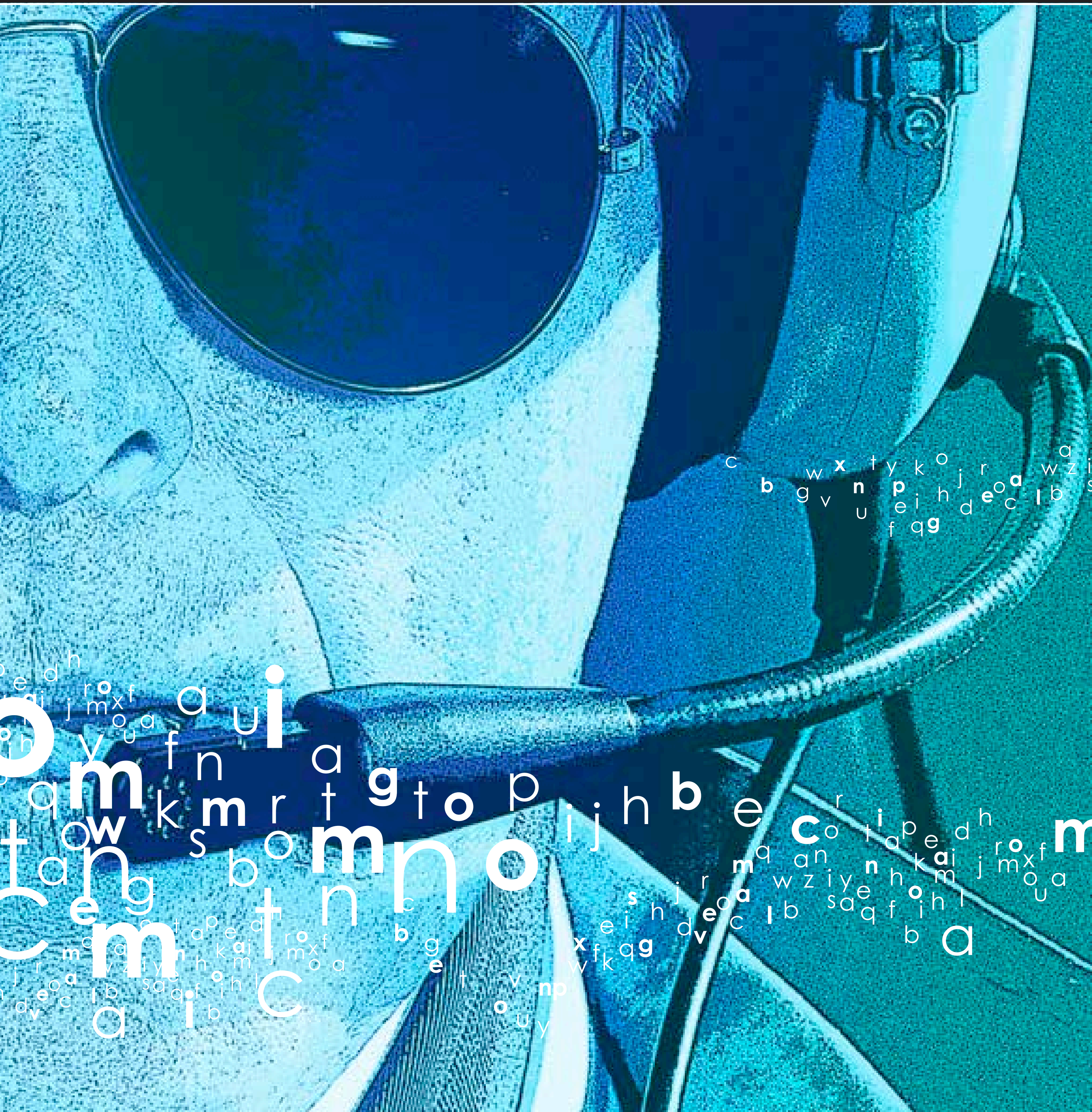
flightsafety australia

88 | September–October 2012

Aviation communication | mind your language

Fatigue regulations | wake-up call on fatigue rules



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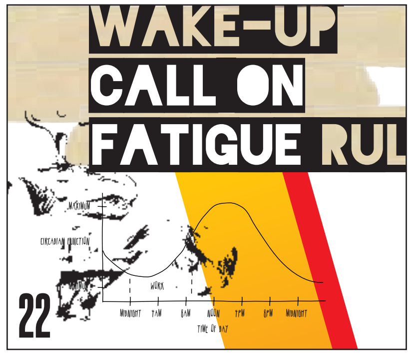

FEATURES

REGULARS

AIR MAIL

From the editor

After the distribution of the last printed issue of *Flight Safety Australia* (July-Aug 2012), we had feedback from various passionate readers. Some welcomed the decision, some were angry, and others like Ian Jennings, were philosophical.

It is with deep regret that I note the passing of the 'Crash Comic', a publication that I have been holding in my hands to read for the last 40 years. I understand the reasons for its demise from my letterbox and now I look forward to its arrival in my in box. That's progress!

Glenn Batson was *saddened to hear that a hard copy of* Flight Safety Australia *will no longer be mailed. I believe this is a bad move and I will not be going online to read the new format. A sad day for safety in Australia.*

Another reader gave some bouquets for the magazine, as well as considered comment.

