. But airline flying was not what inspired Smithy – it was the prospect of a spectacular history-making flight across the Pacific.

In 1927, while in Sydney searching for the funds necessary to attempt the first trans-Pacific flight, Smithy met Charles Ulm. Now crewed together, they halved the round-Australia flight record before travelling to the US to prepare for the Pacific feat. In San Francisco they bought a Fokker Trimotor and named it Southern Cross. On 31 May 1928, together with two Americans, Smithy and Ulm departed California for Australia. After stopping in Hawaii and Fiji, Southern Cross arrived in Brisbane on 9 June. Smithy and his crew had achieved a spectacular accomplishment that inspired the world: they had flown some 83 hours, navigating by dead reckoning across open water and battling severe tropical storms.

After flying Southern Cross on the first non-stop flight across Australia and the first trans-Tasman flight, Smithy became the first person to circumnavigate the globe in an aircraft. US President Herbert Hoover called the achievement "enough to take one's breath away".

On 9 November 1935, while attempting to break the record for the England to Australia route, Smithy and his co-pilot Tommy Pethybridge died when their aircraft crashed into the sea off the coast of Burma.

It was the efforts of aviation pioneers such as Charles Kingsford Smith that made long-range air travel a reality. Among these pioneers, however, Smithy stood out. He held more records and conducted more difficult first flights than anyone else. His flights spanned the globe and attracted praise and amazement from people around the world.

Nancy Bird

My God! It's a woman. **Queensland grazier on hearing his charter pilot's voice on the telephone, 1936.**

Another of Smithy's contributions to aviation was a flying school at Mascot. One of his first students was a teenage girl: Nancy Bird. Born in 1915 on the New South Wales north coast, Bird developed a yearning to fly at an early age. When 19, she became Australia's first female commercial pilot. It was on a barnstorming tour of New South Wales that Bird found her first permanent employment, no mean feat at a time when "even Kingsford Smith" couldn't get a job.

AUSTRALIAN WAR MEMORIAL

In 1935 Bird began flying for the Reverend Stanley Drummond's Far West Children's Health Scheme in outback New South Wales. This was a challenging time, with few dedicated airstrips, inhospitable terrain and limited navigational features. It is a credit to Bird that she remained accident-free. Her skill was also demonstrated when, a year later, she won the Ladies Trophy in the Adelaide to Brisbane air race, recording the fastest time outright for the Melbourne–Adelaide leg.

When the government subsidy was removed from the Far West Children's Health Scheme, Bird moved to Queensland in search of charter work before returning to Sydney to take a break from flying in 1938. Shortly before the beginning of the Second World War, Bird travelled to Europe to learn more about civil aviation and to promote commercial air travel. During this time, she visited 25 countries and at interviews, meetings and social events provided an example of what a woman could achieve in aviation. On the way home in 1939, she stopped in the US and was introduced to Eleanor Roosevelt.

After the outbreak of war, the now married Nancy Bird-Walton was made the Commandant of the Women's Air Training Corps, the forerunner to the Women's Auxiliary Australian Air Force. The Corps' volunteers supplemented Royal Australian Air Force (RAAF) training and recruiting and hence contributed to Australia's war effort.

Nancy Bird's greatest contribution to women aviators in Australia and the region was her founding of the Australian Women Pilots' Association (AWPA). In 1949, encouraged by her experiences with female pilots overseas, she called a meeting of Australian women pilots. This meeting led in the following year to the formation of the AWPA, with Bird as the first president.

An outstanding pilot and organiser, Bird remains a popular figure. From her first promotional talks in pre-war Europe to the present, she has been a sought-after speaker. In both Australia and overseas, Bird represents the promise of aviation and the opportunities in the industry for both men and women. Respected overseas, she is an ambassador for Australia and aviation.

Flynn's Flying Doctors

The whole story of the Royal Flying Doctor Service reflects some of the finest qualities of the Australian character. I am thinking of your courageous determination to face up to difficulties and to find ingenious ways of solving them.

Pope John Paul II, 1986

In the creation of an aerial health service, Stanley Drummond was following the lead of another visionary: John Flynn. As the Superintendent of the Presbyterian Church's Australian Inland Mission (AIM), the Reverend John Flynn established medical services in remote towns and stations in inland Australia. Flynn's belief that aircraft could better provide these services and help alleviate suffering was supported by Lieutenant Clifford Peel, a medical student who had joined the AFC. Peel wrote Flynn a letter in 1917, detailing what resources would be required to provide a medical service from the air. Unfortunately, Peel was killed in France shortly before the Armistice, but his ideas survived him.

One of Flynn's strengths was an ability to raise funds from governments and through donations. By 1928 he had raised enough to establish on 15 May the Aerial Medical Service. Based in Cloncurry, Queensland, the service chartered an aircraft and pilot from the young airline, Qantas.

The service was an immediate success and,

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People in remote Queensland crowd around the Flying Doctor, 1938.

The RFDS bringing a child to hospital, 1956.

to the credit of Flynn's drive, it survived the Great Depression. In 1934, various regional air health services merged with the Aerial Medical Service to form an independent Australian Aerial Medical Service. "Flying Doctor" bases were established through Western Australia, the Northern Territory and inland New South Wales, South Australia and Queensland.

During its early years, the service demonstrated Australian ingenuity to overcome challenges with communicating between remote stations. Alf Traeger, a radio expert with the AIM, developed a pedal-operated generator for radio sets, allowing for calls for medical help to be transmitted by Morse code. These radio sets formed a communication network across the outback.

In 1942, the service became the Flying Doctor Service of Australia. The Royal prefix was added in 1955. Today, the Flying Doctor provides vital medical services across a vast area of the Australian outback. Its services continue to impress visitors from overseas. Flying Doctor bases are popular with tourists and visiting dignitaries often use the service's radio network to transmit messages of encouragement and praise.

The service stands as an example to the world of how aviation can overcome difficulties in a hostile land.

The black box and other innovations

Australia's aeronautical research at the cutting edge and on the world map.

Innovations such as those made by the Flying Doctor have had a disproportionally large effect on world aviation. In the period following the Second World War, the birthplace of many of these innovations was the Aeronautical Research Laboratories (ARL). Formed in 1949 as part of the Department of Supply, the ARL had its roots in wartime aeronautical and engine research conducted by the Council for Scientific and Industrial Research.

By the time it was moved to the newly formed Defence Science and Technology Organisation in 1994 and renamed the Aeronautical and Maritime Research Laboratory (AMRL), the ARL had become a global leader in aviation technology.

ARL's expertise in aircraft fatigue began in response to the in-flight break-up of an airliner in 1945. Following collection and analysis of data, H.A. Wills published in 1947 a groundbreaking paper that described the technique used to this day to determine aircraft fatigue life. In the 1950s, ARL followed this work by conducting the most extensive fatigue test of a single aircraft structure, when it tested 222 Mustang wings. This work made ARL an authority on aircraft fatigue analysis. Today, AMRL draws on this work in its world standard testing of F/A-18 structures.

Work on fatigue was paralleled by studies into ways to increase aircraft life. In the 1970s, ARL pioneered composite bonded repairs for metal aircraft structures that are applied today by the RAAF, the US Air Force and world airlines. This technology has now been extended into repairs for composite structures.

One of Australia's best known contributions to aviation technology – the crash data recorder – also had its beginning in the analysis of aircraft accidents. Designed and produced by Dr David Warren in 1957, the device, now known as a black box, recorded the last few hours of an aircraft's flight in a crash-resistant system. Initially, the recorder was received more enthusiastically overseas than at home, but this changed quickly in 1960. In response to an aircraft accident, Australia became the first country to make flight recorders mandatory. Today, nearly every airliner in the world has a descendant of Warren's black box fitted.

At a relatively early stage in world terms, ARL established a human engineering group to study ways to more effectively present information to pilots. This study led to two innovations: the 'T' visual approach slope indicator (T-VASIS) and the world's first flying head-up display (HUD). The T-VASIS is now the international standard for visual approach aids and HUDs are fitted to military and civil aircraft around the globe.

ARL is another example of Australia's innovative embracement of aviation. A small organisation, it nevertheless produced technologies that enable aircraft around the world to fly more safely and effectively.

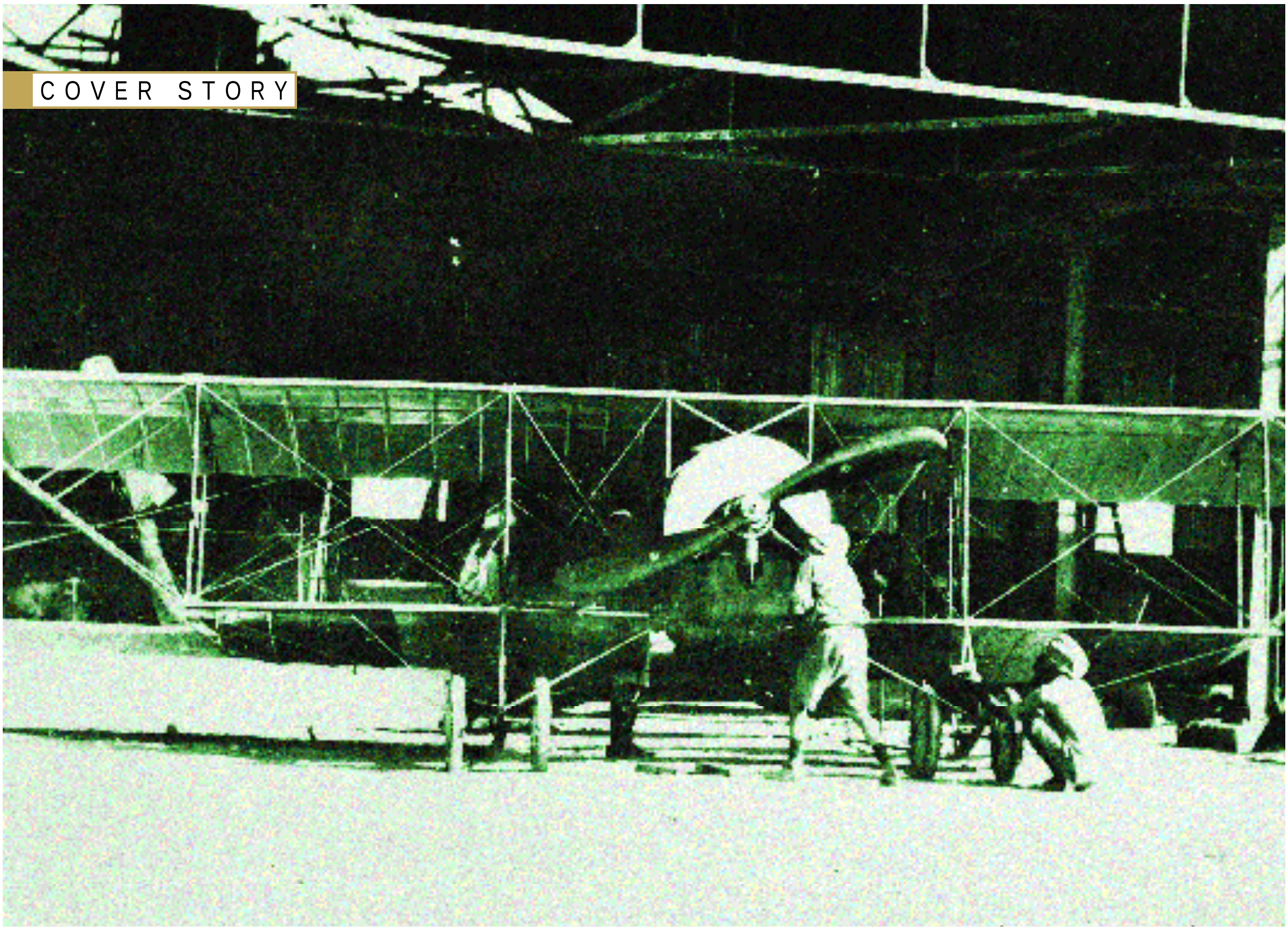
Australia's Air Force

He was an Australian, of a race delighting in additional risks.

Lawrence of Arabia, describing the AFC pilot defending his Bedouin tribesmen.

The stories told above are interwoven with the tale of military aviation in Australia. The Australian Government realised early the value of aviation to defence of the country and in September 1909 offered a £5000 prize for a locally-made flying machine. George Taylor, who had worked with Lawrence Hargrave, was one of the competitors for the prize. In the end there was no winner, though the process contributed towards the formation of the AFC on 26 September 1912.

In the First World War, Australia was the only Commonwealth nation to form its own air units. An AFC HalfFlight became the first Australian aviation unit to be committed to war when it deployed on 20 April 1915 to Basra in Mesopotamia (now Iraq). The Half Flight engaged the Turks in the Middle East while ANZACs like Fysh, McGinness, Kings-



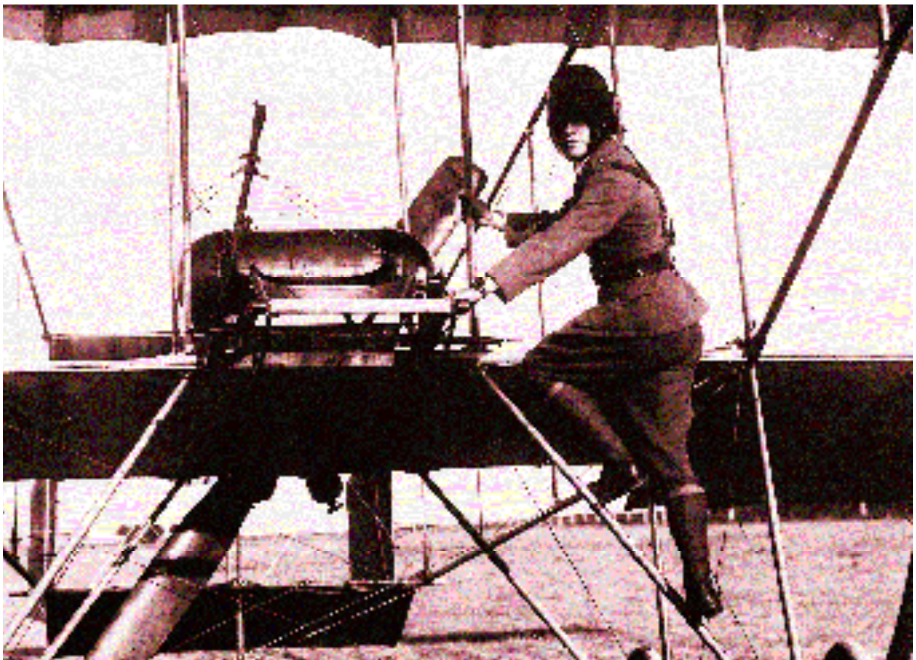
The Half Flight readies a Cauldron biplane for action in the 1916 campaign in Mesopotamia.

ford Smith and Hargrave fought them at Gallipoli. During the siege of Kut, members of the Half Flight demonstrated Australian inventiveness and courage by dropping supplies to the surrounded troops, using cushioned sacks and early versions of the parachute.

The decision to form independent air units greatly enhanced Australia's reputation during World War I. Although small, the AFC demonstrated the country's adoption of aviation. Similar faith in air power was shown in the formation of the world's second independent air force. The Australian Air Force was created on 31 March 1921 and received the Royal prefix five months later.

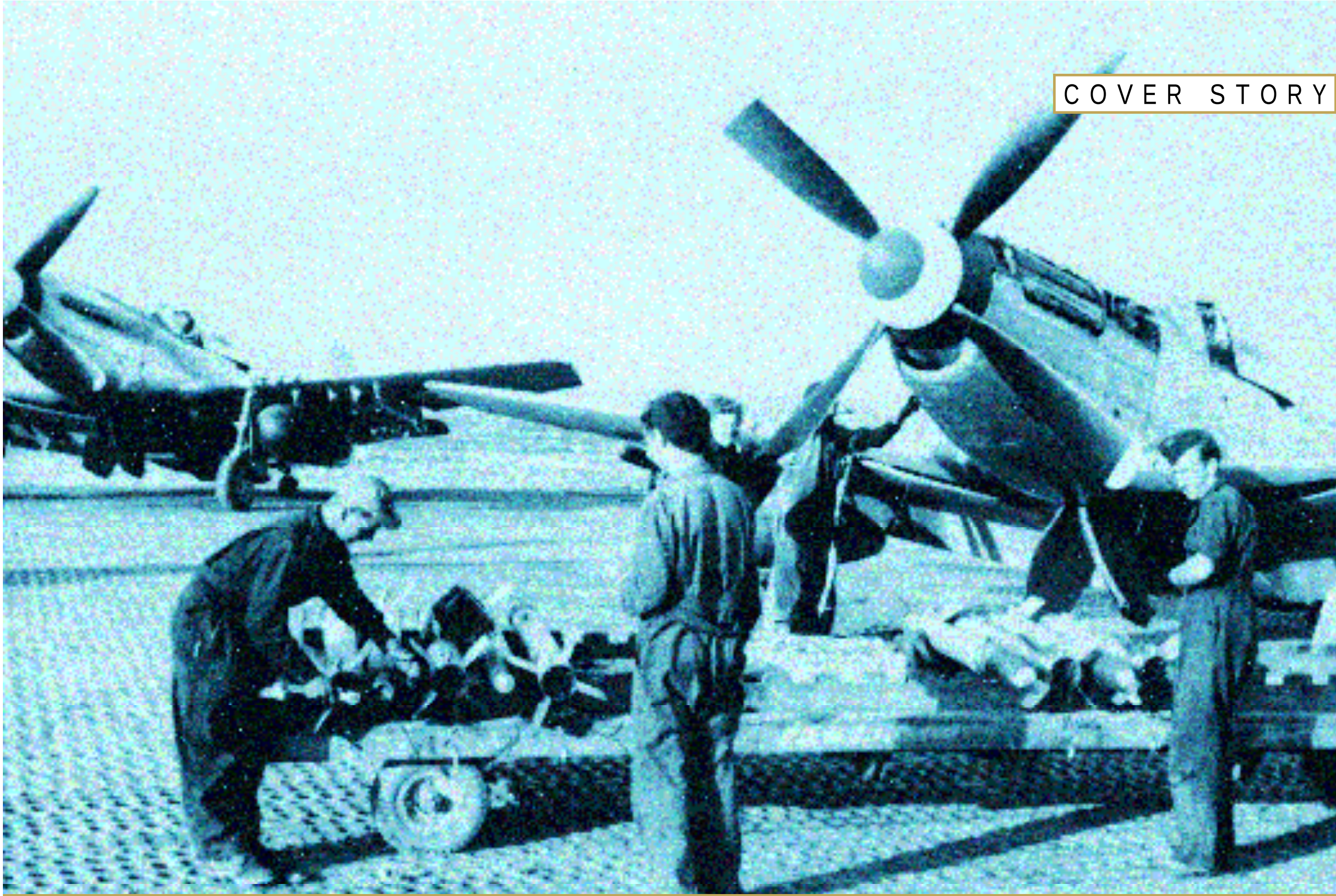
During the Second World War, one of Australia's largest contributions to the air campaign was through the Empire Air Training Scheme. Over the course of the three years that the scheme was run, the RAAF produced 37,730 aircrew. To support this effort, the RAAF had rapidly engaged Australia's flying schools and aero clubs to expand from a single flying school to 34 aircrew training units in three years. This was a huge achievement for a small country.