I have long enjoyed Flight Safety Australia *as the most clearly, intelligently and accurately written flying magazine available, and I do literally read it from cover to cover. I find that many aviation folk, including students, also read it thoroughly because of the admirable balance of content.*

While I am fully supportive of the environmental and probable cost benefits of phasing out the hardcopy magazine I have a couple of minor observations:

- *A magazine is highly portable, unbreakable and does not need a power supply*
- *While most information sources are favouring online transmission I am not convinced that such material is 'taken in' as effectively in terms of the learning process.*

Joerg Hofmann wrote: *I am rather dismayed to hear that* Flight Safety Australia *magazine will be discontinued—the printed version, that is. I think this is a retrograde step for promoting a strong safety culture in aviation. True, there has been an increasing trend of media going online, but let's not forget that people are very selective in what they read online.*

We at *Flight Safety Australia* assure readers that although the magazine may have changed its delivery method, our focus on providing clear, accurate and intelligent content has not changed.

flightsafety australia

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FLIGHT BYTES

Safer skies for children

CASA is exploring the best ways of protecting infants and small children in aircraft, and will be publishing a discussion paper on the topic. Advisory material on infant and child safety will also be updated and improved to provide guidance on child safety best practices and newly available restraints.

The method of carrying infants and small children in aircraft has not changed substantially since the early years of aviation, although there have been major advances in child safety in other forms of transport such as motor vehicles.

Evidence from accidents and research says children who are carried on the lap of an adult passenger are likely to be more severely injured in an accident than other passengers. Other research says that seating small children individually on an aircraft seat may not be appropriate. CASA has been working with Standards Australia on a revision to standards for motor vehicle child restraint systems to allow them to be used in aircraft. New standards would include testing of seats in an aircraft-like environment, restrictions on dimensions, and instructions on how to fit seats in aircraft. This would allow restraints to be marked as acceptable for aircraft use.

Find out more about the **infant and child safety** project CS12/23 on the CASA website under **changing the rules > active projects.**

AAGSC Safety Award

Nominations for the Australasian Aviation Ground Safety Council Safety Award are now open. You can nominate an individual or a team who have made an outstanding contribution to improvements in ground safety. The Australasian Aviation Ground Safety Council would like to recognise them so that all can learn from their initiatives. The award celebrates outstanding contributions to, and significant improvement in, ramp safety through innovation and implementation of new methods, practices or procedures.

Previous entrants have received national and international recognition. Queensland Airports Ltd, Aviation Ground Handling and Gold Coast Airport received coverage in international ground handling magazines, while Virgin Tech's entry featured in *Flight Safety Australia* magazine.

Entries close Friday 28 September 2012—go to **www.aagsc.org** for details.

Eyes in the sky

Good visual function is critical for safe aviation activities. Many eye abnormalities are easily correctable to restore good functional vision. *Flight Safety Australia* covered the topic of (refractive) eye surgery extensively in the November-December 2010 issue (**www.casa.gov.au/fsa**).

However, following such surgery, as a pilot, you need to:

- Report it to your DAME/CASA
- Not go flying—for at least a minimum of four weeks, to three months (most recreational activities are not recommended for four weeks minimum). This is because:
  - There is a risk of damage—the flap is subject to slippage in the first few days to weeks, even months, post surgery and this could be caused by even such minimal trauma as eye rubbing.
  - You may experience glare disability and haloes following refractive surgery. If you are flying at night, or in poor light, you may therefore experience an unacceptable loss of visual acuity or image degradation.

While eye examinations are only mandatory for Class 1 medical certificate holders at initial issue, then biennially from age 60, it pays pilots to have regular check-ups, to diagnose and treat conditions such as glaucoma, cataracts and retinal abnormalities early.

Source: AvMed CASA

Stormy weather

Aircraft turbulence guidelines may need rewriting after new research by the Sydney-based Centre of Excellence for Climate Systems Science chief investigator, Dr Todd Lane, revealed that thunderstorms could produce unexpected turbulence more than 100km away from storm cells.

Lane's research has highlighted the impact of atmospheric gravity waves caused by thunderstorms and how air safety guidelines have not taken them into account.

'It is likely that many reports of encounters with turbulence are caused by thunderstorm-generated gravity waves, making them far more important for turbulence than had previously been recognised,' Dr Lane said.

'Previously it was thought turbulence outside of clouds was mostly caused by jet streams and changes in wind speed at differing altitudes, known as wind shear, but this research reveals thunderstorms play a more critical role', he said.

Lane said it is now recognised that thunderstorms have far-reaching effects, modifying airflow, strengthening the jet stream and enhancing wind shear at a significant distance from the storm cell itself.

Flights along domestic Australian routes and international routes across the tropics towards Asia and between Australia and the US regularly detour around storm cells.

However, this research indicates they may still be close enough to encounter gravity waves and clear-air turbulence.

This unexpected turbulence mid-flight can lead to passenger injuries, with around 97 per cent of injuries caused by turbulence during flight occurring because people are not wearing seatbelts. On average, around 15 people are injured every year due to turbulence.

Beyond the immediate safety concerns, it has been estimated that turbulence costs the aviation industry more than $100M a year globally due to associated rerouting and service checks.

Source: **http://phys.org/news/2012-06-storm-air-safety-guidelines.html**

Boarding soon – electronic flight bags

CASA has recently released a notice of proposed rulemaking (NPRM 1211OS) on the use of electronic flight bags (EFB).

CASA has previously released a civil aviation advisory publication (CAAP) on electronic flight bags to an industry forum made up of major and some smaller operators and industry groups such as the Aircraft Owner's and Pilot's Association.

Mal Read, project manager, says the regulations are framed around what the devices are used for, rather than the hardware or software type.

'Last year the International Civil Aviation Organization (ICAO) reconvened their EFB group, as there was recognition that regulators needed to consider the introduction of the tablet computer', says Read.

'We are proposing to adopt ICAO's four levels of functionality. Function level 1 is basically a document viewer; function level 2 adds some software such as weight and balance and performance calculations; function level 3 can also read data from the aircraft; and function level 4 is a two-way link with the aircraft.

'The regulations will be introduced in stages, with pilots and companies first making use of EFBs at levels 1 and 2.

'We will require air operator certificate (AOC) holders to develop procedures and guidance in their operations manuals, with other users such as private pilots to follow the CAAP.

'Our intent is to create regulations that maximise the advantages offered by new technology, while minimising the risks.

'A trial into the use of EFBs is currently underway with Qantas and Jetstar.

Comment on NPRM 1211OS is due by mid-late September; go to the **changing the rules** section on the CASA website.

Global aviation needs global standards

Performance based navigation (PBN) is one of the International Civil Aviation Organization's (ICAO) highest priorities, with a major push to implement global PBN standards to realise the full benefits this technology offers. PBN encompasses a shift from ground-based navigational aids emitting signals to aircraft receivers, to a system that relies more on the performance and capability of equipment on board the aircraft. It brings numerous safety, economic and environmental benefits. Increased airspace safety and efficiency come with the implementation of a common global standard that includes stabilised approach procedures using vertical guidance. The accuracy of PBN allows more efficient and flexible use of airspace, with less reliance on ground-based navigation aids, bringing optimal route placement, fuel savings and environmental benefits.

As part of this global shift, and following an extensive consultation process, CASA is implementing two Civil Aviation Orders (CAO): CAO 20.91 (which covers PBN standards and the associated navigation authorisations) and CAO 20.18, which will mandate the equipment required for PBN and ADS-B from February 2016. CAO 20.91 came into effect on 18 July 2012, with CAO 20.18 imminent.

The introduction of PBN affects all stakeholders involved in IFR flight operations. 'In Australia, if you've got a GNSS-equipped aircraft approved for IFR operations, then you are good to go without any changes. That's why there are deeming provisions in the CAOs,' says CASA's PBN specialist, Ron Doggett.

'The deeming provisions say if you've got a TSO-certified, stand-alone navigation system that's been fitted according to the regulations and you're a suitably qualified pilot, you are deemed to hold the required navigation authorisations.'

Existing navigation authorisations remain valid for two years under CAO 20.91 unless they lapse or are replaced. After those two years expire, PBN navigation authorisations will be required.

However, aircraft with flight management systems (FMS), such as some newer commuter/regional aircraft, will need to obtain navigation authorisations from CASA. The PBN standards also provide for IFR helicopter-specific operations such as in metropolitan areas and for offshore support.

Further information

Advisory circulars to support CAO 20.91 are due in the near future.

November-December 2012's *Flight Safety Australia's* feature will also focus on PBN and airspace reform.

New – and available now! Safety reminders for your hangar walls

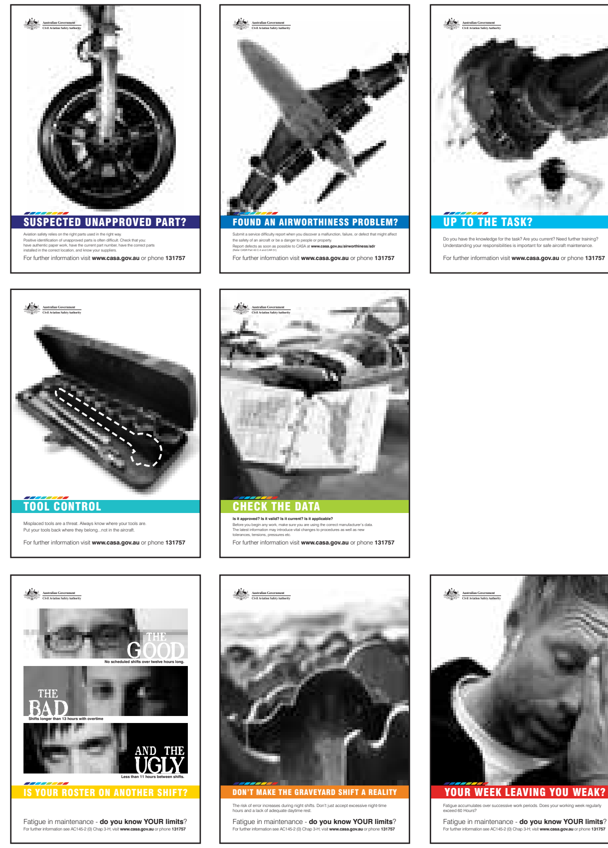
Eight new A3 posters designed to promote the importance of safety in aviation workshops have just been released. They depict vital maintenance safety issues, such as tool control, fatigue management, unapproved parts and using the correct data, and are available from the CASA online store **www.casa.gov.au/onlinestore**

A test panel of engineers and industry members said that their somewhat humorous/quirky take on safety messages would appeal to maintenance professionals and remind them to think outside the box and avoid complacency.

The posters are free of charge but a $15 postage and handling fee applies to orders of any size, so you can add other useful items from the online store.

Coming soon – learning and event management registration

CASA's new online learning and event management registration system is set to go live later in the year, providing industry with a streamlined registration process for seminars and other events, along with access to online learning modules. Look out for more information in the November-December issue of *Flight Safety Australia*.



MIND YOUR LANGUAGE

言語を気にしなさい

KÜMMERN SIE SICH UM IHRE SPRACHE

LET OP UW TAAL

OCCUPI DEL VOSTRO LINGUAGGIO

Occupez-vous de votre langage

In a crowded sky, what you say and how you say it are as important as how you manage the controls. Likewise, in an industry where lives depend on complex machines functioning perfectly, the instructions on how to maintain them are vitally important. Your words matter—make no mistake.

About this, Wilbur Wright was wrong. 'I know of only one bird—the parrot—that talks; and it can't fly very high,' the pioneer of powered flight said in declining to make a speech. Aircraft may fly because their wings move through the air—but they fly safely because of clear communication.