Mustangs from 77 Squadron, RAAF were valuable to the initial stages of the Korean conflict. Able to operate from airstrips that were unsuited to the new American jet fighters, the squadron's aircraft provided vital support to the forces hemmed in at Pusan. According to one commentator, 77 Squadron "made a contribution to the struggle far beyond what could normally be expected of one fighter squadron". In the Vietnam War, Australians were particularly valued by their US allies for their contribution of forward air



Australian War Memorial

On July 30 1915, Lt GP Merz of the Half Flight Corps became the first Australian pilot to be killed in action, during the Mesopotamia conflict.



No 77 Squadron RAAF arming a P51 Mustang in Tagegu, Korea, 1950.

Tiger Moth, as used by the Empire Air Training Scheme in the early days of World War II.

controllers and the unique capabilities possessed by the Canberras of No 2 Squadron for level bombing under low cloud and night radar bombing.

In the years of relative peace following Vietnam, the RAAF made significant contributions to South-East Asian security by providing aircraft, training and associated support to fledgling air forces. The RAAF also led exercises in the region under the south-east Asian Treaty Organisation and the Five Power Defence Arrangement.

Nearly 100 years later, the RAAF returned to the site of the Half Flight's 1915 deployment. Australia's contribution to Operation Iraqi Freedom included fighter, transport and maritime patrol aircraft. The ability of the RAAF F/A-18 fighters to perform both air defence and bombing missions in the same flight earned them praise from other coalition members. The RAAF C-130 Hercules transport aircraft were similarly used flexibly. This led to them carrying much more cargo than their number would suggest.

The recent Iraqi conflict reflects the RAAF's part in global military aviation. The professional and flexible approach displayed allowed the relatively small RAAF contingent to make a significant contribution to the conflict. By showing what an innovative and determined country can achieve, the RAAF has exemplified Australia's contribution to aviation.

Conclusion

These examples are only a small sample of the ways in which Australian individuals and organisations have contributed to the global conquest of the air – there are literally hundreds of stories that have not been told. Looking at these other stories would, nonetheless, reveal the same story – that of a country with a small population making a large contribution to flight.

Looking more closely, another theme emerges:the interrelationship of all of these individuals and organisations. Australia's contribution to aviation has come from a relatively small, closely linked group of people. This has been the benefit of a small population: our aviation pioneers knew of each other's efforts and were inspired or challenged by them. The result has been a combined effort that has changed global aviation.

Australia's aviators, engineers, managers and leaders have been able to achieve this effect through a combination of qualities: innovation as demonstrated by Hargrave and Warren;the vision of aviation pioneers such as Fysh and Flynn; the courage of Smithy and Bird; and the professionalism exemplified by Qantas and the RAAF. These qualities combined have allowed a small country to have a large impact on world aviation.

PROFILE

Breaking through

CASA's new CEO wants to put more objectivity into regulatory reform.

Courtesy The Herald and Weekly Times

BRUCE BYRON is on a mission to take out the "fences and barriers" between CASA and the aviation industry. Byron, who took up his position as CASA chief executive officer in December, joins the authority at a time of sweeping regulatory reform.

He wants to ensure that industry is not a casualty in the reform process, now about halfway through.

"We need a CASA that is independent in the discharge of its safety surveillance and enforcement obligations," he says. "We also need an industry which can develop and grow, and not be constrained by rules that don't enhance aviation safety."

In Byron's view, some rules in the past have thrown up big barriers between industry and CASA.

He wants to put more science into the drafting of regulations. His first big announcement on taking up his position was of a review of civil aviation safety, starting with an analysis of general aviation fatal accidents. The aim is to probe the gigabytes of data collected by the Australian Transport Safety Bureau to identify the most common causes.

A similar study conducted by the United Kingdom Civil Aviation Authority identified controlled flight into terrain,loss of control in visual meteorological conditions, low-flying/aerobatics and loss of control in instrument meteorological conditions as the most common types of accidents.

The study found that factors responsible included inadequate training and pilot deficiencies in understanding the weather, calculating safety altitude, and flight planning and diversion techniques, Byron says.

"Causal factors that have been identified in other aviation environments may be repeated to some degree in Australia," he says. "But there may be factors that are peculiar to the Australian aviation environment. They may be environmental or they may be cultural, but we have to go through the exercise of looking at the causal factors behind the data before we can draw those conclusions."

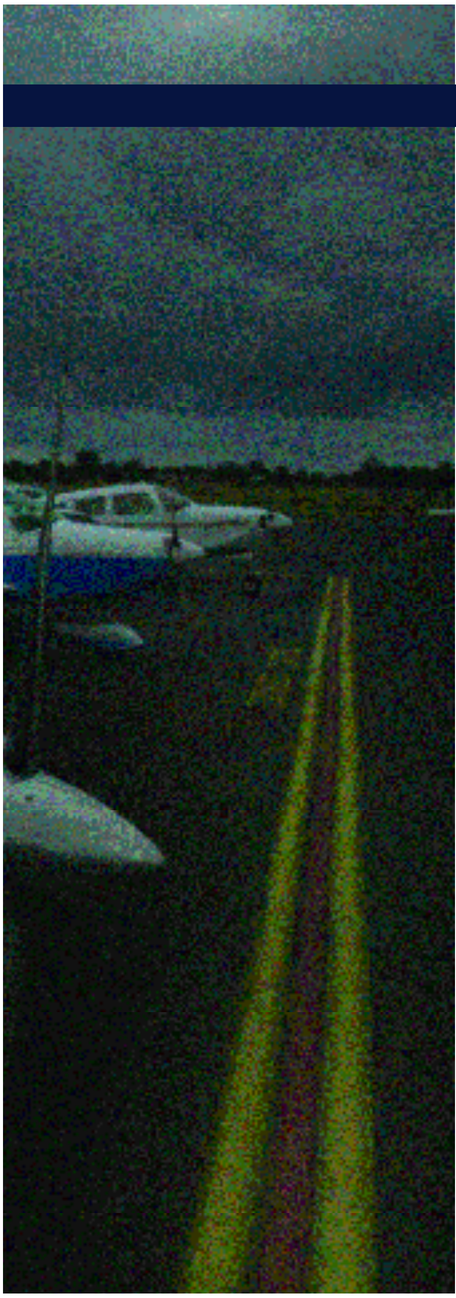
Byron plans to assemble teams of advisers from CASA and industry to "test each of the regulations that we're proposing".

"The regulations and safety education programs we develop need to be more focused on identifiable safety issues," he says.

"We would expect to find some proposed rules in there that don't fit the bill. If that is the case, we need to remove them."

And if the exercise delays the introduction of some rules, "I would prefer that to meeting deadlines with safety regulations that are less than optimum".

Byron also plans to strengthen the industry consultative bodies, the Aviation Safety Forum, which he chaired between 2000 and 2003, and the Standards Consultative Committee.



He has no illusions about the contradictions between safety and profit, and inevitable tensions between the regulator and some sections of the industry.

"In the ultimate safe environment, you simply don't operate," he says. "That's unacceptable. Then there is the other extreme, where an operator is driven entirely by cost, and breaks rules or operates unsafely. That too is unacceptable.

"However, it is a government expectation that in imposing safety regulatory requirements on industry, we need to be aware of the cost to industry."

Asked if there was an acceptable level of fatalities,he said:

"There is no acceptable level above zero. We must seek to minimise it.Given that any form of transport has attendant risks, a realistic objective should be to try to reduce the current rate, whatever the current rate might be. That is a realistic target and people will respond to realistic targets."

All-rounder takes top job

AMID SPECULATION preceding the announcement of Mick Toller's replacement, the Federal Government would say only that the new chief executive officer of CASA would be "acceptable to both industry and the regulator".

Many concluded that suggested Bruce Byron.

Byron's career has spanned the military, industry and the public sector. Having clocked up 10,000 flying hours and flown with the Roulettes, the Member of the Order of Australia has "sky cred" with pilots as well.

He was awarded his RAAF wings in 1966 at age 19. He flew Caribou aircraft in Vietnam before moving into pilot training, a field that would preoccupy him for the best part of 15 years and stimulate his interest in safety.

He was promoted to Squadron Leader in 1975, at age 28, and to Wing Commander in 1980. Three years later, he took up the command of the RAAF Central Flying School.

"I was exposed to training – as an instructor – at a very early stage in my career", he says. " I saw the benefits of and gained satisfaction from delivering very good training."

In the public sector in the 1980s, Byron worked for the Department of Aviation as an examiner of airmen, flying more than 20 types.

A shift to the private sector in the late 1980s eventually saw him appointed executive general manager operations at Kendell Airlines. He managed the airline's transition to high-capacity jet operations. Later, he joined Ansett Australia as vice-president compliance and quality assurance. Subsequently, as a consultant, he designed a safety management system for Virgin Blue.

He says his hairiest experiences, and those that drove home to him the importance of safety, were from his days as an aerobatics instructor.

"When training people to operate very close to the margins of human and aircraft performance, and expecting them to make mistakes, you have got reduced margins of safety yourself," he says.

"The best example is low-level formation aerobatic training. I've been in a few interesting situations in which I've had to react pretty quickly."

Byron's colleagues say he is adept at brokering compromises between aviation's interest groups.

"Bruce does a very delicate balancing act," says Carol Durkin, a member of the Aviation Safety Forum.

"He has a great knack of … keeping any discord out of a meeting. Aviation attracts usually reasonably well-educated and articulate, but individualistic, people. You throw them all together in a room and it can be quite scary."

Bruce Byron (centre) at his RAAF pilots' graduation ceremony, 1966.

When you can't dial 000

© INTERNATIONAL AVIATION SAFETY ASSOCIATION. DIGITAL IMAGE DESIGN BY ANGELA PHILLIPS.

In-flight fires are among the most terrifying situations cabin crew can face. Crew must be prepared to think fast and act aggressively, as there are no second chances, writes Angela Phillips.

IN AUGUST 2000, an AirTran Airways McDonnell Douglas DC-9-32 made an emergency landing after a fire ignited in the bulkhead behind the captain's seat. The aircraft was substantially damaged. Three of the five crew members and two of the 57 passengers on board suffered respiratory illness from smoke inhalation. Another eight passengers were injured in the evacuation.

After smelling smoke, a cabin crew member went to report the situation to the flight crew, only to find that they had already donned oxygen masks and were returning the plane to the airport in Greensboro, North Carolina.

The forward galley was shrouded in smoke and crew seated there retreated to the business class section.

The crew did not attempt to locate the source of the smoke, or to deploy fire fighting equipment. One cabin crew member told investigators she had decided against using a fire extinguisher because she "did not see a fire to fight".

In another accident, in June 1983, an in-flight toilet fire forced an Air Canada McDonnell Douglas DC-9 to make an emergency landing at Greater Cincinnati Airport in Covington, Kentucky. Crew initiated an emergency evacuation but 23 of the 41 passengers on board were unable to escape. They died in the inferno.

The first sign of fire was smoke from between the walls and ceiling panels of the toilet. One of the cabin crew discharged an extinguisher at the panels and closed the door. However, this had "little or no effect" because the extinguisher had not been aimed at the source of the fire, according to a National Transportation Safety Board (NTSB) accident investigation team.

The crew had not tried to locate the source or to remove the panels.

These cases illustrate the gap that often exists between theory and practice in cabin fire fighting. Examples abound of cases in which crew failed to act or to act quickly enough. In one case, in the US, a flight attendant wasted time asking the captain permission to use a fire extinguisher after seeing a "flickering glow"from a floor vent.

An NTSB report on cabin fires has stressed the importance of "immediate and aggressive" action to determine the source and severity of fires.

The report also drives home the importance of communication between cabin crew and pilots, who have to make decisions on whether to make emergency landings or ditchings.

In-flight fires are rare, but when they do happen, the consequences can be serious because of the materials in and geometry of cabins.

Fuel for fire Flammability of materials is one of the biggest issues for cabin crew facing in-flight fires, says senior fire commander Simon Reilly, of Airservices Australia's aviation rescue firefighting unit in Brisbane.

Aircraft cabins contain light-weight materials such as paper, plastic, carpet, curtains, seats and light fittings. These are sometimes combustible and have the potential to release toxic fumes when ignited. The fumes can be fatal if inhaled, even in small quantities.

Reilly warns that the long, narrow, enclosed geometry of cabins promotes fire. "Even a small fire has the potential to grow and spread rapidly," he says. "It can easily develop into an uncontrollable situation."

Temperatures soar in an enclosed space, and the fire might "flash over" the cabin. Flashover occurs when superheated gases get trapped at the ceiling, where they suddenly explode, setting the cabin ablaze. The chance of surviving a flashover is generally zero.

Detection Locating a fire is often difficult, as the expected warning signs might not be present or obvious.

Crew should be on the lookout for smoke, fumes, unusual odours, electrical malfunctions and observations by passengers that might indicate a fire. Such occurrences demand an immediate response and should be reported to the flight deck and investigated.

Sudden headaches or sore throats in passengers or crew might betray gases before they are visible.

If crew members suspect a fire, they should mount an investigation immediately to find the source. They should arm themselves with a suitable hand-held fire extinguisher (one that can be used on most fires) and be prepared to fight the fire immediately. Water should never be used on electrical equipment.

Crew should remove loose clothing, such as scarves, and, if possible, cover their arms and legs with cotton or woollen clothing. In 1995, a flight attendant was engulfed in flames while wearing a short-sleeved shirt and shorts. The fire broke out in the cabin of a Douglas DC-9-32 that was departing an airport in Georgia, US. The fire destroyed the aircraft, and the flight attendant suffered second degree burns and shrapnel wounds to her legs.

When a fire is suspected behind a closed door or panel, crew should use the backs of their hands to check the temperature of the surface before proceeding.

They should use crash axes only as levers to gain access to areas behind panels. They must take care not to damage vital aircraft systems, such as concealed electrical wiring, in the process.

Fire procedures for cabin crew

Simon Reilly's 23 years' experience training thousands of cabin crew members in emergency aviation firefighting procedures has underlined for him the importance of teamwork and coordination.

And cabin crew must know the location of emergency equipment, be proficient in using it, and make sure it is not obstructed.

Cabin crew are trained to follow a strict regime when confronted with an in-flight fire. Fire fighting duties are divided into three roles – firefighting, communication and back-up assistance.

The firefighter The crew member who finds the fire assumes the role of firefighter. They must not leave the fire unattended, but fight it aggressively while alerting another crew member.

Seconds count. Fires in their early stages are much easier to control.

The communicator The second crew member at the scene becomes the communicator. They alert all other crew of the fire without alarming passengers. The communicator should keep in continuous contact with the flight deck, usually via the interphone system, and provide updates of the situation.

At this point, the captain faces a critical decision of whether to continue the flight or declare an emergency. Ineffective communication could lie at the heart of an aviation disaster.

The communicator should inform the captain of the type, origin, location and intensity of the fire, the density and colour of smoke, and action being taken to fight the fire. They must be ready to answer questions and clarify details.

The communicator should also state how much back-up is needed to fight the fire.

Backup crew The third crew member provides backup support to the firefighter. They obtain extra firefighting equipment, such as more fire extinguishers and protective breathing equipment.

The back-up crew member should remove flammable items, such as oxygen bottles and alcohol, from around the fire.

Ultimately, he or she will don fire safety gear, including breathing apparatus and protective gloves, and swap places with the first firefighter.

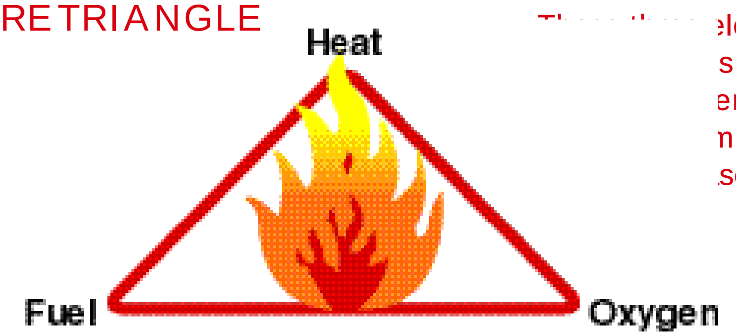
Other cabin crew members might provide back-up assistance by calming and relocating the passengers if necessary.

Preventing re-ignition Once the fire is out, confirm that the source is also out. Embers should be soaked with water or a non-alcoholic beverage, and crew members should continue to monitor the site in case of re-ignition.

These procedures are for guidance purposes only and are not endorsed by Airservices Australia or CASA.