Pass your message: the spoken word

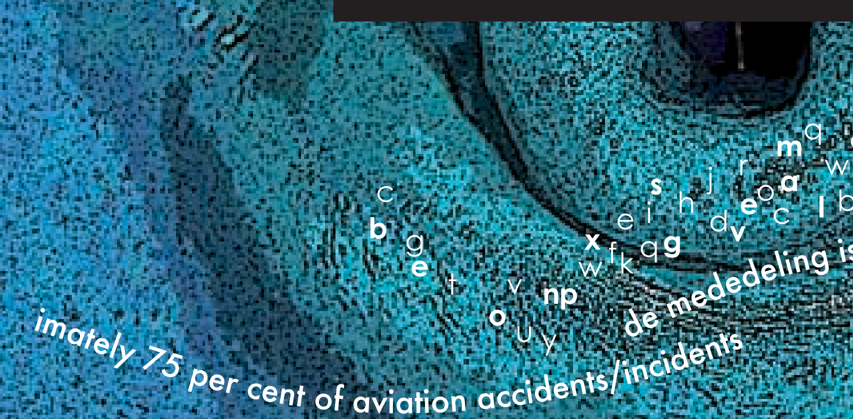
The International Civil Aviation Organization's (ICAO) resolution A37-10 requires 'Proficiency in the English language for radiotelephony communications', in effect making English the official language of aviation.

What qualifications does English have to be the official language of the sky? It is the first language of only 375 million of the world's seven billion people. It is, however, the world's most widely spoken and read second language. Including those who speak its many dialect, pidgin and creole varieties, English has up to one billion non-native speakers and users.

However, as a language, English has some features that are problematic for high-reliability technical communication. More than 30 years ago Charles Grayson and Ralph E. Billings listed 10 types of error that could occur in spoken messages between pilots and air traffic controllers: three of them—ambiguity, transposition and

phonetic similarity—specifically relate to the nature of English.

The English language has an alphabet of 26 letters, but 42 distinct vocal sounds, many of which are represented by unlikely and inconsistent combinations of letters. English also has a very wide vocabulary, making it possible to say the same thing with several different words or phrases, known as synonyms. It also has a large number of homonyms, similar sounding words or phrases that mean different things, such as 'two' and to'. There are an estimated 100,000 homonyms in English. Possible causes of confusion in aviation include roll—meaning take-off, or turning around the longitudinal axis of an aircraft; slot, which can be part of a wing or a permitted time to take off or land; and go ahead, which can mean go forward or speak, a big difference on a busy aerodrome.



The Flight Safety Foundation identifies 49 cases where the US Federal Aviation Administration and ICAO use different words to refer to the same thing.

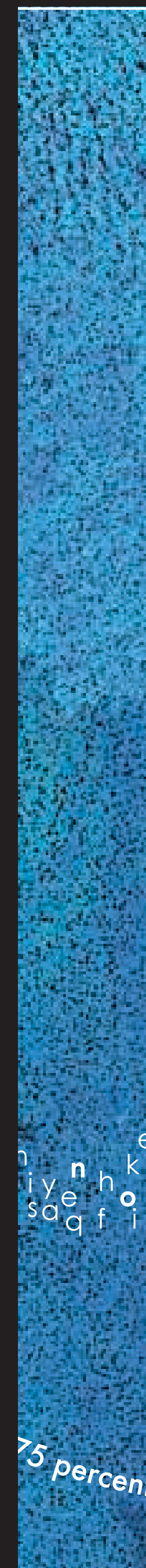
This confusion of words and sounds has a name—mondegreen—a word coined by author Sylvia Wright for misheard song lyrics. As a child, she heard the words 'and laid him on the green' as 'and Lady Mondegreen'. Others have heard 'there's a bad moon out tonight,' as 'there's a bathroom on the right', or have, against all conventions of decency, accepted that AC/DC really did sing 'dirty deeds, done to sheep'. The actual words were 'dirty deeds, done dirt cheap'.

Aviation mondegreens are not as funny. Steven Cushing's *Fatal Words* (1994) describes several documented aviation mondegreens. The similarity between *two* and *to* is a particular problem, Cushing says, which contributed to the crash in 1989 of Flying Tiger Line flight 66, a Boeing 747 Freighter, after the pilots heard 'descend 2400' as 'descend to 400'. The aircraft hit a hill near Kuala Lumpur, Malaysia.

'Descend to and maintain two thousand four hundred feet' was the Australian version from Airservices Aeronautical Information Package (AIP GEN 3.42-82) of the correct phrase that might have saved flight 66.

In the United Kingdom, the word 'to' is banned by convention from any message regarding flight levels, and all messages relating to an aircraft's climb or descent to a height or altitude employ the word 'to' followed immediately by the word 'height' or 'altitude'. A British controller would say: 'G-CD, descend to altitude 2000 feet' or 'Speedbird 38, climb flight level 350'.

British controllers also make a practice of saying flight levels in round hundreds as 'flight level (number) hundred', saying 'flight level three hundred',for example, instead of 'flight level three-zero-zero'. The intent is to reduce confusion between similar sounding flight levels. For consistency they do not use the word 'hundred' in heading messages.



‘One of our biggest issues is communication,’ says Russell Eastaway, an ATC training specialist at Airservices’ Learning Academy in Melbourne, reinforcing this with a telling statistic: ‘communication is a causal factor in approximately 75 per cent of aviation accidents/incidents’.

Confusion can also creep in as to whether words are an instruction or a description.

Cushing cites a controller who told a general aviation pilot ‘traffic at ten o’clock, three miles, level at 6000 to pass under you’. A short time later the controller asked the pilot why he was descending from 7000 feet—the pilot had interpreted ‘level at 6000’ as an instruction.

To this potential for confusion, add complex and critics would say, disorganised, grammar. English has about 1000 grammar rules—and 1500 exceptions. In short, English is the language that gave the world Shakespeare—but also the Tenerife accident of 1977.