Air Canada Flight 797, June 2 1983

FIRE TRIANGLE



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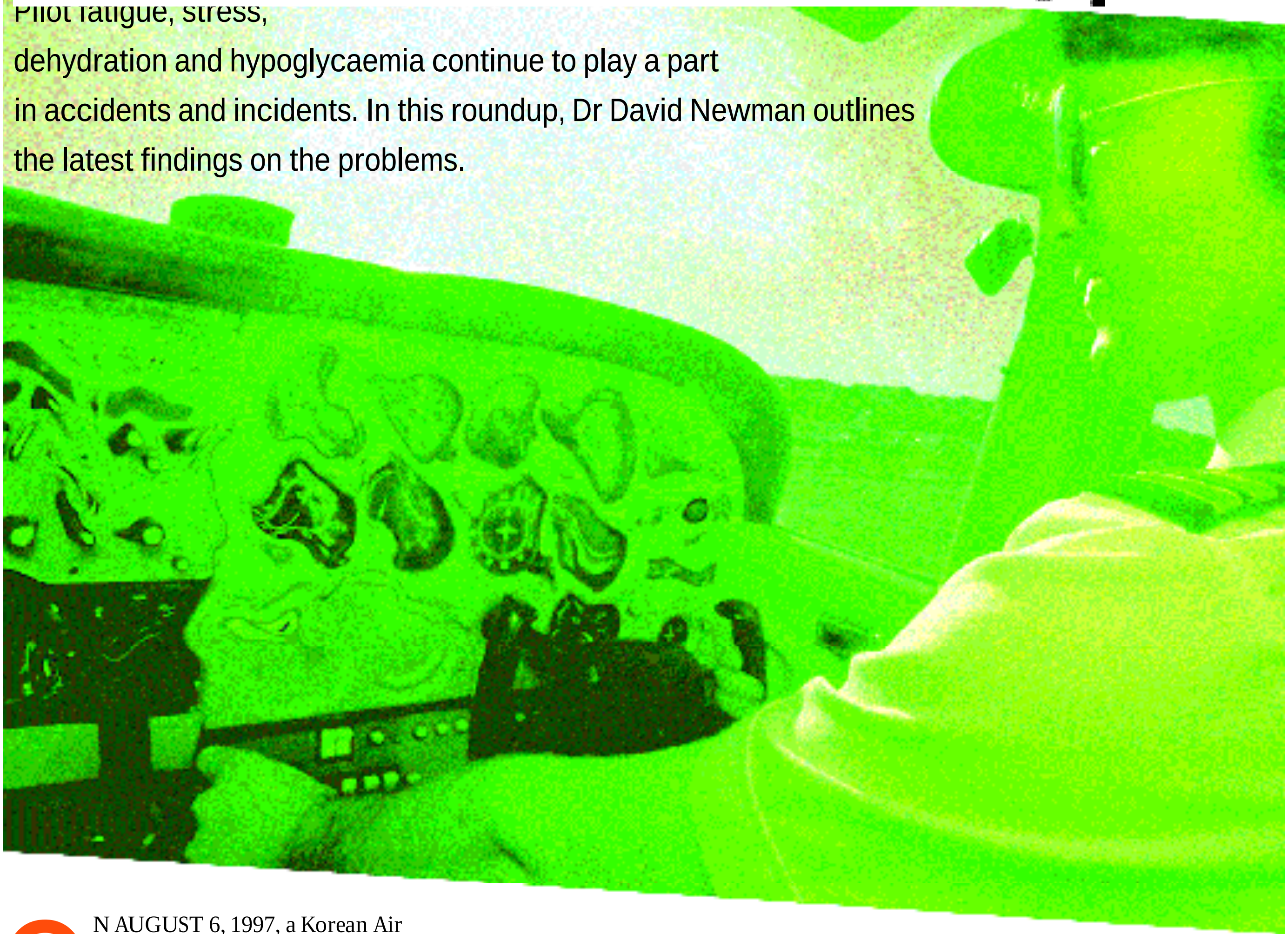
Sleepy, strung-out, dry, hungry pilots

Pilot fatigue, stress, dehydration and hypoglycaemia continue to play a part in accidents and incidents. In this roundup, Dr David Newman outlines the latest findings on the problems.



DIGITAL IMAGE DESIGN BY P MARKMANN

ON AUGUST 6, 1997, a Korean Air Boeing 747-300 crashed on approach to Guam, killing 228 people on board. The US National Transportation Safety Board found that fatigue was implicated in general flightdeck confusion and impaired reactions of the crew in the lead-up to the tragedy.

The finding was based in part on cockpit voice recorder data revealing that the captain was "really sleepy". Although his recent flying hours in the days and weeks leading up to the accident were within legal limits, the accident occurred after midnight and the NTSB concluded that the captain's fatigue contributed to his mishandled approach.

The aircraft hit Guam's Nimitz Hill about 3 nm short of the runway.

In Australia, fatigue has been implicated in at least seven fatal civil aviation accidents, in which 14 people died, over the past 10 years, according to Australian Transport Safety Bureau data. However, the bureau stresses that it is difficult to prove fatigue was a contributing factor in particular cases.

Compelling evidence of a link between fatigue and accidents is emerging from international datasets, however. Between 1974 and 1992, 25 per cent of major US Air Force accidents involving fighter aircraft at night were attributed to crew fatigue. Between 1977 and 1990, 12 per cent of major US Navy accidents were due to fatigue. In the US Army between 1990 and 1999, four per cent of all accidents (both major and minor) were fatigue related.

Meanwhile, a study in 2000 found that in a group of executive and corporate jet crews, 75 per cent reported having "nodded off" during flights. Eighty-five per cent of them considered fatigue to be a safety issue. A similar study examining US Army crews found that 45 per cent reported having "dozed off" during flight, with 81 per cent considering fatigue to be a safety issue in their operations.

In 1998, the NASA Ames Research Centre conducted a series of field studies on fatigue. The investigators found that crew members in short-haul fixed-wing operations slept less, with 67 per cent having a sleep loss of one hour or more a night. Crew woke earlier, had more trouble falling asleep and had lighter and less restful sleep. They also reported drinking more alcohol and caffeine on trip days.

The researchers recommended on the basis of these findings that successive duty days should begin at the same time, or progressively later, and that crews should be provided with information on alternatives to alcohol as a pre-sleep relaxant.

The only recognised antidote to fatigue is adequate sleep. We need seven to eight hours of sleep a night. Failure to get enough racks up a sleep debt that must be repaid. This accounts for the often deep, prolonged sleep that we experience after intense activity with long duty days or a series of late nights. There is no sleep bank that would allow us to get sleep in advance to offset subsequent fatigue.

Sleep cycle There are four stages of sleep, ranging from fairly light sleep in stage one to deep sleep in stage four – the phase of restorative sleep that kills off fatigue. In a typical sleep cycle, most of the stage four sleep occurs early, in the first third of the cycle.

Rapid eye movement (REM) sleep is another important phase of sleep. In this lighter phase the sleeping person dreams. Each eight-hour sleep cycle has four or five episodes of REM sleep, during which memories are thought to be organised and laid down. When a person is learning new tasks in the day, they often get more REM sleep that night.

Fatigue reduces performance on every level. Decision-making is impaired, vigilance and attention are reduced, judgement is often less than optimal, and people are more inclined to accept a lower standard of performance than they would normally.

Reducing sleep by just one hour a night leads to increased daytime sleepiness, which is cumulative over successive nights. Reducing sleep by two hours a night leads to impaired alertness and measurable levels of reduced performance. The pattern of subsequent sleep changes, with the person falling asleep more quickly and drifting into a deeper sleep with fewer awakenings. Such patterns indicate a significant level of fatigue.

Alcohol Many people use alcohol as an aid to sleep, and although drinking reduces the time taken to fall asleep, it interferes with the normal pattern of sleep. It increases the number of awakenings and suppresses early REM sleep. In large doses, it can suppress REM sleep entirely. It also increases the level of subsequent daytime sleepiness.

Caffeine Caffeine is often used to offset the effects of fatigue. As a central nervous system stimulant, it improves alertness and vigilance, but don't consume it too late in the duty day or its effectiveness as a fatigue mitigator will be significantly reduced.

Sleep inertia Sleep inertia is the transition phase between sleep and wakefulness. It is that groggy feeling you have when you are awoken from a deep sleep. It interferes with many aspects of task performance,including decision-making ability. The degree of sleep inertia depends on what stage of sleep you are woken up from. Sleep inertia is likely to be more pronounced if you are woken suddenly from stage four sleep. If enough time elapses between waking up and being required to perform a task, the effects are likely to be less obvious, but sleep inertia can last for up to half an hour.

In a group of executive and corporate jet crews, 75 per cent reported having "nodded off" during flights.

Photo by James Ostinga. Digital image design by P Markmann

Flight operations The combination of long duty periods,night flying, a relatively hypoxic environment, and transmeridian travel make the issue of fatigue in aviation a big one.Our biological or circadian rhythms evolved to ensure we got adequate rest and sleep, by making us sleepy at regular, predictable intervals. Modern 24-hour aviation operations force crewmembers to work against their biological programmes.

Soon, ultra-long range flight involving sectors of more than 18 hours will become routine, with aircraft such as the A340-500 and B777-300ER. Issues of fatigue management will take on greater importance. Much research is being conducted around the world on fatigue modelling and management systems, and Australia is a major player (See *Unlocking the secrets of sleep*, page 41).

Fatigue management takes into account much of what we currently know about fatigue and work–rest cycles. It can involve such areas as on-board crew rest facilities, napping strategy, appropriate flight scheduling and adequate crewing. Maintaining crew alertness in the modern automated cockpit can be a real challenge on long-haul flights,however.

Stress Understanding stress and learning how to effectively cope with it could help reduce accidents.

Stress is the response to unfavourable environmental conditions. If excessive demands are placed on a person,they may exceed the person's ability to cope with them. Continued stress can create physical symptoms such as insomnia,lack of appetite,headache and irritability. And the body's natural "fight or

flight" response to stress produces physiological effects, including muscle tremors, increased heart rate,sweating and incoordination.

Stressors are factors that create stress. They can be broadly grouped into environmental, life, reactive and organisational stressors.

Environmental stressors include noise, with exposure to more than 90 dB of noise impairing performance. Another environmental stressor is temperature. Temperatures below 15° C or above 30° C can be stressful. Very low and very high humidity are other stress factors, with levels below 40 and above 60 per cent causing problems. Vibration and hypoxia may also be factors.

Life stressors are emotional, domestic,social and financial woes. They can create problems in the cockpit and are, at the very least, distracting for the pilot.

Typical life stress score tables rate events according to the level of stress they induce. A total score of 60 to 80 points represents a normal level of modern life stress. A score well over 100 represents serious life stress.

Death of a spouse scores the highest, at 100 points.Going on holiday rates only 13 points.

Reactive stress is the mental and physical response to certain situations. Examples of reactive stress in aviation include running out of fuel,narrowly avoiding a mid-air collision or experiencing windshear on final approach.

Organisational stressors relate to your workplace. Examples include poor communication, role conflict or ambiguity, high workload, poor perceived autonomy levels,lack of career development, pay inequality or red tape.

Stressors are cumulative and additive. Everyone has a personal stress limit. If this limit is exceeded, even a moderate workload can be hard to cope with,and the person goes into stress overload. This can affect performance and decision making, and can be a real problem in safety-sensitive industries such as aviation and nuclear power generation.

If stress is not managed, other problems, such as denial, aggression, and alcohol and substance abuse can result. These "coping strategies" can make the problem worse.

Stress management involves recognition of the factors causing stress, and removing stressors that can be eliminated. Prioritisation of multiple tasks is critical, as is adherence to standard operating procedures and checklists. Time management is also important, and the ability to delegate tasks can help in reducing workload and therefore stress. Other measures include keeping fit, taking rest breaks, learning appropriate relaxation strategies, maintaining a healthy lifestyle and recognising your limitations.

Dehydration Dehydration is a big risk in Australia. Reduced humidity levels in aircraft and reduced fluid intake to limit urination can increase the risk. Hot weather operations, especially at low altitudes, also increase the risk of dehydration and heat stress. High workload, poor cabin ventilation and work in hot climates to which the pilot is not acclimatised, also increase the risk.

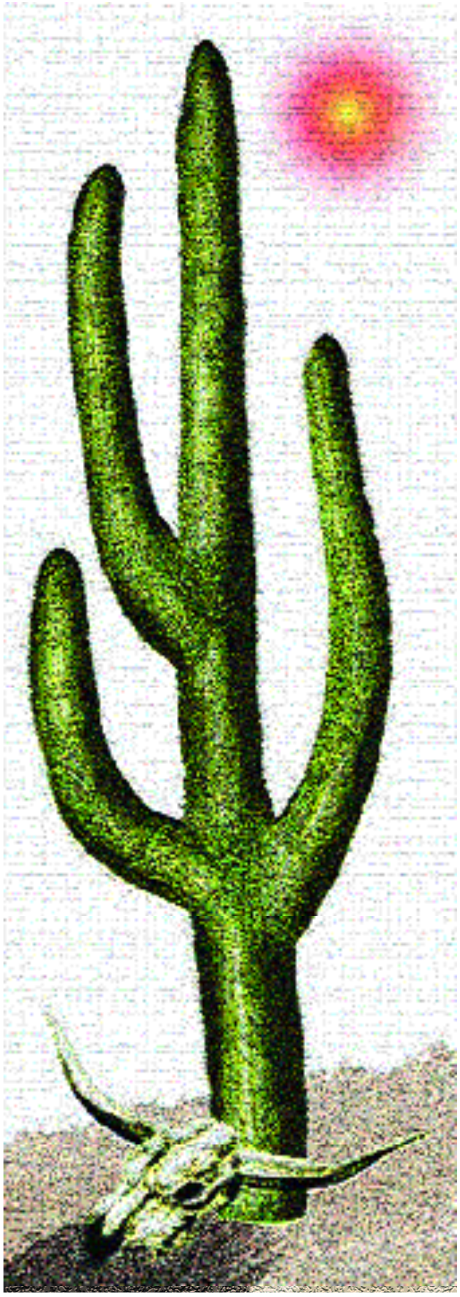
The "greenhouse effect" of the cockpit canopies and windows can send temperatures soaring. Solar radiation enters the cockpit at a certain wavelength and heats up the internal structures. These structures re-radiate the energy, but at a different wavelength, one at which it cannot easily escape the cockpit glass.

Under normal conditions, you need to replace about 1,500 mL of fluid a day. Every 24 hours, you lose approximately 500 mL of water through the skin, 500 mL in the urine and a further 500 mL via the respiratory tract. This fluid loss would happen even if you sat in front of the TV for 24 hours. Exercise,high workloads and hot ambient conditions increase the fluid loss, so you will need to consume more than 1,500 mL.

Dehydration seriously reduces your performance, impairs your judgement and decision-making abilities, and reduces your G tolerance. It can increase your risk of developing kidney stones, and might also put you at risk of suffering heat disorders. These range from simple sunburn to heat exhaustion and heat stroke.

Heat exhaustion is an intermediate level of heat stress. It results from the combination of water and salt depletion. Clinically, the signs and symptoms include weakness, fatigue, headache, impaired judgement,

If stress is not managed, other problems, such as denial, aggression, and alcohol and substance abuse can result.



nausea, vomiting, dizziness, fainting, sweating (which may be profuse), and a modest rise in core body temperature.

Heatstroke – the failure of the body's thermoregulatory systems – is more dangerous. It results in an inability to control body temperature, sending the core temperature to 40° C, against the normal level of about 37° C. The nervous system malfunctions,and the sweating mechanism fails, leaving the skin dry and hot. Muscles can break down because of the high internal body temperature, causing at least some degree of kidney failure.

Thirst represents a fluid loss equivalent to 2 to 3 per cent of body weight. Symptoms such as a lagging pace, weariness,nausea,and emotional instability will be evident when fluid loss is only a little worse, at 5 per cent of body weight. Much more severe fluid loss, at 10 per cent body weight, causes delirium, a swollen tongue, circulatory problems, concentrated blood with reduced volume, and kidney problems. Twenty per cent fluid loss by body weight is at the limit of human survival.

It can be difficult to work out your level of dehydration. Do not rely on how thirsty you are, because thirst is not a reliable guide to dehydration. Urine is, however, and pilots should take notice of the colour and quantity of their urine. An adequate hydration level is reflected by good amounts of light-yellow urine. Dark urine is concentrated urine, suggesting that the body is conserving fluid as much as possible.Drink enough to return the urine to the normal straw colour.

Avoid or minimise alcohol, coffee, tea and soft drinks because they affect the kidneys, increasing urine production and exacerbating dehydration. Water is the best replacement fluid. Always carry some, even in temperate climates.

Hypoglycaemia Low blood sugar level caused by improper eating leads to weakness, tremors, dizziness, sweating, disturbed thinking, slow reaction times, changed behaviour, reduced G tolerance,lethargy and eventually unconsciousness.

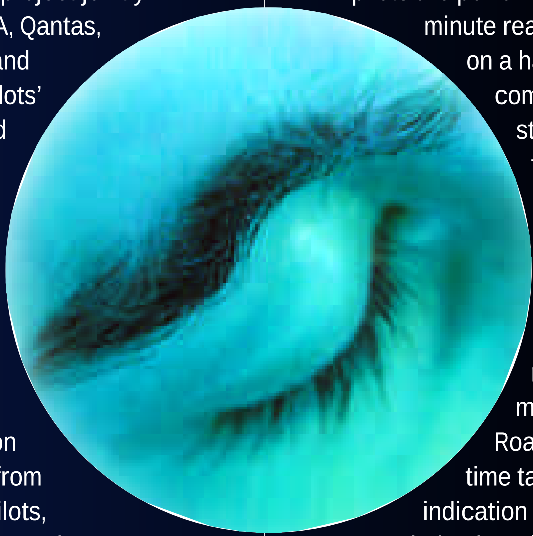
Eating will help to correct these problems, but studies have shown that symptoms, such as slow reaction times, do not return to normal for up to 30 minutes after the blood sugar level returns to normal. It is better to avoid hypoglycaemia in the first place. You should eat within six hours of a flight, and take food with you if the flight is long.

Dr David Newman is an aviation medicine consultant and the managing director of Flight Medicine Systems:
www.flightmed.com.au

Unlocking the secrets of sleep

The amount of sleep obtained by long-haul pilots depends on their level of fatigue at the start of the flight and the period they have been awake before the flight, according to a study at the University of South Australia's Centre for Sleep Research.

The study, forming part of a multi-million-dollar fatigue risk management system (FRMS) project jointly funded by CASA, Qantas, the Australian and International Pilots' Association and the Australian Research Council, is aimed at improving pilot fatigue management.



Preliminary results, based on data collected from 131 long-haul pilots, indicate that pilots who rate themselves as being more fatigued at the start of a flight obtain more sleep during the flight.

Researcher Tracey Sletten presented the results at the Australian Aviation Psychology Symposium in Sydney in December. According to Sletten, the results demonstrate that methods used to manage crew in-flight rest opportunities are working.

"It makes good sense for pilots who are less refreshed at the start of a flight to get more sleep during the flight," says Sletten. "It shows that long-haul pilots are taking measures to ensure that they are alert during approach and landing, which are among the most critical phases of flight.

"The results suggest that Qantas crew are taking measures, such as allocating rest periods on a needs rather than seniority basis, to maximise sleep obtained by those who need it most."

Rank did not affect the amount of sleep obtained, she said.

The study also found that pilots obtain more sleep during long-haul flights when there are four pilots rather than three. In the next phase of the study, which began in December, long-haul pilots are performing a five-minute reaction time task on a hand-held computer at the start and end of flights, and at the start and end of in-flight sleep periods. According to the project's research manager Greg Roach the reaction time task gives an indication of neurobehavioural capability. "In the first phase of the study, we have been investigating the amount and quality of sleep that pilots obtain at home, during layovers, and particularly during long-haul flights," Roach says. "In the second phase of the study we will examine the impact that sleep has on neurobehavioural performance."

The results of these and other studies being undertaken as part of the FRMS project will aid in the development of a system to manage pilot flight and duty times.

"Early morning starts, long flights, unfamiliar sleeping quarters and time zone changes all contribute to the challenge of managing pilot fatigue," Roach says.