The ritual of the readback is an attempt to control this inherent ambiguity. The readback acts as a trap for misunderstanding before it can cause damage.

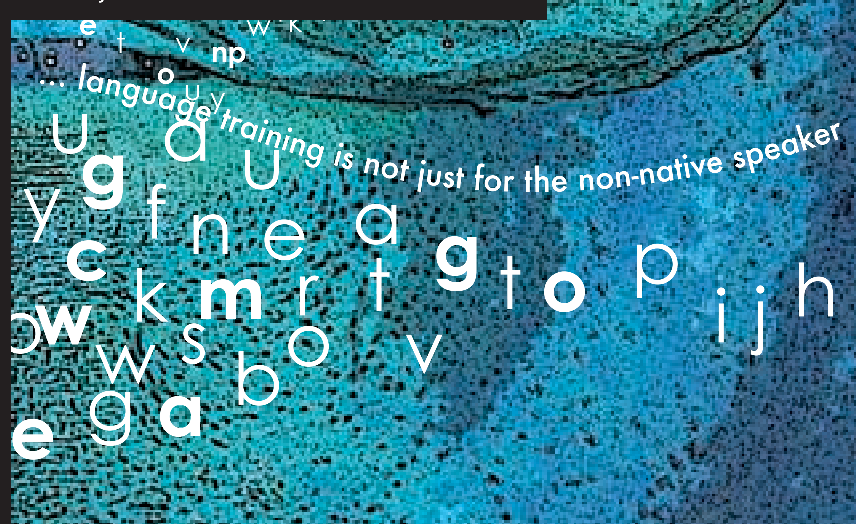
Russell Eastaway explains that the Learning Academy emphasises ‘active listening, where ATC trainees focus on listening to every word’, as well as not combining a number of different instructions in one transmission, in order to minimise confusion.’ Compared to the rest of the world, Australian ATC training and oversight is ‘very regimented’, Eastaway says. ‘All controllers have regular six-monthly assessments, with communication one of the test elements. To retain their ATC endorsements, controllers must score at least 4 on a scale of 1-7. If controllers scored 3 on communication/phraseology, for example, they would have to undertake remedial study, and be reassessed in a month’s time.’

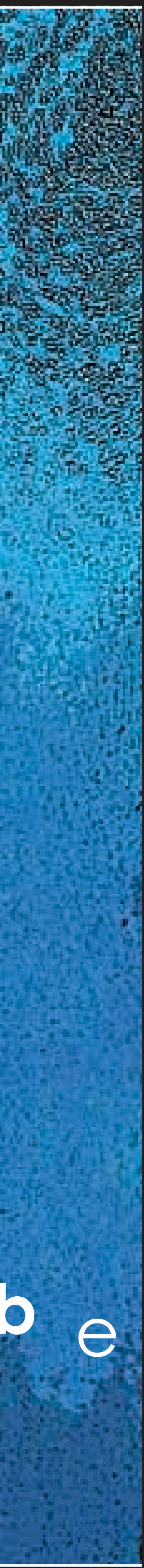
Standard phraseology is another convention to control error, eliminating potentially confusing words and phrases. Thus in the international phonetic alphabet the number nine is pronounced as niner, in order to differentiate it from the similar vowel sounds in five (correctly pronounced as *fife*) and the German word ‘nein’, meaning no.

But standard vocabulary cannot always stop what linguists call code switching. This is when native English speakers switch between technical jargon and normal, vernacular English. Problems arise when the same word has different meanings in technical and vernacular use. And human beings tend to code switch at just the worst time for safety—when they’re under stress.

At the suburban Los Angeles John Wayne Airport in 1981, a flight was cleared to land at the same time as another flight was cleared to taxi into position for take-off. The controller told the approaching flight to go around, but the pilot asked for permission to continue landing. In understandable stress, the pilot used the word ‘hold’ to express his request. In aviation, ‘hold’ means to ‘stop what you are doing’, but in ordinary, or colloquial, English it can mean to continue on the same course (hold fast, hold your line, hold your own etc.). The controller agreed for the flight to hold, in the aviation sense, and expected it to go around. Instead it continued with its landing and collided with the aircraft on the runway. ‘Hold’ is still heard in aviation contexts, but this accident suggests it is a word for pilots and controllers to use with caution.

The Tenerife accident of 1977 involved a subtle case of code switching. Here the captain of the KLM flight, although fluent in English, appears to have reverted to Dutch grammar in his radio call that preceded the runway collision of two Boeing 747s that killed 583 people. Captain Veldhuyzen van Zanten said ‘we are now at take





off'. In English, this is ambiguous. One meaning would be 'we are at the take-off point,' which was how the English-speaking Spanish air traffic controller understood it. But in Dutch, the English grammatical 'ing' ending for verbs (such as 'taking off') becomes 'at' plus the infinitive form of the verb—'at take-off'. In Dutch you say the equivalent of 'at' instead of ' ing'. Athough Captain van Zanten spoke in English, his grammar was Dutch, and it said, 'we are taking off'. It didn't help that minutes earlier he had received an en-route clearance that sounded like a clearance to take off.

Language of the gods: English as a foreign tongue

Over the next 20 years, aviation English is likely to follow a similar path to the language generally—towards having more non-native speakers than native speakers. The fastest-growing region in global aviation is the Asia Pacific region, which takes in the markets of China and Southeast Asia.

In 2010, the International Air Transport Association (IATA) estimated that about a third of all passengers travelled on routes to, from, or within, the Asia Pacific. For North America and Europe, the equivalent number was 31 per cent. By 2015, IATA anticipates that Asia-Pacific traffic will grow to 37 per cent, while Europe and North America will fall to 29 per cent of world aviation traffic.

Australia is already playing a part in this transformation, with a substantial industry arising to train airline pilots from Asian and Pacific countries. For most of these young pilots, English is their second, or third language.