"Ultimately, the data will enable us to develop a system of managing and regulating pilot duty schedules that has a sound scientific basis."

A stitch in time

On-condition maintenance of turbine engines can save money – and lives, writes Les Lyons.

AUSTRALIAN PT6A turboprop operators enjoy an advantage over their counterparts overseas through programs developed by CASA to extend manufacturers' published overhaul periods.

However, some operators are not keeping their side of the bargain, failing to perform effectively the enhanced maintenance actions – on-condition maintenance and engine condition trend monitoring (ECTM) – required under the CASA program.

These maintenance actions not only make PT6A engines more reliable, delivering huge safety dividends, but can also result in annual savings of thousands of dollars.

On-condition maintenance is preventive primary maintenance requiring components to be inspected or checked periodically against appropriate standards. It is designed to trigger the removal of parts from service before failure.

ECTM is a critical element of maintaining a turbine engine on-condition, but some operators are under the misconception that ECTM alone amounts to on-condition maintenance.

ECTM involves the analysis of gas path parameters, such as fuel flow, turbine temperature and rotor speeds. However, ECTM cannot detect sulphidation corrosion on turbine blades until the blade fails. Nor can it detect combustion chamber cracking until the cracks join and a section of material is lost. And it cannot provide an understanding of when a critical and very expensive component is deteriorating beyond cost-effective repair limits.

Scheduled inspections Apart from ECTM, on-condition maintenance also requires scheduled inspections. These should include:

• inspection of the engine gas path as visible through the engine inlet and exhaust ducting

• boroscope inspection of gas path components, in particular the combustion chamber and turbine components

• monitoring of the engine oil system by inspection of the engine oil filter, oil screen and chip detectors

• spectrographic oil analysis program (SOAP) – although SOAP is a must for certain turbine engines, such as the TPE331, the program has not proven fully effective in others, such as the Pratt & Whitney Canada PT6A.

The inspection schedule should be based on in-service experience with the engine type and model. The time in service between inspections should initially be quite short until in-service experience can support gradually extending the inspection intervals.

ECTM Meanwhile, for an on-condition program to be effective, ECTM should include the following:

Entry Engines entering the program must be of a known condition. There is no point in starting to monitor an engine if the engine is part life and has had no recent assessment of its condition. Ideally, an engine entering an ECTM program should be either new or newly overhauled. Otherwise, before entering an ECTM program, a hot section inspection (HSI) and a compressor wash should be carried out. To establish the engine baseline parameters, an engine performance run should be performed before and after the HSI and compressor wash.

Training An ECTM program is only as effective as the people conducting it. People involved in the recording, entry and appraisal of ECTM should be adequately trained. This applies particularly to those analysing the ECTM data and to the pilots if the recording system is not automatic.

Procedures manual The program must be documented. A procedures manual (and operating manual,ifapplicable) should detail the practices and procedures to be observed by everyone involved in the recording, entry and appraisal of ECTM.

Equipment The program must be supported by appropriate equipment.

Recording If the recording system is not automatic, in-flight parameters must be recorded each flying day or every five flight hours.

Analysis The parameters recorded should be plotted and analysed by an appropriately qualified person at least every four days. There is no point in recording engine parameters if the person analysing the data has limited knowledge of basic gas turbine theory.

Response There is no point conducting an ECTM program without appropriate procedures to effectively respond to all parameter deviations beyond the limits detailed in the ECTM procedures manual. Some engine components register only small parameter deviations even when the condition of those components has deteriorated to a critical level.

Alternatives The expertise and equipment requirements for an effective ECTM program are beyond the resources of most single aircraft or small fleet operators. However, these operators do have access to an effective and regulator-approved ECTM programme. Most turbine engine manufacturers now offer on-line ECTM programs, such as the Pratt & Whitney Canada new generation "WebECTM" program,incorporating state-of-the-art on-condition monitoring tools.

Turbine trend monitoring

The recent release of the Pratt & Whitney Canada PT6A WebECTM program has raised several questions among operators. Following are the most frequently asked.

1. How does an operator join the program?
The operator has two options: He or she can subscribe to a designated analysis centre (DAC), details of which are listed in SIL PT6A-122, or subscribe direct to P&WC. Refer to Page 3 of SIL PT6A-122.

2. How does the operator record the data?
Once registered with either a DAC or P&WC, the operator gets pass codes into a web portal to a site that allows them to enter the data.

3. How does the operator get the data to PWC or a PWC-designated analysis centre?
Via the same portal.

4.How do the analysis results get back to the operator?
Via the same portal.

5. Could the latter be used as an auditing record?
Yes. The data will always be available.

6.What is the cost per annum,excluding introductory specials, for (a) One single-engine aircraft
Account registration: $US300.00
Set up engine: $US50.00
Monthly fee: $US15.00

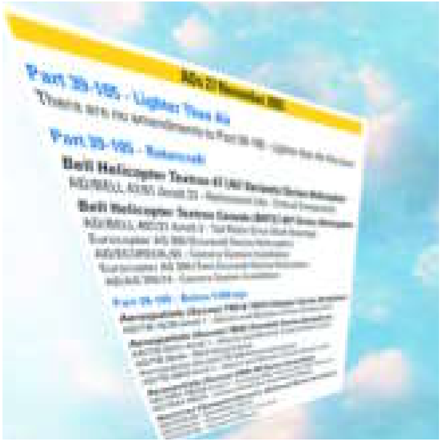
(b) One twin-engine aircraft
Account registration: $US300.00
Set up engines: $US50.00 per engine
Monthly fee: $US15.00 per engine

(c) A fleet of five single-engine aircraft
Account registration: $US300.00
Set up engines: $US50.00 per engine
Monthly fee: $US15.00 per engine

(d) A fleet of five twin-engine aircraft
Account registration: $US300.00
Setup engines: $US50.00 per engine
Monthly fee: $US15.00 per engine
NOTE: The costs above are for the basic Web ECTM subscription only.

Watching brief

New rules will put the onus on air transport operators to heed aircraft manufacturers' advice on dealing with aircraft defects, write David Villiers and David Pattie.



OPERATORS WILL take more responsibility for assessing aircraft manufacturers' service bulletins, under new regulations expected to come into force in early 2005.

The new rules, expected to go to the Federal Government for approval early this year, will require operators to assess information provided by the manufacturer for relevance to their aircraft.

Operators will have to implement the manufacturer's recommendations or record their reasons for not doing so.

The new rules,under Parts 91, 121A,121B and 133 of the Civil Aviation Safety Regulations, are designed to ensure that critical safety advice from manufacturers is assessed and acted on appropriately. They will affect individual operators as well as about 350 Australian companies involved in air transport operations.

Under existing regulations, the responsibility of the operator to assess service bulletins is implied only. Operators are required to ensure continued airworthiness of their aircraft, taking manufacturers' information into account. However, there are no rules making it compulsory to act on advice in safety-related service bulletins.

Most air transport operators subscribe to service bulletins. Some routinely assess them,implementing their recommendations when necessary. Others hold off until CASA implements airworthiness directives mandating the bulletins' recommendations.

Service bulletins, called service letters by some manufacturers, convey information ranging from new accessories on the market to alerts on major aircraft defects. Some bulletins address aircraft life limits.

Service bulletins often follow exhaustive tests by the manufacturer to investigate suspected defects. They carry instructions, backed up by detailed technical drawings, on how to deal with the defect. If the manufacturer has gone out of business,other support organisations, such as De Havilland Support Limited for De Havilland products, can issue service bulletins.

When bulletins address serious safety concerns, the aviation regulator of the country in which the aircraft is certified usually mandates compliance with the manufacturer's advice. The regulator does this through an airworthiness directive (AD).

The lag between a service bulletin and an AD can range from a day to several months.

The International Civil Aviation Organization requires the regulator of the state of design to send the AD to countries with the aircraft type on their registers. Regulators in other countries usually follow suit, issuing their own ADs.Occasionally, regulators issue ADs before their counterparts in the state of design. CASA receives and reviews about 1,200 ADs each year from various overseas regulatory authorities.

CASA also reviews about 8,000 service bulletins each year to determine whether ADs are required. Each year it issues about 900 ADs, which are gazetted in the Government Gazette, tabled in Federal Parliament and posted on the CASA website. A summary of ADs is also included in each issue of *Flight Safety Australia.*

The new rules covering service bulletins will provide another line of defence.

You can get emails sent to you automatically whenever the CASA ADs page is updated. See: www.casa.gov.au/aircraft/ad.

David Villiers is head of airframes, airworthiness standards branch,CASA.

David Pattie is head of air transport, airworthiness standards branch,CASA.

ADs 27 November 2003

Part 39-105 - Lighter Than Air

There are no amendments to Part 39-105 - Lighter than Air this issue

Part 39-105 - Rotorcraft

Bell Helicopter Textron 47 (All Variants) Series Helicopters

AD/BELL 47/61 Amdt 22 - Retirement Life - Critical Components

Bell Helicopter Textron Canada (BHTC) 407 Series Helicopters

AD/BELL 407/21 Amdt 2 - Tail Rotor Drive Shaft Bearings

Eurocopter AS 350 (Ecureuil) Series Helicopters

AD/ECUREUIL/92 - Camera System Installation

Eurocopter AS 355 (Twin Ecureuil) Series Helicopters

AD/AS 355/74 - Camera System Installation

Part 39-105 - Below 5700 kgs

Aerospatiale (Socata) TB9 & TB10 (Tobago) Series Aeroplanes

AD/TB 10/35 Amdt 1 - Aileron and Elevator Control Gimbal Joint

Aerospatiale (Socata) TB20 (Trinidad) Series Aeroplanes

AD/TB 20/41 Amdt 1 - Aileron and Elevator Control Gimbal Joint

AD/TB 20/44 - MLG Hinged Strut

Aerospatiale (Socata) TB 200 Series Aeroplanes

AD/TB 200/8 Amdt 1 - Aileron and Elevator Control Gimbal Joint

Aerospatiale (Socata) TBM 700 Series Aeroplanes

AD/TBM 700/28 Amdt 1 - Fuselage Skin Around the VHF1 Antenna

AD/TBM 700/33 - Vertical Stabiliser Attachment Fittings

American Champion (Aeronca, Bellanca) Series Aeroplanes

AD/CHA/26 - Gascolator Bowl

AD/CHA/27 - Exhaust Stack 'Y' Junction

AD/CHA/28 - Cleveland Wheels

Airtractor AT 300, 400 and 500 Series Aeroplanes

AD/AT/11 - Wing Main Spar - Steel Spar Caps and Centre Section Splice Blocks - CANCELLED

Avions Mudry Cap Series Aeroplanes

AD/CAP 10/4 Amdt 3 - Flight Limitations

Cessna 120 and 140 Series Aeroplanes

AD/CESSNA 120/12 - Carburettor and Cabin Air Heater Muffs

Consolidated Aeronautics, Colonial & LA-4 Series Aeroplanes

AD/LA-4/10 Amdt 1 - Aircraft Structure - Inspection for Corrosion

De Havilland DH 83 (Fox Moth) Series Aeroplanes

AD/DH 83/1 - Flight Limitations and Structural Inspection

AD/DH 83/2 - Cockpit Safety Harness Installation - Integrity and Lifing

AD/DH 83/3 - Cockpit Lateral Tie Rods and Aircraft Structure

Embraer 110 (Bandeirante) Series Aeroplanes

AD/EMB-110/16 Amdt 2 - Control Column P/N 4A-500-10-01-20 - Inspection

Fairchild (Swearingen) SA226 and SA227 Series Aeroplanes

AD/SWSA226/93 - Rudder Gust Lock

AD/SWSA226/94 - Boost Pump Wiring

Luscombe Model 8 Series Aeroplanes

AD/LUSCOMBE/3 - Cleveland Wheels

TECNAM P92, P96, and P2002 Series Aeroplanes

AD/TECNAM/1 - Fin Rear Spar

Part 39-105 - Above 5700 kgs

Airbus Industrie A319, A320 and A321 Series Aeroplanes

AD/A320/120 Amdt 3 - Slide Raft Telescopic Girt Bar

AD/A320/124 Amdt 1 - Overwing Emergency Exit Door Frame Corners

AD/A320/137 Amdt 1 - Fuel Probes and Fuel Tank Level Sensors

AD/A320/146 Amdt 1 - Airworthiness Limitation Items

AD/A320/148 Amdt 1 - Pitot Probes

AD/A320/151 - Keel Beam Side Panels

Airbus Industrie A330 Series Aeroplanes

AD/A330/21 Amdt 1 - Low Pressure Fuel Shut-Off Valve

AD/A330/23 - Elevator Servo Control Transducer Attachment lug Inspection and FCOM Amendment

AD/A330/25 - Auxiliary Power Unit Control Box

Beechcraft 300 Series Aeroplanes

AD/BEECH 300/1 - Cockpit D Side Window - CANCELLED

Boeing 747 Series Aeroplanes

AD/B747/296 - Body Station 2598 Bulkhead

Israel Aircraft Industries 1125 (Astra) Series Aeroplanes

AD/IAI-A/17 - Main Landing Gear Ground Contact Switches

Short SD3-60 Series Aeroplanes

AD/SD3-60/61 - Engine Power Check - CANCELLED

Part 39-106 - Piston Engines

Rotax Series Piston Engines

AD/ROTAX/13 - Mixture Enrichment Jet

AD/ROTAX/14 - Turbo Charger Pressure Oil Line Banjo Bolt

AD/ROTAX/15 - Inspection of Exhaust Bends

AD/ROTAX/16 - Inspect/Replace Engine Mount

AD/ROTAX/17 - Inspection for Cracks in Crankcase

AD/ROTAX/18 - Replacement of Valve Spring Retainers of Engines in Single Valve Spring Configuration

AD/ROTAX/19 - Oil Dipstick

AD/ROTAX/20 - Exhaust Muffler Inspection

Part 39-106 - Turbine Engines

Rolls Royce Germany Turbine Engines - BR700 Series

AD/BR700/4 - Engine Electronic Controller

Rolls Royce Turbine Engines - RB211 Series

AD/RB211/22 Amdt 1 - Spray Nozzle Fuel Supply Tube - Inspection

Part 39-107 - Equipment

Fuel Supply and Metering Equipment

AD/FSM/25 Amdt 4 - Lear Romec Fuel Pumps

Propellers - General

AD/PROP/1 Amdt 2 - Propellers - Overhaul

Propellers - Fixed Pitch

AD/PFP/17 Amdt 4 - Hub Cracking

Propellers - Variable Pitch - Hamilton Standard

AD/PHS/18 Amdt 1 - Hub Cracking

AACs 30 October 2003

Part 9 - AME Licensing and Examination

AAC 9-4 Issue 11 - Acceptance of Training Courses Conducted by Overseas Equipment Manufacturers, Operators, Maintenance and Training Organisations.

AAC 9-5 Issue 9 - AME Specific Type Training Courses and Examinations Conducted by Approved Australian Operators, Maintenance and Training Organisations.

AAC 9-91 Issue 10 - Administration and Procedure – Aircraft Maintenance Engineer Licences – Category Airframe.

AAC 9-93 Issue 6 - Accept Administration and Procedure – Aircraft Maintenance Engineer Licences – Category Radio.

AAC 9-94 Issue 7 - Administration and Procedure – Aircraft Maintenance Engineer Licences – Category Airframe.

AAC 9-95 Issue 9 - Administration and Procedure – Aircraft Maintenance Engineer Licences – Category Instruments.

ADs 25 December 2003

Part 39-105 - Lighter Than Air

There are no amendments to Part 39-105 - Lighter than Air this issue

Part 39-105 - Rotorcraft

Aircraft - General

AD/GENERAL/7 Amdt 5 - Airspeed Indicators and Altimeters - Modification - CANCELLED

Eurocopter AS 350 (Ecureuil) Series Helicopters

AD/ECUREUIL/93 - Collective Lever Lock

Eurocopter BK 117 Series Helicopters

AD/GBK 117/14 - Tail Rotor Drive Bearings

Eurocopter EC 120 Series Helicopters

AD/EC 120/3 Amdt 3 - Reinforced Coupling Tube Assembly

Eurocopter SA341 and SA342 (Gazelle) Series Helicopters

AD/GAZELLE/26 - Flexible Disks of Tail Rotor Drive Shafts

Kawasaki BK 117 Series Helicopters

AD/JBK 117/20 - Tail Rotor Transmission/Intermediate Gearbox

Robinson R22 Series Helicopters

AD/R22/51 - Main Rotor Clutch Shaft

Part 39-105 - Below 5700 kgs

Aircraft - General

AD/GENERAL/7 Amdt 5 - Airspeed Indicators and Altimeters - Modification - CANCELLED

Beechcraft 200 (Super King Air) Series Aeroplanes

AD/BEECH 200/55 Amdt 2 - Fuselage Stringers 5 Through 11

Cessna 208 Series Aeroplanes

AD/CESSNA 208/14 - Flap Bellcrank

Part 39-105 - Below 5700 kgs (continued)

Cessna 525 Series Aeroplanes

AD/CESSNA 525/3 Amdt 1 - Electric Pitch Trim System

De Havilland DHC-1 (Chipmunk) Series Aeroplane

AD/DHC-1/29 Amdt 2 - Tailplane Attachment Fittings

AD/DHC-1/35 Amdt 1 - Engine Mounting Frame Joints

Moravan Zlin Z-242L Series Aeroplanes

AD/Z-242L/2 - Wing Life - CANCELLED

AD/Z-242L/3 Amdt 1 - Limitation of Operation

AD/Z-242L/4 Amdt 1 - Limitation of Operation - 2

Pilatus PC-12 Series Aeroplanes

AD/PC-12/38 - MLG Shock Absorber Attachment Bolts

Univair Corporation Ercoupe, Forney, Alon, and Mooney M10 Series Aeroplanes

AD/UNIVAIR/1 Amdt 1 - Wing Outer Panel Internal Structural Components

Part 39-105 - Above 5700 kgs

Aircraft - General

AD/GENERAL/7 Amdt 5 - Airspeed Indicators and Altimeters - Modification - CANCELLED

Airbus Industrie A330 Series Aeroplanes

AD/A330/26 - Spoiler Servo-Controls Life Limitations

AMD Fan Jet Falcon (Falcon 20/Mystere-Falcon 200) Series Aeroplanes

AD/AMD 20/30 - Extinguishing Pipe in the Engine Area

Beechcraft 1900 Series Aeroplanes
AD/BEECH 1900/41 - Elevator Trim System

Boeing 727 Series Aeroplanes
AD/B727/186 - Forward Ceiling Access Panel/Door

Boeing 737 Series Aeroplanes
AD/B737/153 Amdt 1 - Elevator Tab Control Rod Jam Nut
AD/B737/154 Amdt 2 - Elevator Tab
AD/B737/164 Amdt 1 - Elevator Tab Repair
AD/B737/172 Amdt 1 - Speedbrake Operation Limitation
AD/B737/180 Amdt 1 - Speedbrake Operation Limitation - 2
AD/B737/192 Amdt 1 - Elevator Tab Mast Fitting
AD/B737/218 - Windshield Wipers

Boeing 747 Series Aeroplanes
AD/B747/297 - Shoulder Restraint Harness Attachment

Boeing 767 Series Aeroplanes
AD/B767/190 - Shoulder Restraint Harness Attachment

Bombardier (Boeing Canada/De Havilland) DHC-8 Series Aeroplanes
AD/DHC-8/88 Amdt 1 - Flap Drive Actuator - Inspection
AD/DHC-8/94 - Pitot Static System

SAAB SF340 Series Aeroplanes
AD/SF340/94 - Aileron and Elevator Trim Tab Fittings
AD/SF340/95 - Windshield Wiper Arm - 2

Part 39-106 - Piston Engines

Lycoming Series Piston Engines
AD/LYC/109 Amdt 2 - Crankshaft Gear Bolt

Part 39-106 - Turbine Engines

General Electric Turbine Engines - CF6 Series
AD/CF6/53 - Forward Engine Mount Platforms

Rolls Royce Turbine Engines - Tay Series
AD/TAY/5 Amdt 2 - 12th Stage Compressor Disc - Inspection

Propellers - Variable Pitch - Hartzell
AD/PHZL/69 Amdt 2 - Hartzell X and V Shank Propellers
AD/PHZL/80 - Composite Blades Cracking

When enough's enough

LAMEs are sometimes pressured to break rules

Davo (not his real name) wants to keep his job, but he fears it won't be long before there's an accident with the long hours he's being asked to work.