Atsushi Tajima's 2004 study on aviation safety summarises a popular view on the safety implications of non-native English speakers as pilots.

'When pilots report problems regarding cross-cultural communication, they identify "language/ accent", "dual-language switching [in non-English-speaking countries, speaking in English to foreign pilots, but simultaneously speaking in the local language to local pilots]" and "[different] reception across languages" as among the most frequently reported problems,' Tajima writes.

He quotes a NASA study: 'Twenty-five per cent of the reports cited language problems as a primary cause of the foreign airspace operational incidents reported to ASRS.'

However, former Emirates head of human factors, Surendra Ratwatte, argues that English proficiency is, to use an idiom, a two-way street. Native English speakers also need to be careful, disciplined and precise in how they use the language.

'English is the official language of aviation and its practice should be mandated; however, language training is not just for the non-native speaker of English,' Ratwatte writes. 'Anglo pilots, who have been arbitrarily granted the linguistic advantage, should be taught how to communicate simply, slowly, and precisely with non-Anglo personnel as required,' he and Ashleigh Merritt wrote in a 1997 paper.

Dominique Estival and Brett Molesworth studied English proficiency and communication in general aviation, using the abbreviation EL2 pilots to describe those who spoke English as a secondary language. They concluded that: 'the most challenging communication problem for pilots is not with ATC, but with other pilots, and that, irrespective of qualification or native language, pilots find it most difficult to understand other pilots'.

Estival and Molesworth concluded that pilots found communicating with ATC to be the least challenging of their communication tasks. 'This result indicates that communication problems within general aviation cannot be solely attributed to language proficiency levels of EL2 pilots. Rather, the problem appears to be more widely spread and the results suggest that all pilots experience, and contribute to, communication problems within general aviation.'

Communication is also an issue within the cockpit. Here research has produced surprising and heartening conclusions. In 1997, Merritt and Ratwatte compared the safety performance of mono- versus multicultural cockpits. They presented diverging conclusions. Merritt found that language barriers and cultural differences inhibited open communication and team fellowship.

However, Ratwatte found that multicultural crews, especially those comprising crew members with English as a second language, had to verbalise their messages concisely and perform 'by the book'. He said this led to strict rule-based behaviour, with standard operating procedures (SOPs) being used more often than in more relaxed flight decks. Ratwatte argues that greater reliance on crew resource management principles, such as more precise communication and more crosschecking, means mixed-cultural cockpits may actually be safer.

Tajima is scathing about the idea that language problems in aviation can be cured only by more training or censure of non-native speaking pilots. 'Merely and hegemonically blaming their language inabilities or limitations for preventable accidents will not fundamentally solve the problem', he writes.

'It is important to notice that the ultimate goal is "not to improve their English proficiency itself," but "to avoid fatal accidents due to miscommunication". Their efforts in acquiring English proficiency may have certain limitations, or will reach a "ceiling", as it were. Although the KLM captain of the Tenerife accident had made intensive use of aviation English for decades, he was still not totally free from interference from his native language. Therefore, we should sincerely and rigorously strive to create an error-resistant and mistake-free language environment.'

The theme of the role of language in 'avoiding fatal accidents due to miscommunication' is one taken up by passionate opponent of dead, managerial English, Don Watson, author of books such as *Weasel Words* and *Bendable Learnings*.

Watson outlines the sinister impact of abstract managerial language in a powerful essay on the 7 February 2009, Black Saturday fires in Victoria. Describing it as 'the day words fell short', seven months after the fires, he reflected on the evidence that fire managers were giving to the royal commission about what they called 'communication'.

'One CFA manager described the business of telling the public as "messaging"; "communicating the likely impact"; "to communicate the degree of the circumstance"; providing "precise complex fire behaviour information"; "to communicate more effectively in a timely manner not just that it is a bad day, but other factors as well." He spoke of his task as "value-adding" and "populating the document." He and other managers talked a good deal about "learnings," "big learnings" and even "huge learnings".

They neglected to tell people in concrete language that any fire on February 7 was likely to be one they could not fight, and might not survive. If instead of "fire activity with potential to impact" we had dangerous, unpredictable, deadly fires, the CFA's "messagings'' might have persuaded more people to get out of the way. If instead of "wind events" the experts and the authorities had said the wind will blow a tremendous gale of searing air through forests so dry they will explode into fires that no one can stop …'

Watson concluded: 'Telling people requires language whose meaning is plain and unmistakable. Managerial language is never this.' In a technical field such as aviation, where safety is paramount, concrete language is especially critical.

Leaving a mark: the written word

Any language where the unassuming word fly signifies an annoying insect, a means of travel, and a critical part of a gentleman's apparel is clearly asking to be mangled.

Bill Bryson Mother Tongue: The English Language*, 1990*

Aviation enthusiasts with the leisure time to peruse the excellent online resource that is *FlightGlobal*'s digital archive may notice a charming feature in editions from the magazine's first 20 years. As the semi-official voice of British aviation *Flight* published notices to airmen (later abbreviated to notams) on behalf of the British air ministry.

Here is an example from February 1930:

'In preparation for air survey work in the vicinity of Baghdad a number of white circular ground marks have been made in various localities within an area extending 40 miles N. and 20 miles S. of Baghdad, and approximately 20 miles on each side of the River Tigris ... Pilots of aircraft visiting or passing over Iraq are warned of the existence of these marks, which might be mistaken for landing ground markings.'

Here is part of a modern NOTAM

BANKSTOWN (YSBK)
RAIM GPS RAIM PREDICTION 271400
YSBK
TSO-C129 (AND EQUIVALENT)
FAULT DETECTION
NO GPS RAIM FD OUTAGES FOR NPA
TSO-C146A (AND EQUIVALENT)
FAULT DETECTION
NO GPS RAIM FD OUTAGES FOR NPA
FAULT DETECTION AND EXCLUSION
06280355 TIL 06280402
06290351 TIL 06290358
06300347 TIL 06300354
GPS RAIM FDE UNAVBL FOR NPA
METAR METAR YSBK 280330Z AUTO 01002KT 9999 // BKN054 BKN063 17/09 Q1021 RMK
RF00.0/000.0
TAF TAF YSBK 272214Z 2800/2812 VRB03KT 9999 LIGHT SHOWERS OF RAIN SCT030
FM280200 06005KT 9999 SCT040 RMK T 13 15 15 12 Q 1025 1022 1020 1020
C0211/12
ATIS 416 (BK NDB) AND 120.9 NOT AVBL DUE MAINT
EXC ON 15 MIN RECALL
FROM 07 031000 TO 07 041200
DAILY 1000/1200

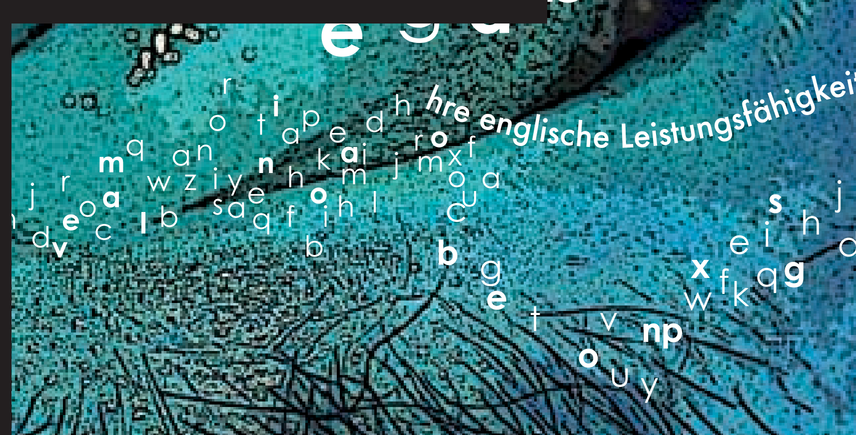
The contrast between the quaint but lucid notices in *Flight* and the ATCK of ABRVTD information in CPTLS is jarring. Notams, which began as plain language bulletins, have evolved into the ultimate in jargon.

The use of teletype machines to propagate notams to remote airfields in the 1930s left a legacy of abbreviation and upper-case lettering at odds with all conventions of readability. This was done because teletype machines used only upper case letters and charges were metered by the letter.

The result—long after teletype machines have been consigned to history in most parts of the world—is that vital aviation information is transmitted in a hostile and deliberately obscure format.

Defenders of the system argue that its codification produces an exact message and that all pilots should be able to read and decode notams as a mark of professionalism.

However, the highly coded notam format is unique in transport. Contrast a modern notam with the language of an equally modern notice to mariners, dated July 2012.



'Mariners are advised that a survey of the Mooloolah River and its coastal bar on 2 July 2012 shows a least depth of approximately 2.5 metres at LAT near the centre line of the entrance channel. There are lesser depths to approximately 2.0 metres at LAT near the channel's eastern and western extremities.'

Notams fail in at least three ways:

Relevance

Robert F. Potter and Michael D. Nendick of the University of Newcastle studied notams in Australia and reached some strongly critical conclusions.

They concluded: 'Notam information is often required to be published by regulatory dictates. Some information is either not directly understood by aircrew, not able to be used by aircrew in some operations because of the technical nature of the effects, or not of any apparent operational significance.'

A specific criticism by Potter and Nendick was that notams are not only issued with immediate implementation requirements, but also with implementation dates which may be some time in the future. The reason is to give advance warning of changes, but Potter and Nendick argued that this requires aircrew to read but effectively ignore notams that do not apply on the day of intended operation. 'Where this involves a number of notams, a significant amount of time is consumed searching through notams which have no relevance to operations within the current time frame,' they say.

Ambiguity

Excessive abbreviation, coupled with an ever-growing list of abbreviations, produces a situation where parts of notams can have several meanings.

There are 1500 acronyms and abbreviations on CASA's list, many with the potential for confusion. For example, BC means 'back course' in a notam, or 'patches' in a METAR weather report; likewise, BLO can mean 'below' or 'blowing'.

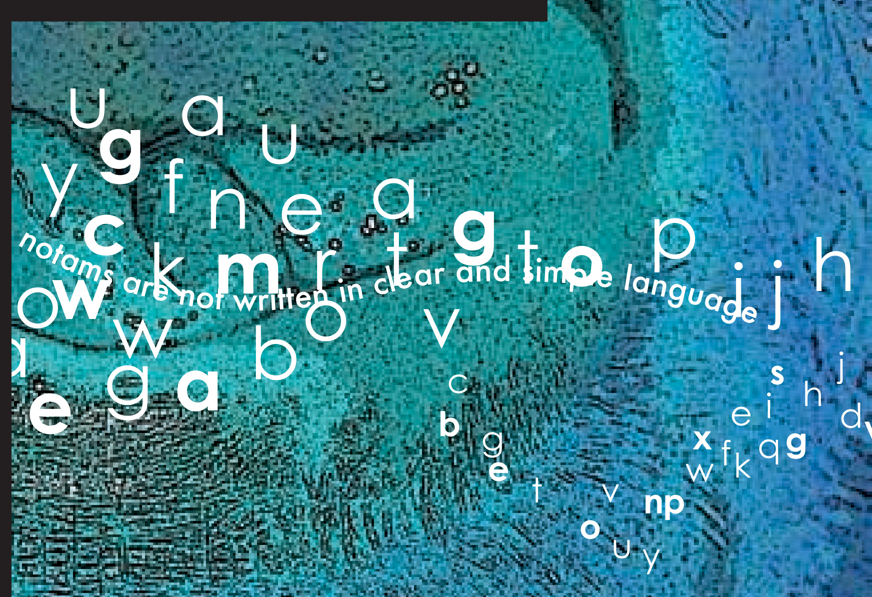
'Notams are not written in clear and simple language and they are replete with unfamiliar and sometimes ambiguous contractions,' a 2004 study by the Flight Safety Foundation concluded.