Davo called the confidential CASA Hotline to report his concerns.

His identity was protected, and CASA took action.

CASA Hotline: 1800 074 737

Dye crack buster fluster

Red dye has been used for decades to detect cracks and corrosion in aeroplanes. However, it has some drawbacks, writes Col Hockings in the first of a series of articles on non-destructive testing.

Colour contrast, or red dye penetrant, often called dye check, is the most familiar of the non-destructive test (NDT) methods. Its origins date back to pre-World-War II railways. It has enjoyed widespread acceptance across many industries, including aircraft maintenance, for the detection of cracks and corrosion.

The dye check method is simple: clean the inspection surface,then apply the penetrant and wait long enough for it to make its way into any surface openings, such as cracks. Remove excess penetrant,leaving the dye in the defects.Finally, apply a developing agent over the surface. This has two functions – to draw out any penetrant and to provide a high colour contrast to it.

Developments in materials have improved the performance of red dye. However, there are limitations to the sensitivity of the method, and some air forces and airlines have prohibited the use of red dye on aircraft. These organisations favour fluorescent penetrants over dye check whenever a penetrant inspection is prescribed in approved data.Fluorescent penetrants are far more sensitive to small defects.

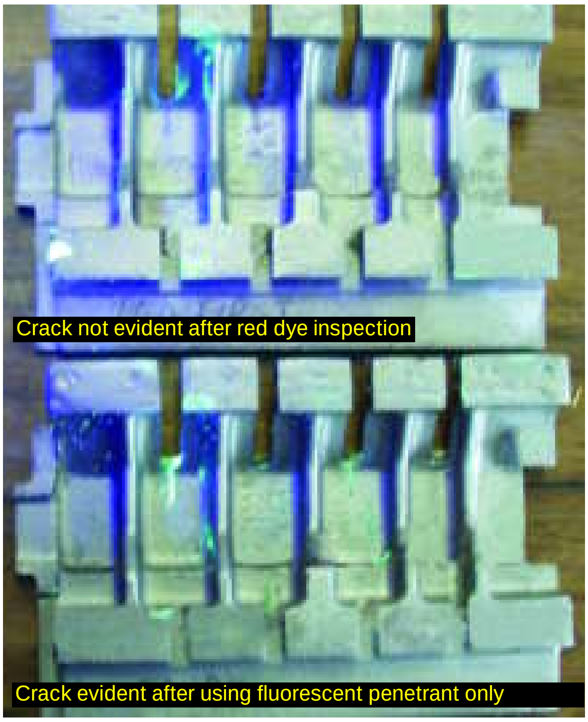
For red dye to work at all,the most important step is to ensure that the inspection surface and any defects present are clean. Dirt or contaminants can cause the inspection to fail. That's because penetrant inspections exploit capillary action – the flow of fluids into narrow openings or tubes without any apparent application of another force. Capillary action is what makes the penetrant enter a defect,assuming, of course, that the defect is open to the surface. If a crack or other opening is full of dirt or other material, the penetrant cannot enter, so thorough cleaning using approved methods and materials is critical.

Another problem with red dye is that it can compromise subsequent fluorescent penetrant tests. Red dye can remain in cracks for years,barring the entry of fluorescent penetrant,and obscuring the defect.

And the compound can "switch off" fluorescent penetrants. Fluorescence occurs when molecules in excited states return to their ground, or lower, energy levels, releasing light energy. Sometimes, the molecules can return to the ground state without emitting light, in a process called quenching. Red dye causes quenching in fluorescent materials.

Fluorescent penetrant inspections should never follow red dye checks. If red dye has been used for an aircraft inspection,use an alternative method, such as the eddy current technique or a close visual inspection using magnification, for inspections of that area.

Col Hockings is a Qantas NDT supervisor.



Crack not evident after red dye inspection

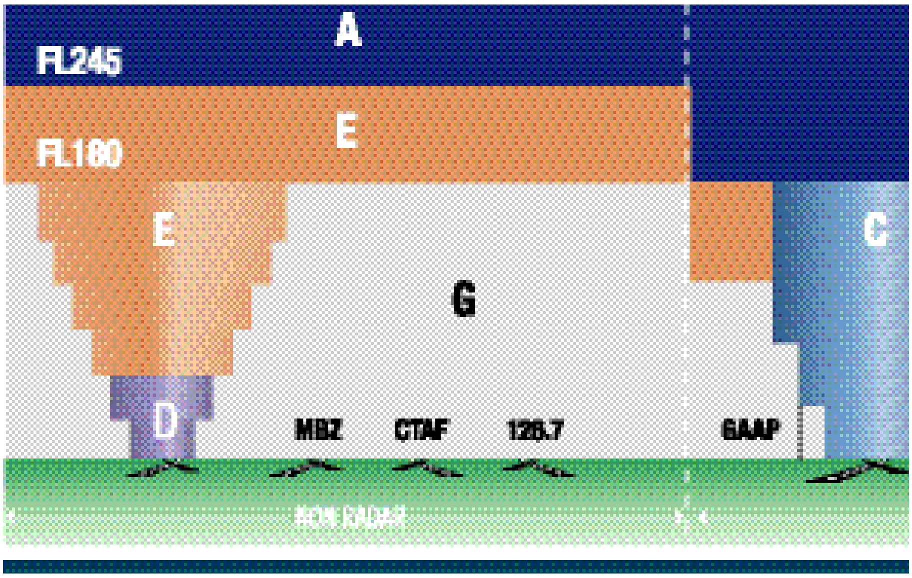
Crack evident after using fluorescent penetrant only

A LAME can use pressure pack red dye penetrant NDT methods but should be trained in their use, limitations and possible masking of other processes. It is recommended by CASA that red dye penetrant not be used unless the LAME is confident that its use will not cause problems for any subsequent inspections, or the process is specifically called up in approved data by the aircraft or component manufacturer.

- Albert Fleming, CASA

SAFETY CHECK Test your aviation knowledge

IFR quiz Class E airspace ops



1. **Which of the following colours is used on the en route charts (ERC) to depict class E Airspace ?**
   (a) light blue
   (b) green
   (c) no colour
   (d) light brown

2. **Refer to ERC (L) 2, dated 27/11/2003. Would an IFR category aircraft cruising at A090 between Wagga Wagga (WG) and Rugby (RUG) be operating either wholly or partly in class E airspace?**
   (a) yes
   (b) no

3. **Referring to the above ERC, would a VFR category aircraft cruising at A085 between Bathurst (BTH) and Cootamundra (CTM) be operating in class E airspace?**
   (a) yes
   (b) no

4. **If the VFR aircraft referred to in question 3 were to climb above A085, would a clearance to operate in class E airspace be required, and on what frequency should this aircraft be monitoring?**
   (a) yes,135.25 (ML cen)
   (b) yes, 134.85 (flight watch)
   (c) no, 135.25 (ML cen)
   (d) no, 127.35 (BTH CTAF)

5. **Refer to ERC (L) 2 dated 27/11/2003. An IFR category aircraft has planned West Wyalong (WWL) - Cowra (CWR) - Sydney (SY) at A090. Approaching CWR, Centre advises that clearance to enter and transit class E airspace is not available. Which of the following may be appropriate actions to take?**
   (a) Descend to A070 and continue in class G airspace, requesting an airways clearance in Sydney's class C airspace in the normal manner.
   (b) Enter a holding pattern before the class E airspace boundary awaiting the clearance.
   (c) Request "IFR pickup" and proceed climbing to A095 (a VFR level), and stay in VMC while awaiting the IFR clearance.
   (d) Both (a) and (c) would be suitable options.

6. **The IFR category aircraft in the previous question adopts the "IFR Pickup" option and re-establishes cruise at A095 in VMC and now operates VFR. Which of the following now apply?**
   (a) The aircraft shall receive traffic information.
   (b) A clearance to operate at A095 is not required.
   (c) Traffic separation is not provided: "see and be seen".
   (d) The aircraft must not re-establish cruise at an IFR level until in receipt of an IFR clearance to be in class E airspace.
   (e) The aircraft must remain VMC but continue to adhere to all IFR procedures, such as LSALT, position reporting and track keeping
   (f) All the above.

7. **Refer to ERC (L) 3 dated 27/11/2003. An IFR category aircraft is cleared at A100 tracking from Grafton (GFN) to Armidale (ARM). Weather conditions are VMC. If a VFR descent were desired to A080, which of the following would be the correct procedure to adopt?**
   (a) A clearance is not required to initiate the descent, but ATC will provide traffic information on IFR flights and VFR flights as far as practical.
   (b) A clearance is not required to initiate descent and no traffic information will be given since it is a "VFR decent".
   (c) A clearance is required to conduct a "VFR descent" and ATC will provide traffic information on IFR flights and VFR flight as far as practical.

8. **Refer to ERC (L) 3 dated 27/11/2003. An IFR category aircraft has been cleared at A090 tracking along W330 between Tamworth (TW) and Coffs Harbour (CH). The aircraft is flying in and out of the cloud tops and this is generating turbulence. If the pilot wants to operate "VFR on top" to reach smoother flying conditions, which of the following procedures should he or she adopt?**
   (a) As with "VFR climb", no clearance is required and no traffic information is given since the aircraft is "VFR on top".
   (b) A clearance is required to operate "VFR on top" and IFR traffic information will be provided, together with VFR flights, as far as practical. Once cleared, the aircraft could climb to FL 115 (with appropriate oxygen requirements) while maintaining VMC.
   (c) A clearance is required to operate "VFR on top" and the aircraft must adhere to VFR levels, such as FL115. If further level changes are required to remain VMC then ATC must be advised before the level change for traffic purposes.
   (d) Both B and C are correct

9. **Refer to the previous question. After passing Point Lookout (PLO) the cloud tops lower and the pilot wants to continue IFR at A090. The pilot must cancel "VFR on top" and obtain an alternative clearance at the IFR level. True or false?**
   (a) True
   (b) False

10. **Once the aircraft is re-cleared to maintain an IFR level, traffic separation service, as distinct from traffic information service, is re-established. True or false?**
   (a) True
   (b) False

Flying ops quiz

1. Compared with starting a turboprop engine with a free turbine, starting a single-shaft turboprop engine requires:

(a) less starter torque because the propeller is feathered during start

(b) more starter torque because the propeller is feathered during start

(c) more starter torque because the starter must also drive the propeller during start

(d) less starter torque because both the propeller and gas generator are driven during start.

2. Referring to aircraft AC electrical systems, a split bus system is one where each engine-driven generator:

(a) powers nominally half the aircraft load and the buses are not cross-connected during normal operation.

(b) powers nominally half of the load and the buses are normally cross-connected by a bus tie circuit breaker.

(c) is separately regulated but the outputs are maintained approximately equal by means of a load controller

(d) can only be applied to aircraft with more than two engines.

3. In airspace where ATC approval is not required to change level, the pilot of an IFR aircraft intending to change level must:

(a) report position, level and intention to ATC approximately one minute prior to making any change

(b) report the intention to ATC at least two minutes prior to making the change

(c) broadcast position, level and intention approximately one minute prior to making any change

(d) broadcast the intention at least two minutes prior to making the change.

4. For VFR flights by day or night, the criterion under which visual approaches may be authorised by ATC is that the aircraft must be:

(a) within 3 nm of the aerodrome

(b) within 5 nm of the aerodrome

(c) within 10 nm of the aerodrome

(d) within 30 nm of the aerodrome.

5. When cleared for a visual approach, the track/heading authorised by ATC must be maintained until:

(a) within 3 nm of the aerodrome and with the aerodrome in sight

(b) by day, within 5 nm and, by night, 3 nm and with the aerodrome in sight

(c) within 3 nm of the aerodrome by day or night

(d) the aerodrome is in sight.

6. An aircraft on a VFR flight may operate in E airspace:

(a) provided a clearance is obtained and the aircraft has a serviceable transponder

(b) provided a clearance is obtained and the aircraft has a serviceable transponder and the appropriate VHF frequency is monitored

(c) without a clearance and provided that the aircraft carries a serviceable transponder and the appropriate VHF frequency is monitored

(d) without a clearance provided only that the appropriate VHF frequency is monitored.

7. A VFR flight must be able to navigate by visual reference to the ground or water when:

(a) below altitude A020 and must be able to fix the aircraft's position by features on topographical charts at intervals of at least 30 minutes

(b) at or below 2000 ft AGL and must be able to fix the aircraft's position by features on topographical charts at intervals of at least 30 minutes

(c) below altitude A020 and must be able to fix the aircraft's position by features on topographical charts at intervals of at least 60 minutes

(d) at or below 2000 ft AGL and must be able to fix the aircraft's position by features on topographical charts at intervals of at least 60 minutes.

8. When navigating by visual means in controlled airspace, a pilot must notify ATC when the aircraft diverges from the track approved by ATC by:

(a) more than 3 deg

(b) more than 3 nm

(c) more than 1 degree

(d) more than 1 nm.

9. In the case of an unserviceable transponder, specific ATC exemption against the requirement for carriage of a transponder for VFR aircraft in E airspace:

(a) is not available

(b) may be available on request.

10. With reference to TCAS alerts, a resolution advisory is:

(a) an immediately reportable matter (IRM)

(b) a routine reportable matter (RRM).

IFR quiz alternate requirements

You are planning an IFR flight (charter category) to Mildura (YMIA). The TAF for YMIA reads:

TAF YMIA 181914 2008 250 20G30 5000 SHRA FEW 006 FEW 009 BKN 011 TEMPO 0406 3000 RA BKN 010

T14 14 13 12 Q1010 1008 1007 1007

Your aircraft is a Beechcraft Baron 55 equipped with one of each NAV Aid (ADF VOR DME ILS) and a non TSO'D GPS.

The crosswind limit for the aircraft is 20 kts.

1. With an ETA YMIA of 0615Z considering weather, do you have an alternate requirement and why?

(a) Yes – because the TEMPO WX is below the alternate minima and the ETA is within the 30 min buffer period.

(b) Yes – because the cumulative amount of cloud is greater than "SCT" and it is below the alternate minima.

(c) No – because the cumulative amount of cloud (FEW + FEW) is "SCT". The only requirement is to carry 60 mins holding fuel due to "TEMPO" (within the 30 min buffer period) being below alternate minima.

(d) No – because the cumulative amount of cloud is not below the approach minima. The only requirement is to carry 60 mins holding fuel due to "TEMPO" visibility being below the approach minimum visibility.

2. If a NOTAM were in effect stating "RWY09/27 not available due W.I.P," would this have a bearing on your alternate decision?

(a) No – since the alternate minima are the same for all runways.

(b) Yes – since the wind gust would exceed the crosswind limit on the available runway .

(c) No – since the steady wind is within the crosswind limit on the available runway.

3. Do you have an alternate requirement from a navigation aid standpoint?

(a) No – since the aircraft has the required redundancy of one of each of the navigation aids.

(b) No – since the operation only requires one navigation aid.

(c) Yes – since the operation requires two navigation aids on board for either the NDB or VOR.

4. En route to YMIA you are advised that the MIA VOR has failed. Will this affect your alternate requirement?

(a) No – since the alternate minima are the same for all approaches at YMIA.

(b) No – since the aircraft is equipped with GPS to retain the NAV aid redundancy for charter.

(c) No – since the aircraft is equipped with DME to retain the redundancy for charter.

(d) Yes – since the aircraft is equipped only with one ADF and no longer has the required redundancy. The DME and GPS do not meet this requirement.

5. Considering a night arrival at YMIA in your Baron, would you have an alternate requirement from a lighting standpoint?

(a) Yes – unless the aircraft has 2 VHF transceivers or 1 VHF, 1 HF and 30 mins holding fuel is carried.

(b) Yes – unless a responsible person has been arranged to manually switch on the lighting.

(c) No – since "SDBY" power is available.

(d) No – since "PTBL" lights are available and providing a responsible person has been arranged.

(e) Both (b) and (d) are correct.

6. Could YMIA serve as a suitable alternate from a lighting standpoint for an RPT DHC "Dash 8" (MTOW 16462 kg)?

(a) No – since the lighting is PAL

(b) Yes – if the aircraft has 2 VHF transceivers or 1 VHF, 1 HF and 30 mins. holding fuel is carried.

(c) Yes – if a responsible person to manually switch on the lighting is in attendance.

(d) Yes – the responsible person is not required if the DHC "Dash 8" is a cargo-only operation and it meets the 2 VHF or 1 VHF, 1 HF and 30 mins holding fuel requirement

(e) Both (c) and (d) are correct.

Part of a Melbourne (YMML) TAF reads "4000 DZ OVC 008."

A TTF is issued at 0500, part of which reads "5000DZ OVC 014" Your aircraft is single ILS equipped and the ETA is 0640Z.

7. Do you have an ALTN requirement for YMML based on this weather information?

(a) Yes – since the TAF alone must be considered in planning the ALTN.

(b) No – since the TTF is above the ALTN criteria and ETA is within the 3 hour validity of the TTF. You can plan on the TTF.

8. Considering just the TAF extract above, is there an ALTN requirement for an aircraft fitted with duplicated ILS, ADF and marker beacons?

(a) Yes – since all aircraft must adhere to the ALTN criteria of (1206 – 4.4) for the ILS.

(b) No – since this aircraft may operate to the ALTN criteria of 700/3km.

(c) No – since all aircraft may operate to the ALTN criteria of 700/3km.

(d) No – since the WX is above the special ALTN criteria of 700/3km. Also, local METAR/SPECI forecasting must be available, together with an aerodrome control service.

The following TAF is issued for Mount Isa: (YBMA) TAF YBMA 191905 2008 340 20 CAVOK FM 03 340 25 G35 5000 DU PROB 40 0305 4000 DU T 25 30 32 35 Q 1010 1008 1006 1008.

You are flying a category B aircraft and your ETA YBMA is 0240.

9. Do you have an alternate requirement based on this TAF?

(a) No – since the WX is CAVOK and there is no crosswind restriction.

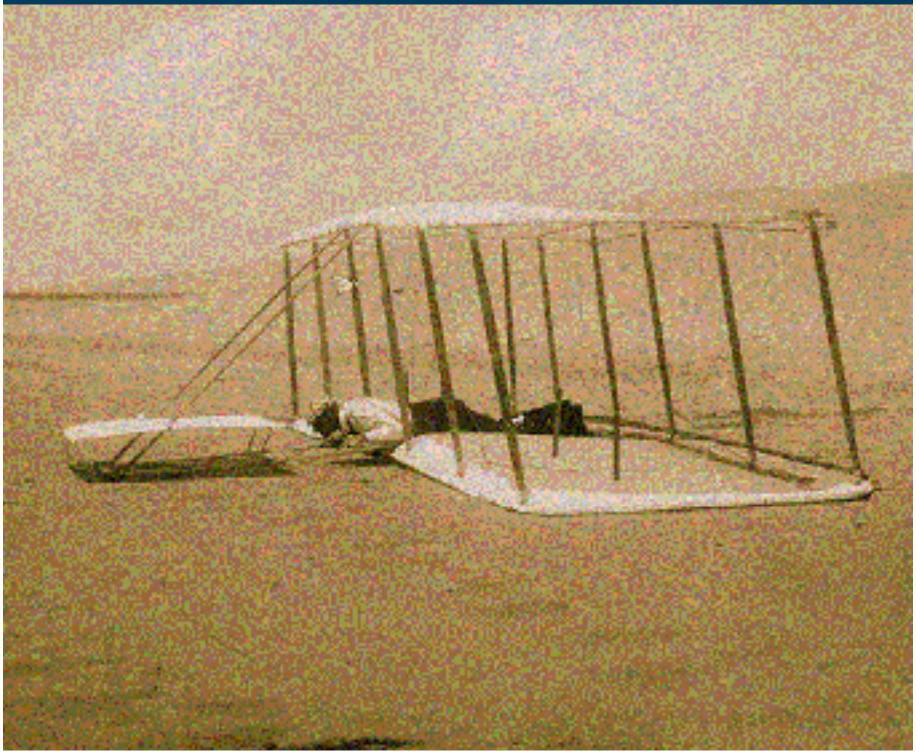
(b) No – since the ETA is prior to the onset of the deteriorating visibility.

(c) Yes – since the ETA is within 30 mins of the onset of the 4000 M visibility in dust.

(d) No – since the visibility of 5000m in dust is not below the ALTN criteria.

What's the message?

In 25 words or less, tell us what you think is the message to be inferred from the photo. The best entry receives $50 worth of safety aviation products. Send your entry to: *Flight Safety Australia*, GPO Box 2005, Canberra ACT 2601 or email to: fsa@casa.gov.au by March 1.



Last issue's winning message:

After years of breaching duty time regulations, Santa finally relents to Rudolph's request to fly Concorde.

David Hodgkinson
Glen Iris

Quiz answers

IFR Class E quiz

1. (d) ERC 2

2. (a) ERC 2

3. (b) ERC 2

4. (c) AIP ENR 1.1 - 3.1, ERC 2

5. (d) (a) is an option but (d) would be more efficient if "IFR pickup" criteria can be met.

6. (f)

7. (c)

8. (d)

9. (a)

10. (a)

Flying ops quiz

1. (c) The starter has to bring both the spool of the turbine as well as the propeller up to speed during start, which requires more torque than if only the gas generator is rotated for starting.

2. (a) The split-bus system is usually applied to twin-engined aircraft and, since the AC generators are not operated in parallel, no synchronisation or load controller is required.

3. (a) AIP ENR 1.7 4.2.1

4. (d) AIP ENR 1.1 11.5.1.a

5. (b) AIP ENR 1.1 11.5.4.b

6. (c) AIP ENR 1.1 18.3.1 and GEN 1.5 6.1.2

7. (b) AIP ENR 1.1 19.2.1

8. (d) AIP ENR 1.1 19.2.1.c

9. (a) AIP GEN 1.5 6.2.3; exemption may be available to aircraft for the portion of a flight that is subject to a clearance; VFR flights in E airspace are not subject to a clearance and are therefore not eligible for the exemption.

10. (a) AIP GEN 1.5 7.2 and ENR 1.14 2.1.1e

Alternates quiz

1. (c) AIP ENR 1.1 - 85 PARA 72.2.1(A) PARA 72.2.4 PARA 72.2.7. Answer (b) would be correct if AWIS was not available.

2. (b) AIP ENR 1.1 - 86 PARA 72.2.1(D)

3. (a) AIP ENR 1.1 - 88 PARA 72.3.1(A)(2). Answer (b) would be correct for a private operation.

4. (d) AIP ENR 1.1 - 88 PARA 72.3.1(A)(1)

5. (e) AIP ENR 1.1 - 89 PARA 72.4.3 PARA 72.4.1. Answer (b) would be correct for the alternate.

6. (e) AIR ENR 1.1 - 89 PARA 72.44.

7. (b) AIR ENR 1.1 - 87 PARA 72.2.8 AIP GEN 3.5 - 30 PARA 12.18. The TTF supersedes the TAF during the period. It can have operational advantages.

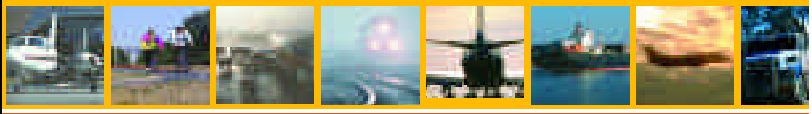
8. (d) AIP ENR 1.5 - 31 PARA 6.2.1 PARA 6.2.2

9. (c) AIP ENR 1.1 - 86 PARA 72.2.1(C)

Australian Government

Australian Transport Safety Bureau

The Australian Air Sa



The ATSB makes a significant contribution to the safety of the Australian aviation industry and travelling public through investigation, analysis and open reporting of civil aviation accidents, incidents and safety deficiencies.

It performs air safety functions in accordance with the provisions of Annex 13 to the Convention on International Civil Aviation (Chicago Convention 1944) as incorporated in the *Transport Safety Investigation Act 2003*. The Act contains the ATSB's authority to investigate air safety occurrences and safety deficiencies.

Investigations commenced on or before 30 June 2003, are conducted in accordance with Part 2A of the *Air Navigation Act 1920*.

Investigations commenced on or after 1 July 2003, are conducted in accordance with the Transport Safety Investigation Act 2003 (TSI Act).

The ATSB is an operationally independent bureau within the Federal Department of Transport and Regional Services. ATSB investigations are independent of bodies, including regulators that may need to be investigated in determining causal factors leading to an accident or incident. ATSB is a multi-modal bureau with safety responsibilities in road, rail and sea transport in addition to aviation.

The Australian Air Safety Investigator is a regular four-page feature in *Flight Safety Australia* produced with editorial indepen-dence by the ATSB. It aims to keep the industry informed of the latest findings and issues in air safety from the bureau's perspective.

Australian Transport Safety Bureau
PO Box 967,
Civic Square ACT 2608

Telephone: 1800 621 372
Email: atsbsupp@atsb.gov.au
Website: www.atsb.gov.au

A Confidential Aviation Incident Reporting (CAIR) form can be obtained from the ATSB website or by telephoning 1800 020 505.

ATSB Wins International Award

THE Australian Transport Safety Bureau (ATSB) has received international recognition for outstanding work in its *Investigation into Ansett Australia maintenance safety deficiencies and the control of continuing airworthiness of Class A aircraft* report.

Early in November 2003 in Washington, the prestigious Flight Safety Foundation 2003 Cecil A Brownlow Publication Award went to the ATSB for "extraordinary efforts in identifying, investigating and reporting on a systemic problem affecting aviation safety worldwide".

The ATSB's report, released in November 2002, highlighted that a robust system for regular inspection and maintenance of Boeing 767 aircraft was essential to assure continuing airworthiness.

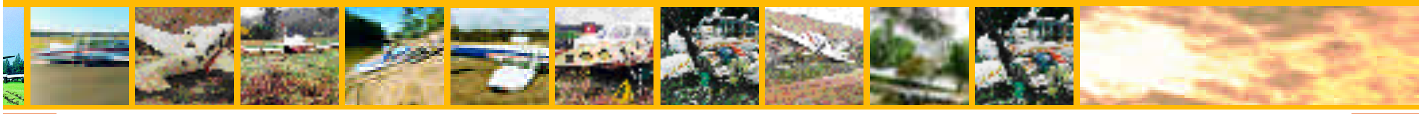
Mr Kym Bills, ATSB Executive Director, accepted the award at the joint meeting of Flight Safety Foundation, the International Federation of Airworthiness and the International Air Transport Association in Washington.

"The ATSB is thrilled to have its work recognised by the Flight Safety Foundation. The Award highlights the critical contribution the ATSB makes to aviation safety – not only in Australia but internationally," Mr Bills said.

The Flight Safety Foundation's (FSF) annual International Safety Awards Program recognises individual and group achieve-ments in aviation safety, as well as acts of heroism by civil aircraft crew members or ground personnel.

The *Cecil A Brownlow Publication Award* recognises publications,articles, electronic media or individuals with demonstrated excellence and commitment in their coverage of aviation safety topics. Submissions are judged on the quality of writing and research, the presentation and, importantly, the contribution to safety awareness.

The *Investigation into Ansett Australia maintenance safety deficiencies and the control of continuing airworthiness of Class A aircraft* report can be found at: www.atsb.gov.au/aviation/sdi/ansett_classa/index.cfm ■



Aviation Safety Research Grants Programme 2004

Invitation for applications for aviation safety research grants programme 2004

Programme No. B203/0152

The Australian Transport Safety Bureau invites applications from suitably qualified individuals and organisations to undertake research into aviation safety in Australia.

Interested parties are invited to obtain details of the grants programme from the Bureau.

It would be an advantage for applicants to have a high level of experience in an area related to aviation safety, research, aircraft operations, human factors or the aviation industry.

The contact for technical aspects of this tender is Mike Jamieson, telephone (02) 62747462.

Applications for grants, together with research proposals, may be lodged by email at aviation.research@dotars.gov.au or sent to Aviation Safety Research Grants Programme, PO Box 967, Civic Square, ACT, 2608.

The above application period closes at 2.00pm (ESuT) on 29 January 2004.

A copy of the application form and information package may be obtained by emailing the above address or by visiting our website at www.atsb.gov.au/aviation/research/grants.cfm

What is the Australian Transport Safety Bureau?

The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal body that investigates, analyses and reports on transport safety. The ATSB is not part of the Civil Aviation Safety Authority (CASA). The ATSB is Australia's prime agency for the independent investigation of civil aviation accidents, incidents and safety deficiences. To report an Aviation, Marine or Rail accident telephone ATSB (toll-free, 24 hours): **1800 011 034.**

Safety briefs

Failure of outer wheel bearing

Occurrence 200204836

While on approach to land at Perth, the crew of the Boeing 727 notified air traffic control (ATC) that they required runway 21 instead of 24. This was in consideration of the wet runway conditions and as a possible precaution should they experience antiskid problems. They also advised ATC to expect a normal approach.

After parking the aircraft, the crew reported the loss of the inner left main wheel and requested RFFS to attend while the aircraft was secured. An inspection of the Perth runway did not find any debris.

A search conducted at Melbourne airport, the point of departure, resulted in the recovery of debris from runway 34. The wheel had impacted the perimeter fence past the overrun area of runway 34 and was recovered from that position.

Investigation revealed corrosion and rolling contact fatigue spalling of the bearings that probably resulted in failure of the bearing and the loss of the wheel from the aircraft.

The operator has amended maintenance procedures for re-inspection intervals of wheel bearings after long term storage. ■

Aircraft incorrectly loaded

Occurrence 200300685

The HS-748 aircraft was engaged in a night freight operation and was under charter to a freight carrier. The aircraft had been loaded with four LD type containers and an amount of freight. During the post loading walk-around, the first officer had difficulty in removing the tailstand from the aircraft. The first officer asked the loading staff if the aircraft was loaded in accordance with the load sheet. The loading staff indicated that the aircraft had been loaded according to the sheet. The first officer consulted the pilot in command and ascertained that the loaded centre-of-gravity of the aircraft was towards the middle of the allowable centre-of-gravity envelope. The crew then removed the tailstand and completed the before start checks and started the engines in preparation for taxi.

Shortly after the engines had been started, the loading staff approached the aircraft and signalled to the pilot in command that they wished to talk to him. The pilot in command shut down one engine and dispatched the first officer to speak with the loading staff. After speaking with the loading staff, the first officer signalled to the pilot in command to shut down the other engine.

Subsequent enquiries by the loading staff had revealed that an incorrect container had been loaded on board the aircraft. These enquiries revealed that the aircraft had been loaded with an empty LD container in the forward position. The correct LD container weight was expected to be 1120 kg. The aircraft had been loaded incorrectly.

The freight carrier instituted an internal investigation that revealed a number of factors contributing to the incorrect loading. These factors included an absence of loading documentation for both the loading supervisor and the pallet loader operator. ■

Uncommanded in-flight engine shutdown

Occurrence 200204444

The crew of the Boeing 717-200 aircraft reported that during the climb from Launceston airport, while passing 7,000 ft above sea level, the right engine sustained an uncommanded in-flight shutdown. A R ENG RPM LO alert was observed followed by a RH SYS FAIL advisory. The crew reported that they did not see any caution advisories prior to the shutdown. The ENGINE FAIL/SHUTDOWN checklist was actioned and the crew completed a

single engine landing. Following the event, the operator's maintenance personnel interrogated the multi-function control display unit and carried out a right engine electronic engine controller fault review check. Several fault codes were noted in the on board computer memory which related to electronic faults listed for a FADEC SYSTEM FAULT [full-authority digital engine control] and EEC BOX FAULT [electronic engine controller]. After conferring with the engine manufacturer, the EEC and the fuel-metering unit (FMU) were removed for further testing. After replacement of those units, normal engine performance returned. ■

Collision with ground during spraying

Occurrence 200300909

The Cessna 188 was being used to spread insecticide over a cotton crop. Soon after takeoff, and as the pilot was setting the aircraft up to conduct the initial spray run, the aircraft descended from a steep turn, into the crop and impacted heavily. Although the aircraft was substantially damaged, the pilot was not hurt. The weather conditions were CAVOK (cloud ceiling, visibility and general weather were suitable for visual flight) with a variable wind of about 3 to 5 kts. The temperature was reported as being about 26 degrees C.

The pilot gained an agricultural rating 8 months prior to the accident and had accumulated about 36 hours agricultural flying experience before the accident. She had about 15 hours experience on the aircraft type and was operating under the supervision of an experienced agricultural pilot.

The pilot reported the following information:

The aircraft had been loaded to within 0.6 kg of the maximum takeoff weight.

Following the takeoff, the aircraft 'felt heavy' but was climbing adequately.

During a steep turn towards the direction of the initial spray run, the aircraft began descending towards the ground. The wings were levelled and full power applied but the engine did not appear to deliver full power. Further turns were made to avoid wires and trees and then as the aircraft continued descending the wings were rolled level before the aircraft hit the ground.

A subsequent engineering inspection by the operator revealed that one of the magnetos had no defects, but the other magneto had badly worn or burnt breaker points. No other defects were found during the engineering inspection. The operator's engineering assessment determined that it was unlikely that the faulty magneto would have affected the ability of the engine to deliver full power.

The investigation could not determine why the aircraft failed to remain airborne, although the steep turn at high weight may have been a factor in the accident.

The ATSB did not conduct an on-site investigation. ■

Ground resonance event

Occurrence 200200651

The AS350B2 Squirrel helicopter was being operated on a private flight with the pilot and two passengers on board. The pilot reported that shortly after lifting the helicopter into an approximately 1.2 metre hover, he noted that the main rotor system had a pronounced vertical, once per revolution, vibration. The pilot then elected to terminate the hover and land the helicopter. He further reported that when the skid landing gear touched the ground, the helicopter began to oscillate violently. The pilot then activated the emergency fuel cut-off. Subsequently, the engine and main rotor revolutions per minute (RPM) began decreasing. The pilot and passengers reported that the oscillations of the helicopter became more violent and pronounced as the main rotor RPM decreased. Once the main rotor ceased rotation, the occupants exited the helicopter. One passenger received minor injuries.

The helicopter sustained substantial damage to the main rotor assembly, the right landing gear skid, the forward cargo mirror mount bracket, the left and right structure keel beams, and the right rear passenger seat support. The principle damage to the main rotor assembly consisted of the fracture and separation of the yellow and blue starflex rotor arm outboard segments.

An examination of the helicopter's main rotor head and blades did not reveal any anomalies,other than the separated starflex rotor arm outboard segments, that could have resulted in the vertical vibration reported by the pilot. A witness near the helicopter during its hover flight did not report any foreign objects or birds in the area of the main rotor disc during the flight.

The damage to the main rotor starflex rotor assembly was consistent with the damage documented in a technical report compiled by the Australian Defence Science and Technology Organisation relating to a previous military AS350 helicopter occurrence. That report indicated that the starflex rotor arms failed due to severe upward bending due to excessive loading. That investigation determined that the circumstances of the accident were consistent with a ground resonance event. ■

Unexpected weather conditions

Occurrence 200201556

The Boeing 747 aircraft was operating a scheduled passenger flight from Melbourne to Perth with an estimated time of arrival (ETA) at Perth of 0945 WST. The flight crew had been provided with a valid aerodrome forecast (TAF) for Perth, which indicated that the visibility and cloud base would be above the alternate criteria throughout the period of the forecast. As there were no operational requirements, the aircraft departed Melbourne without alternate or holding fuel being carried for Perth.

Three minutes after the aircraft's departure from Melbourne, an amended TAF for Perth was issued with fog being forecast until 0800. After that time, conditions at Perth were forecast to improve above the alternate criteria. Subsequent Perth trend type forecasts (TTF) issued from 0603 until 0759 also indicated an improvement above the alternate criteria after 0800.

Soon after the aircraft passed the flight plan point of safe diversion (PSD),a Perth TTF was issued that indicated the meteorological conditions would be below the alternate criteria until 15 minutes after the ETA of the aircraft at Perth. At 0845, a message from the operator about the 0825 TTF was provided to the crew by air traffic services. As the aircraft had flown past the PSD and fuel was not carried to divert to an alternate airport, the crew decided to continue the flight to Perth. The aircraft made an uneventful landing at 0938.

The Bureau of Meteorology (BoM) aviation forecasters assessed the formation of fog in the expected weather conditions as being unlikely. However, reduced visibility and low cloud were observed until 0930 due to a mixture of advection fog and frontal fog that was difficult to forecast.

BoM advised that a fog forecasting team was formed in March 2002 to review of the fog forecasting process at Perth. The team developed and implemented a systematic structured approach in May 2002. The approach takes into account synoptic pattern matching, statistical data, model input and the impact of the Perth topography on fog formation. ■

Glass cockpits *under the lens*

GA aeroplanes are graduating to glass cockpits, writes John Mulcair.

DIGITAL IMAGE DESIGN BY PETER MARKMANN

NOT SO LONG AGO, it was science fiction. In the great imaginative epic, *2001: A Space Odyssey*, a highlight of the film was the graceful dance of a Pan Am space liner as it was rotated by onboard computers to align with a spinning space station.

The flight deck instrumentation was remarkably uncluttered for the 1960s when the film was made: just a few screens showing essential information as the docking took place.

Glass cockpits came gradually into airline use, with pilots getting vital information from screens, with just a handful of analogue instruments for back-up coverage of vital functions.

Now, decades after the flight envisaged by Stanley Kubrick and Arthur C. Clarke, glass cockpits are starting to spread beyond airline use and private jets into general aviation.

In 1995, NASA and players in the general aviation and avionics industries, plus research institutions, announced an ambitious program called AGATE – Advanced General Aviation Transport Experiments – to try to revitalise the struggling sector.

Its lofty ambition was to promote more efficient GA as an alternative to short-range car trips for private and business transport needs.

At the time,the programme partners said the average general aviation aircraft then flying was about 30 years old.

Flight deck technologies dated back as far as the 1950s, while piston propulsion technologies had been unchanged for 40 years.

The AGATE program finished in 2001, but has evolved into NASA's Small Aircraft Transport System, SATS, with funding of $US69 million through until 2005.

AGATE targeted technologies for new operating capabilities in small aircraft including: improved bad weather flight systems; emergency avoidance systems that support decision making; night and low visibility terrain-following systems; traffic avoidance systems; and systems that ease flight-planning workload,minimise danger of injuries,and improve comfort, performance and efficiency.

Some of the AGATE/SATS objectives are starting to see the light of day, with the mainstream light aircraft manufacturer, the Cessna Aircraft Company, recently announcing it would offer as an option an all-glass integrated avionics system on all new Skylanes, Turbo Skylanes, Stationairs and Turbo Stationairs.

Cessna Pacific expects quick adoption by customers,especially as the option is likely to be priced in some aircraft at around the same as the current analogue offering.

Its Garmin G1000 avionics package integrates all primary flight,navigation, communication, terrain, traffic, weather and engine sensor data on two high resolution 10.4-inch glass displays.

Cessna says the system will ease pilot workload and offer a new level of safety and situational awareness during all phases of flight.

The displays are designed to provide high contrast and a wide viewing angle on both the primary function display and multi-function display in all ambient light conditions.

The heart of the system is a solid state attitude heading and reference system (AHRS), able to align while moving and restart in-flight.

The Skylane and Stationair will keep a non-electric airspeed indicator, attitude gyro, altimeter and magnetic compass as back-ups.

Cessna has decided to attack the market through aggressive pricing, with its glass cockpit Skylane 12 per cent cheaper than similarly equipped models with less advanced avionics.

Its agents must have sensed it would be a seller, ordering the whole 2004 production run and leaving Cessna to decide how it was going to boost output.

The innovative Cirrus Design company, which has been dominating single-engine sales, decided from the outset that glass cockpits were the way to go, and it has examples already in Australia.

The success of the company, snapping at Cessna's heels, recently drew the attention of *Time* magazine, which analysed its performance at a time most other GA manufacturers were struggling.

A look inside the cockpit impressed *Time*'s reporter, who noted that the instruments were displayed in a dramatically different way.

She wrote that instead of the small, round, black-and-white gauges of old, new Cirrus planes used two colourful,10-inch computer screens with pictures that conveyed vital information on speed,heading and altitude on the first, and weather, terrain and the location of other aircraft, on the second.

Cirrus says the delay in getting glass cockpits into general aviation is mainly because of the cost of adopting technologies originally developed for the military and commercial airliners.

But in recent years,it says,low-cost solid-state gyros, commercially available "glass", modern software development tools and an enlightened certification environment have made the cost more realistic.

Cirrus claims that the benefits glass cockpits deliver to general aviation pilots are quite different from those for commercial airliner pilots.

In the airline and business jet arenas the primary reason for introducing glass cockpits was reliability, delivering better dispatch rates and customer satisfaction.

Benefits such as ease of use and quicker learning were secondary at best.

Experienced airliner crews, flying almost daily and having regular regulator or company flight checks probably would mean safe operations regardless, Cirrus said.

However, owner-flown, personal transport pilots can't amass the flight time and achieve the currency of professional pilots.

Cirrus' experiences show the glass cockpit plays a different role for them – easy to fly and difficult to misinterpret.

Its idea is to avoid interpretation altogether and make the "view"through the glass window analogous to the view out of the aircraft windscreen.

Cirrus decided to use the landscape, or wide screen horizontal style,layout for the screens in its aircraft when most presentations were vertical.

Its reasons, it said, were to do with the horizon and the inexperienced and/or less current (at least in airline terms) pilots flying or learning to fly general aviation airplanes.

The idea is to get the widest horizon possible and create a compelling display that simply can't be ignored.

Despite the sales gloss, there are some potential downsides to the introduction of glass cockpits to general aviation,especially for the less experienced pilot.

In a presentation on flight training for the 21st century, the FAA noted that with increased automation the role of experience was further limited.

It emphasised the importance of pattern recognition, noting that experienced pilots more quickly discerned problems because they saw recognisable patterns.

For example,the FAA presenters said, the simultaneous failure of attitude and heading information in a single-engine aircraft immediately suggests vacuum pump failure to the experienced general aviation pilot.

However, in an all-electric glass cockpit, that set of cues might have a completely different meaning.

Cessna 182

Diamond DA 40

Diamond DA 42

Cessna mustang

Cirrus SR22 the glass cockpit is standard for all Cirrus aircraft

CASA is watching the advent of glass cockpits in general aviation with interest, highly aware that they have caused some human factors problems, especially for younger and less experienced pilots.

It says that even in airline operations, Cathay Pacific, for example, found some years ago it was easy to transition younger pilots from older models of the Boeing 747 to the glass cockpits of the 747-400.

But it was more difficult to get them to make the reverse step if they were trained initially on glass cockpits.

CASA human factors specialist Mike Nendick says good equipment design, and initial and recurrent pilot training are essential for general aviation pilots making the transition to glass cockpits.

Systems data must be kept up to date and validated.

With data cards for maps costing hundreds of dollars and reissued regularly, this could be a financial challenge for many pilots.

Although some semi-glass cockpits are already installed in the after-purchase market in Australia,there have been difficulties in finding the appropriate real estate in cockpits for screens.

And equipment is not standard, raising problems when pilots hire aircraft.

Issues such as screen size, display readability, switching between data modes and ease of manipulation of control keys and knobs – especially when workloads are high – are exercising the minds of aviation human factors experts.

Nendick says that factory installed glass cockpits might allay these problems.

Pilots will have to fix their screens if they go down.

They will also need to remember how to revert to basic navigation techniques "if it all goes blank", he says.

John Mulcair is a journalist based in Sydney.

Who do you get to find out why a rocket crashes off course? Aircraft investigators, naturally. Merran Williams reports.

Rocket science

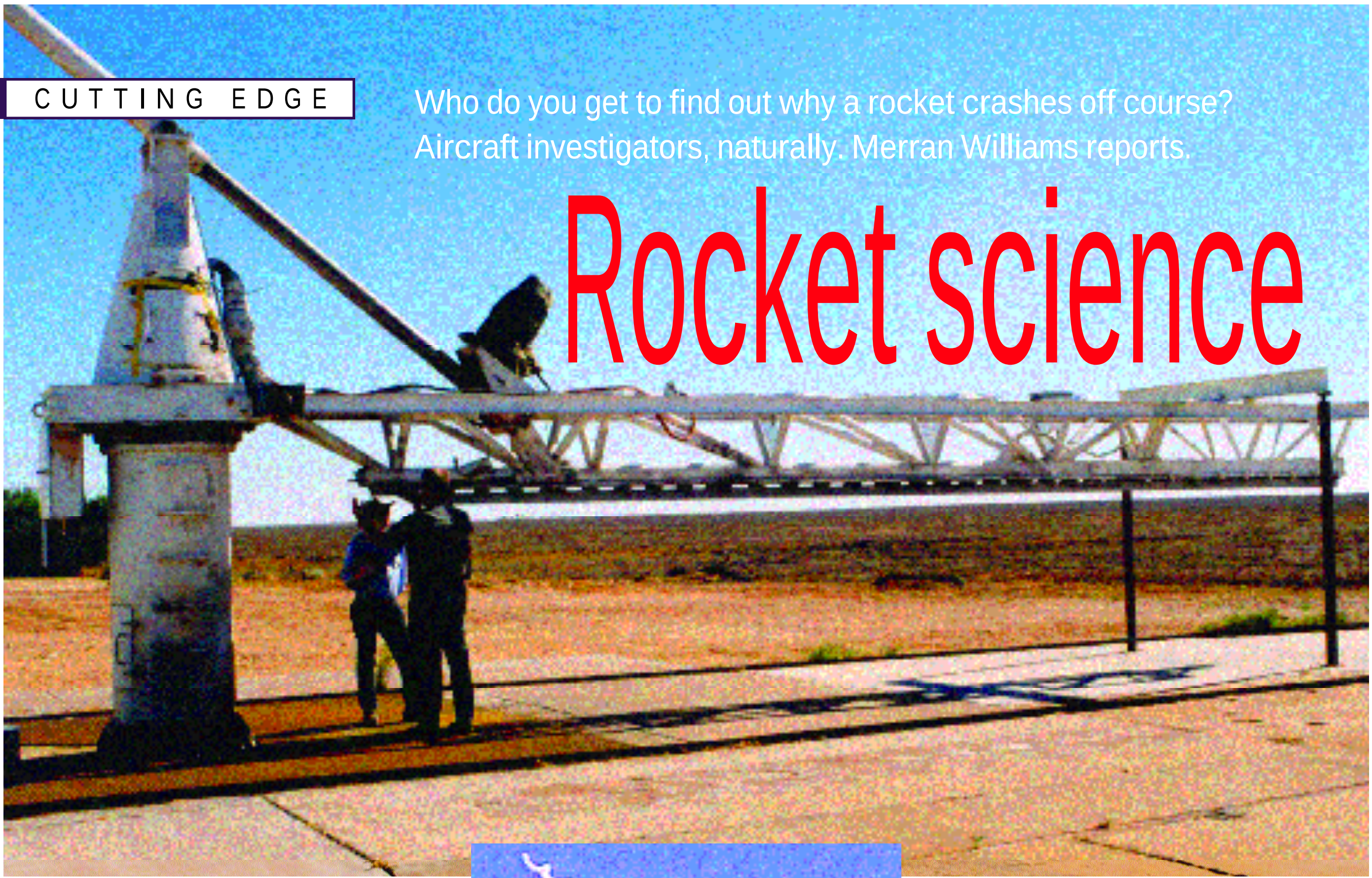


PHOTO COURTESY NEVILLE BLYTH

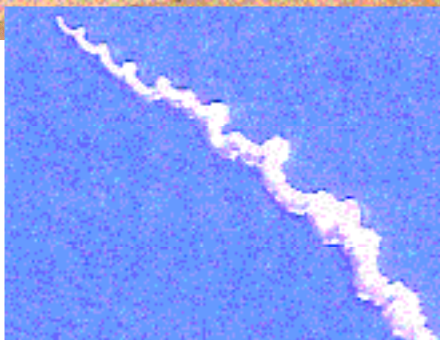
ON AN OCTOBER afternoon in 2001, a rocket soared into the sky over Woomera in northern South Australia. The two-stage solid fuel rocket contained the HyShot supersonic combustion ramjet or "scramjet" revolutionary air-breathing jet engine. US-based company Astrotech Space Operations provided the launch vehicle, while the University of Queensland (UQ) developed the experimental "scramjet" payload and organised the launch.

The first-stage booster seemed to work, although researchers noticed an anomaly in the telemetry data. But after the first stage separated and the second stage ignited, the rocket and its smoke trails seemed to curl like a corkscrew. As the rocket flew out of sight of the launch pad, it appeared to become unstable.

Shortly after the flight, the "Terrier" first stage was picked up from the intended impact area. Remnants of the first-stage fins were found to the north-east of the flight path about three months later.

"Orion", the second stage, carrying the payload, was found the following month about 28 km east of the Stuart Highway. The stage was 100 km north-west of the launch site, 273 km short of the distance it was expected to travel.

To find out what went wrong, the Federal Government launched the first, and so far only, investigation ever held under Australia's Space Activities Act. The legislation provides for the relevant minister to appoint an investigator to examine the circumstances surrounding an accident or incident. The investigator can then invite qualified people to contribute their expertise to the investigation.



The corkscrew effect Not a desirable result.

According to the director of the Space Licensing and Safety Office (SLASO), Mike Green, the legislation was written with the Bureau of Air Safety Investigation,now the Australian Transport Safety Bureau, in mind. It was recognised that the ATSB could provide the relevant skills and experience,as the principles of aircraft accident investigation could be transferred to the investigation of space object accidents.

ATSB senior transport safety investigator Neville McMartin embarked on an intriguing search for answers.

"We approached it as we would approach any investigation," he recalls. "We started with interviewing witnesses onsite at Woomera, gathering data and dealing with the usual issues that come up. Because we weren't across all these issues, we looked for an independent advisor to provide information on risk analysis and how it related to the rocket launch."

ATSB investigator and failure analysis specialist Neville Blyth was given the job of investigating the technical aspects of the accident. Initially there was little to see, as only small parts of the rocket had been recovered.

When the larger rocket parts were found in the following months, Blyth and ATSB team leader and engineer Joe Hattley visited Woomera and examined them in detail, looking for impact marks and noting how the components had reacted with each other in flight.

"Physical evidence can be as useful as evidence from a flight data recorder," Blyth says."Referring to the behaviour of the physical components can help you see how a rocket ends up as wreckage."

Blyth was fascinated to follow the NASA investigation into the recent shuttle disaster, because he saw similarities with the HyShot accident.

Fin failure – from pre-launch insecurity

"Like the shuttle, the HyShot vehicle broke up during flight and the wreckage was distributed over a big distance," he says. "You saw aerodynamic heating due to the velocities involved and NASA looked at the accident as they would a major aircraft investigation. They laid physical evidence out in a big hangar and considered how it (components) had burnt,how it had twisted."

While the HyShot investigation did not have the luxury of NASA's resources or the chance to carry out destructive testing, it didn't take long before the investigators found a glaring inadequacy in the design of the fins used on the rocket's first stage.

"It became increasingly clear that the failure of the fins was a result of a failure of engineering," Blyth says.

The investigation found that the fixed fin support structure had broken up during the flight on the first stage because of an overload through the fixed fin spindle sockets. Instead of using the smaller standard Terrier fins, large Nike fins had been fitted to the rocket because it was thought the Nike fins would provide greater stability.

The Nike fins were designed to secure to the leading side of the fin base, while the original Terrier fins were designed to fasten to the trailing side.

No pre-existing defects were found within the physical structure of the fin support, but some of the fin journal sockets seemed bent, suggesting movement or rotation of the fins during flight.

Marks and damage around the fixed fin adjustment lug mounting points indicated in-flight movement and possible insecurity of the fin adjustment lugs. Crushing damage of the fin rib sections beneath the lug mounting set screws was possibly pre-flight damage that might have contributed to the in-flight movement. The Nike fins used on the first stage were not designed to secure to the booster rocket and there was no reinforcement or other strengthening features.

The investigators concluded it was likely that the first stage Nike fins either sustained damage from aerodynamic overload due to their movement during flight, or the fin structure was unable to support the increased aerodynamic load of the larger Nike fins.

For the second, successful flight of the HyShot scramjet in July 2002,the first-stage fins were given increased physical support and the period between dropping the first stage and igniting the second stage was increased.

Another scenario considered by investigators was that sandbags or rocks blown up by the launch could have damaged the first stage fixed pins. This would have made the second stage unstable when it separated,and prevented it from reaching stabilised flight.

Investigators reviewed video and stills that showed sandbags being disturbed by the launch. But it was impossible to tell whether they caused a rock to hit a fin.

The HyShot's problem launch also taught the researchers and regulators a lesson in specialist risk assessments. The investigation found that, although the risk analysis conducted by UQ allowed for failure of the first stage and non-ignition of the second stage, it did not cover the possibility of the rocket malfunctioning and veering off course.

The university acknowledged during the investigation that it had not specifically considered the possibility of the rocket crashing near the Stuart Highway. The impact site of the second stage and payload was just 28 km from the highway, which was open to traffic at the time.

The final report on HyShot recommended that SLASO require all Australian launch operators to submit a comprehensive risk hazard analysis for independent verification before a launch is approved, and consider requiring the release of the analysis to all those involved in the project for review and discussion.

As Australia's fledgling space industry takes off during the next decade, the Space Activities Act and associated regulations will play an important role in creating a safe environment for testing and research. ATSB investigators plan to keep a close eye on developments and look forward to sharing the safety lessons learned in aviation to ensure a successful space program.

Adapted from a report into the anomaly of the HyShot rocket at Woomera on 30 October 2001. The full report can be downloaded from the Space Licensing and Safety Office website at:
http://www.industry.gov.au/space

PHOTO COURTESY NEVILLE BLYTH

UNIVERSITY OF QUEENSLAND/CHRIS STACEY

Aiming for the stars HyShot II prepares for launch. Thanks to lessons learned from the investigation, modifications improved the security of the Terrier (first stage) fins and contributed to a successful mission.

Keeping dangerous goods safe

NEW RULES about carrying dangerous goods on aircraft have brought Australia into line with new International Civil Aviation Organization standards.

The rules cover training, documentation, record keeping and incident reporting, as well as provisions for packing, marking, labelling, and loading and stowage in aircraft.

CASR Part 92 came into effect on January 1, coinciding with the commencement of the latest edition of the International Air Transport Association Dangerous Goods Regulations. It replaces regulations 262A to 262V of the Civil Aviation Regulations 1988.

Part 92 includes specifications for dangerous goods training. Some additional courses and instructors need to be approved by CASA.

By July 1 this year, all staff involved in packing dangerous goods must have received training in a CASA-approved course. Part 92 also requires travel agents to display dangerous goods information to customers and include this information with passenger tickets.

Key changes effective from January 1 are:

- cabin crew dangerous goods training courses to be approved by CASA
- some additional aerial work operators to maintain a dangerous goods manual
- a reduction in training interval for ramp staff
- additional flexibility in arranging for employees' dangerous goods recurrency training
- automatic exemptions for certain operators from the requirement for dangerous goods training and for certain types of operation
- extra flexibility for private operators/pilots, who must still ensure dangerous goods are carried in proper condition
- automatic exemptions for groups, such as emergency and police services to carry certain equipment
- display parachute jumpers carrying certain flares no longer require CASA approval.

Key changes effective from July 1 are:

- shippers required to undertake approved dangerous goods training courses and to maintain training records
- travel agents to provide information relating to dangerous goods
- airport terminal owners/operators must display information relating to dangerous goods.

Those affected are:

- AOC holders
- ground handling agents
- freight forwarding agents
- dangerous goods training providers
- shippers of dangerous goods (see AC 92.1(0) dangerous goods training through link on website)
- security screening organisations
- airport terminal owners/operators (see CASR 92.200 through link on website)
- private operators/pilots,(see CASR 92.175 through link on website)
- travel agents (see CASR 92.205 through link on website).

Full details of the new regulations and actions needed to comply with them are available at casa.gov.au/transition/parts/92.asp or contact your nearest dangerous goods inspector on 131 757.

CASA dangerous goods inspectors are based in Brisbane (Bob Timmins for Qld), Melbourne (Adrian Tusek for Vic/Tas), Perth (Ben Firkins for WA, SA and NT), Sydney (Karen Scrimes for NSW) and Canberra (Paul Steele for CASA Standards).

You can also download CASA's dangerous goods poster through a link on the website.

Manufacturers move to new rules

COMPANIES INVOLVED in the manufacture of aircraft and components have now moved to new rules that bring Australia into line with international manufacturing certification standards.

Under the new rules, makers of all things aeronautical, from threaded inserts to engines, and from life jackets to locally built aircraft, now have approvals that are recognised worldwide.

Rather than all coming under the one type of approval, as in CAR 30, all manufacturers now receive specific production approvals for the types of parts or products manufactured.

The new regulations, under subparts of CASR (1998) Part 21 – certification and airworthiness requirements for aircraft and parts, came into effect on December 1, 1998. From that date all new applicants for production approval had to apply for approval under CASR Part 21.

Existing CAR 30 manufacturing approval holders were given a five-year period to transition to a CASR Part 21 approval, which ended on November 30 last year.

During 2002, CASA invited 118 organisations to briefings and workshops to prepare them for transition. Sixty-two organisations declared an interest in moving to the new rules, and subsequently applied to switch to a Part 21 approval.Each of these organisations was case managed during the transition process, with agreed assessment dates and times set.

CASA assessed each organisation's manufacturing quality systems and design justifications for the manufactured items.

The safety regulator had to be satisfied with the design data approved by an authorised person.

By the November 30, 2003 deadline,CASA had issued CASR Part 21 production approvals for 11 production certificates , three one-off production certificates, 14 Australian parts manufacturer approvals, nine process approvals and four Australian technical standard order authorisations.

Thirty-seven organisations successfully completed the assessments, with some gaining multiple approvals. Seven chose to discontinue their applications. A further 21 organisations did not meet the requirements by the deadline, but are continuing the transition process.

GPS approaches for new generation aircraft

BOEING

HISTORY WAS MADE in December when CASA issued an approval for Qantas B737-800 aircraft to conduct GPS non-precision approaches.

Captain Ian Brinkworth is the first Qantas pilot to be awarded a GPS NPA endorsement on the B737.

"This is the culmination of more than 14 months of work to make GPS approaches available to new generation aircraft such as the 737-800," says Ian Mallett, head of aerodrome and CNS/ATM standards at CASA.

Australia now has some 550 GPS approaches, with the safer, straight-in designs available at all licensed aerodromes. More are being added on almost a daily basis.

"While general aviation has had access to this technology for five or six years, it was the introduction of the B737 New Generation to the Qantas and Virgin Blue fleets that initiated this project," says Mallett.

Earlier models of the B737 were not equipped with GPS but the NGs (-700s, -800s and BBJs) are built to take advantage of satellite navigation.

"We quickly discovered that GPS NPAs for these new generation aircraft was going to be more complex than we imagined," Mallett says.

The equipment functions differently from the TSO-C129 A1 receivers commonly used by GA and regional airlines. Technology-related issues included GPS integrity monitoring, display scaling and crew alerting.

"The project has involved staff from across CASA, as well as Qantas, Virgin Blue, Boeing, RAAF, the FAA, Transport Canada and various International Civil Aviation Organisation panels and agencies," Mallett says.

"This is just the first step in an ongoing consultative process. Work on approvals for Virgin Blue 737NGs, as well as other aircraft types, such as the A330, has already begun and will continue into 2004."

The outcomes of the work were presented to ICAO at the recent 11th Air Navigation Conference in Montreal. Issues over the use of Required Navigation Performance (RNP) operations will be addressed at the newly established RNP Study Group that will meet early this year.

Enhanced security package announced

THE FEDERAL GOVERNMENT will introduce background checking and new photographic licences for pilots by July this year as part of new measures to tighten aviation security.

The $93 million aviation security package was announced by Transport and Regional Services Minister John Anderson in December.

The background checking will be the same as that used for aviation security identification cards already issued to airport employees working in security-sensitive areas.

Pilots will bear the cost of the checking and photographic licences.

Departmental security investigators will audit compliance and carry out random checks on pilot licensing.

Sport aircraft pilots will not have to undergo background checking and will not be issued with photographic licences.

The Federal government also plans to boost regional airport security, with all of the nation's 180 passenger-handling airports to be regulated.

The new regime will also cover operators of freight aircraft, charter flights, and private and corporate jets.

New freight-screening technology will be trialled, with more rigorous checks on domestic freight.

Operators will be required to install hardened cockpit doors in all regular passenger and charter aircraft with more than 30 seats. The government will fund the doors on non-jet regional aircraft.

Systems approach

AS THE new regulations evolve and the aviation industry world-wide moves to a "systems" approach to safety and performance monitoring, CASA has been reviewing its approach to compliance auditing.

After extensive research CASA is now implementing a philosophy of systems-based auditing, designed to look not just at what operators do but also how they go about meeting regulatory requirements.

The March/April issue of *Flight Safety Australia* will feature an in-depth article on the background to this systems approach, how it works in practice and the benefits expected for industry and CASA.

Airspace answers

Airspace reforms introduced on 27 November 2003 generated almost 1,500 calls to the National Airspace System Implementation Group's 1800 helpline. Mike Smith answers the most frequently asked questions.

What SSR code should I squawk?
From AIP ENR 1.6 – 9:
"8.1.3. When operating in Australian airspace, or on reaching the Australian FIR boundary if inbound to Australia, pilots of Mode 3A and 3C transponder-equipped aircraft must ensure that the assigned temporary discrete code for that flight sector, or the appropriate non-discrete code from the following listing is selected:
a. civil flights in controlled airspace – 3000
b. civil IFR flights OCTA not participating in RIS – 2000
c. civil VFR flights OCTA not participating in RIS – 1200
d. military flights in controlled airspace – 5000
e. military flights OCTA not participating in RIS – 6000
f. civil flights not involved in special operations or SAR operating OCTA in excess of 15 nm offshore – 4000
g. civil flights engaged in littoral surveillance – 7615"

In Class C airspace, ATC will assign pilots discrete SSR codes.

What is an appropriate frequency to monitor?
An appropriate frequency to monitor is one that gives you the best situational awareness or SAR. When operating near an airport monitor the CTAF, MBZ or tower frequency.

If I cannot contact Flightwatch, who do I contact?
Contact ATC on the nearest frequency indicated on the ERC-L charts in a frequency box.

Where ATS airspace classes adjoin vertically (Class E over Class D and Class E over Class G) what requirements exist at the common level?
ENR 1.4-2 refers:
1.1.7 When ATS airspaces adjoin vertically (one above the other), flights at the common level must comply with the requirements of, and the services provided will be in accordance with the airspace of lower alphabetical classification (where A is the highest and G is the lowest).

Where Class E airspace is above Class G at 8,500 ft, then at 8,500 ft pilots must comply with the requirements of Class G airspace. Pilots of VFR flights are allowed to fly at 8,500 ft as it is uncontrolled airspace.

Where Class E airspace is above Class D airspace at 4,500 ft the requirements of Class E apply.

For pilots of VFR flights, what is provided when you ask for a Radar Information Service (RIS)?
The Radar Information Service (RIS) is a service provided by ATC within radar coverage. It provides traffic, position and navigation informationto flights not receiving a separation service and is available to improve situation awareness and assist pilots in avoiding collisions with other aircraft. The service may be provided to VFR flights in Class E and G airspace (see sub-section 2.16). ATS will assign a temporary discrete code for each aircraft participating in Radar Information Service (RIS).

When should VFR flights submit flight notification?
VFR flights planning to operate into Class C or Class D airspace require a clearance. By submitting flight notification you will facilitate the timely provision of a clearance.

As a VFR pilot, can I contact ATC by radio if I need to?
Air traffic controllers are always ready to provide a range of services to the VFR pilot who needs assistance, so don't be afraid to ask if you need their help.

For operations over water, who do you make SKED reports to and what SSR code do you squawk?
SKED reports should be made to ATS on the ATS frequency. Civil flights not involved in special operations or SAR operating in uncontrolled airspace in excess of 15 nm offshore should squawk code 4000.

How can I check the serviceability of my transponder?
When operating in radar coverage, you can seek confirmation from ATC. Outside radar coverage you should ensure that you have your transponder checked as part of routine maintenance.

Where can I get further information?
If you've got a question about airspace reform, contact the National Airspace System Implementation Group through the Commonwealth Department of Transport and Regional Services on (02) 6274 7111, or go to www.dotars.gov.au/airspacereform.

Mike Smith is executive director of the National Airspace System Implementation Group

Air fair

CASA is bringing in a fairer system for enforcing safety rules, writes Bruce Byron.


FIZER PHOTOGRAPHY

THE FEDERAL GOVERNMENT'S new system for enforcing civil aviation law comes into effect on February 21.

The reforms give CASA a more balanced set of enforcement tools while opening up the regulator's decisions to closer scrutiny.

The aim is a fairer system, in which "the punishment fits the crime".

Under the reforms, people who voluntarily report inadvertent breaches of the regulations to the Australian Transport Safety Bureau (ATSB) will generally be protected from enforcement action for those breaches, following a similar system in place in the United States.

In situations in which CASA must suspend a person's certificate or licence because of a serious and imminent risk to air safety, CASA must seek an order from the Federal Court to extend the suspension beyond five business days.

In other circumstances,CASA's decisions to vary, suspend or cancel certificates or licences "for cause" will be stayed automatically for at least five business days, or until any appeal against the decision is heard by the Administrative Appeals Tribunal, enabling people to continue in business while the appeal proceeds.

CASA will be able to seek undertakings from those in the aviation industry who are not compliant with the civil aviation law but are willing and able to work constructively with CASA to become compliant. These arrangements will be enforceable by the Federal Court.

And, much as in the road rules, those fined for breaching the civil aviation regulations will incur demerit points against their certificates or licences (see table below). Repetitive breaches within a fixed period can result in certificates or licences being suspended or, ultimately, cancelled.

If within a three-year period a person or organisation has 12 or more points recorded against them, they will automatically have their licence or certificate suspended for three to five months.

If a person or organisation has their licence or certificate automatically suspended three times, their licence or certificate will be cancelled, and they will be unable to apply for a new one for three years.

A new approach The system represents a new philosophical approach to enforcement,an approach based on my belief that:

• A person who reports making an honest mistake generally should not be prosecuted or fined, and should not have their licence, certificate or authority suspended or cancelled.

• There should be a measured response to less serious contraventions of the safety rules that should involve counselling, warnings, training, infringement notices or enforceable voluntary undertakings, rather than criminal prosecution or the suspension or cancellation of licences, certificates or authorities.

• People who deliberately operate outside the rules or who put the lives of fare-paying passengers at risk should be prosecuted and, if necessary, be removed from the industry – no matter how powerful they are, or are seen to be.

Most industry players are committed to working within the safety rules. The new enforcement tools will enable CASA to focus its limited resources on major breaches with real safety implications.

Introducing the amendments into Parliament, Transport Minister John Anderson said the new enforcement measures preserve CASA's powers to act when there is a serious and imminent risk that could jeopardise safety.

"It is important that CASA has sufficient power to act quickly in such cases," he said.

"I am confident that these new enforcement measures will strike the appropriate balance between enhancing natural justice and maintaining CASA's powers to take action on safety breaches.

"The bobby on the beat is there to keep the peace in an amicable and confidence-inspiring way; he must always carry a truncheon, but it's there for those who flout the rules, not to intimidate the people who want to do the right thing."

I have arranged for a detailed series of question and answers about the new enforcement changes to be placed on CASA's website (www.casa.gov.au).

I urge you to take the time to visit the website and find out more about the changes. In addition I have arranged for a hard copy of these questions and answers to be available at each of CASA's area offices.

Bruce Byron is the chief executive officer of CASA.

Penalties, fines and demerit points

Penalty in regulation	Maximum fine that may be imposed by a court on an individual	Maximum fine that may be imposed by a court on a body corporate	Infringement notice penalty	Demerit points incurred
5 penalty units	$550	$2750	$110	1
10 penalty units	$1,100	$5500	$110	1
15 penalty units	$1,650	$8250	$330	2
20 penalty units	$2,200	$11,000	$330	2
25 penalty units	$2,750	$13,750	$330	2
30 penalty units	$3,300	$16,500	$550	3
35 penalty units	$3,850	$19,250	$550	3
40 penalty units	$4,400	$22,000	$550	3
45 penalty units	$4,950	$24,750	$550	3
50 penalty units	$5,500	$27,500	$550	3

Demerit points are automatically incurred on payment of an infringement notice or when found guilty of an offence.

Baby on board

Parents flying with babies face tough decisions, writes Helen Waddington.

ANOTHER BUSY holiday season in Australia. Plane loads of families cross the country to join loved ones or escape them. Those flying with infants face decisions about the best way to keep their little ones safe.

Supplementary loop belts – also known as infant seatbelts – must be used for all infants carried in the arms of adult passengers. The belt has a stitched loop through which the adult belt is passed. It is fastened around the infant and attached to a fully secured adult seatbelt.

In Australia, airlines provide the special belts.Flight attendants brief parents on the belts' use,and,if necessary, help with fitting them. However, there is a limit to the number of infants allowed to be carried. For example, one airline's 737s carry only eight supplementary loop belts.

There has been some confusion over regulations governing restraint of infants carried in the arms. Civil Aviation Order 20.16.3 states: When an infant is carried in the arms or on the lap of a passenger … the seatbelt, when required to be worn,shall be fastened around the passenger carrying or nursing the infant, but not around the infant.

This CAO should not be construed as allowing an infant to travel unrestrained in an aircraft. Regulations require all passengers and crew members to be restrained. The intent of the CAO is to make it clear that the adult seatbelt cannot be used to restrain the baby. If the seatbelt was passed around both the parent and child, the parent would crush the child against the restraint if the aircraft stopped suddenly, in a rejected take-off, for example.

To avoid confusion, CASA recently issued CAAP 235-2(1) to clarify the regulations, responsibilities of the carrier and correct use of child restraint systems. You can view the document at: http://www.casa.gov.au/download/caap/ops/235_2

However, in a serious but potentially survivable accident, supplementary loop belts do not keep children as safe as adults. In an accident,a parent holding a child would fold forward around their own seatbelt. The baby would be crushed between the parent's chest and thighs. However, the belts protect babies from being thrown around the cabin in turbulence or in a crash. Under crash conditions, G forces make a 10 kg child effectively weigh 90 kg, a weight impossible for a parent to hold.

Although the current system has restraints for even the smallest infant, the safest choice is for the child to travel in its own seat with a standard infant-restraint car seat. This would give them the same protection as adults.

The use of infant seats on certain flights is a matter between airlines and passengers, however, and many child restraints do not fit in or cannot be fully secured to aircraft seats.

Child seats currently acceptable in Australia include those complying with Australian design standard AS/NZS 1754 for infant car seats.

These seats must be secured in the aircraft in a manner consistent with the manufacturer's design criteria. This standard requires that a top tether, in addition to the fastened lap belt, be fitted. However, airline seats have no way of attaching the top tether, and there is seldom any suitable aircraft structure to which to fasten it. If the securing of a child seat in an aircraft involves more than using the aircraft lap belt,the design of the installation must be approved as a modification to the aircraft under regulation 35 of CAR 1988.

Other seats not requiring a top tether are also acceptable. These include seats accepted by the US Federal Aviation Administration, seats approved to Canadian Motor Vehicle Safety Standard, seats accepted by the UK Civil Aviation Authority and those meeting European Safety Standard requirements of ECE Regulation 44.

Any child or infant seat must be installed in accordance with the seat manufacturer's instructions. Parents should check with the airline when booking to ensure the infant restraint seat can be correctly secured.

CASA plans to conduct tests to see if normal Australian child car seats could be used without the top tether.

"Even without the top restraint,the automotive child seat has a good chance of providing much better protection for the child than is provided by a supplementary loop belt," says David Villiers, of CASA's airworthiness standards branch.

There is a drawback to this approach, however. Currently, infants who travel on their parents' laps travel free. An infant restraint seat occupies an airline seat of its own, for which parents have to pay.

Protection for children in airliners is a big issue worldwide. In Canada, research is under way into a lightweight, stowable, folding seat made of composite material that fits into all aircraft seats. Another initiative is a German prototype called the "tyke tube" – an inflatable tube,fixed to the adult passenger, into which the infant is placed.

The tube is intended to prevent the adult from crushing the infant. German researchers have also developed another inflatable seat,called a "Luftikid".

None of the systems provides the same level of protection as is required for adults, however, and none is currently approved.