Readability

The all-capital format of notams is the worst example of a deadening failure in aviation writing, the OVERUSE of INAPPROPRIATE CAPITALISATION. Studies such as Miles Tinker's, *Legibility of Print,* established that all-capital print greatly slows speed of reading, in comparison with lower-case type. Most readers judge all upper-case text to be less legible. Tinker found that the faster reading of the lower-case print was due to its characteristic word forms. These permit reading by word units, while all capitals tend to be read letter by letter.

Codified notams may be difficult for humans to understand, even with training, but machines can read them easily. The Eurocontrol Digital Notam (xNOTAM) Project, run in cooperation with the US FAA, is endeavouring to provide notam information in a format suitable for automatic processing, to enable automated systems that support ATC and air navigation. A notam advising a closed runway could be received and read by a computer on an aircraft flight deck and this information could be presented to pilots in the form of a cross or red line over the runway on a navigation display, or even on a heads-up display.

For a closer look at the safety-critical role of communication in aviation maintenance, see the airworthiness section of this issue, pages 31-33.



Further information

Grayson R.L., Billings C.E.'Information transfer between air traffic control and aircraft: communication problems in flight operations'. In: *Information Transfer Problems in the Aviation System.* C.E. Billings; E.S. Cheaney; eds. NASA Technical Paper 1875, National Aeronautics and Space Administration, 1981.

'Pilot air traffic control communications. It's not (only) what you say, it's how you say it'. In *Flight Safety Digest* July 1995 http://flightsafety.org/fsd/fsd_jul95.pdf

The Clarity and Accessibility of NOTAM Information for the Aviation Industry Technical Report Prepared for the Bureau of Air Safety Investigation (BASI) Robert F. Potter and Michael D. Nendick Department of Aviation and Technology, University of Newcastle http://www.atsb.gov.au/media/761312/clarity_accessibility_notam.pdf

Airservices Australia fact sheet: Communication with air traffic control http://www.airservicesaustralia.com/wp-content/uploads/communicating_with_atc_fact_sheet.pdf

http://www.youtube.com/watch?v=oU0j0r_cqvk 'Mayday, Mayday—We are sinking'

http://www.skybrary.aero/index.php/Communication:_Linguistic_Factors_%28OGHFA_BN%29

http://www.theage.com.au/opinion/society-and-culture/vital-lessons-from-the-day-words-fell-short-20090918-fvfr.html

Homonyms

Expressions	Meanings
Taxi	Helicopter (hover taxi, air taxi)/to move
Aircraft	One or many aircraft
Flight	Apparatus/persons
November	Name of letter N/aircraft identification letter/month
Tango	Name of letter T/air taxi or helicopter
Zulu	Name of letter Z/time at Greenwich meridian
Contact approach	Type of approach to an airport/command to radio the controller who handles approaches
Gate	Location at the terminal building/point in the sky
Roll	Pivot in the air about longitudinal axis/forward movement
Slot	A part of forward edge of some wings/time interval for a takeoff
Remain	Localisation/radio frequencies
Flight deck	Top of an aircraft carrier/cockpit of an airplane
Go ahead	Urge speaking/forward motion
Stand by	Wait/standing

ATC notes

Operating in Class D Airspace

Airservices frequently receives questions from pilots about operating in Class D airspace - metropolitan and regional. To help pilots with their questions, we have recently released a Safety Net explaining some of the common points of confusion.

This Safety Net covers:

- the level of separation provided to IFR and VFR aircraft
- the abbreviated clearance process
- the requirement to comply with ATC instructions
- why TCAS advisories are sometimes received when maintaining separation from other aircraft, and
- the requirements to make a Departure Report.

ATC clearances

All aircraft require a clearance to operate in, or transit through, Class D airspace. Pilots must establish and maintain two-way communications with the tower and receive clearance prior to entering the airspace. You are required to read back and comply with the clearance provided by ATC.

In addition to your initial clearance (either abbreviated or full) there are also a range of operations that require a specific ATC clearance, including take-off and landing, or entering, crossing or taxiing along any runway.

ATC service level

When operating in Class D airspace, you will be provided with an ATC service. This varies depending on if you are operating IFR or VFR.

IFR flights are separated from other IFR and Special VFR flights and receive traffic information (not separation) in respect of VFR flights. VFR flights receive traffic information in respect of all other flights.

In the event that you are given responsibility for separation with other aircraft, this will be communicated to you. In this situation, you must also consider how TCAS operates and manoeuvre the aircraft in such a way as to minimise the likelihood of an unwarranted TCAS Resolution Advisory.

For more information on operating in Class D airspace the Safety Net is available on the 'Pilot and Airside Safety' pages of our website at: www.airservicesaustralia.com/publications/safety-publications/

Clearer skies ahead with ADS-B

Airservices is continuing the roll-out of Automatic Dependant Surveillance Broadcast (ADS-B) technology – a satellite-based technology enabling aircraft to be accurately tracked by air traffic controllers and other pilots without the need for conventional radar.

From 4 September 2012, ADS-B services will be provided to all aircraft that are ADS-B Out capable with individual aircraft approvals no longer required. Approval to operate using ADS-B, issued by the state of registration, will also no longer be required.

Aircraft operators must ensure they meet CASA ADS-B regulations when operating in Australian airspace. They will also be responsible to ensure that ADS-B transmissions comply with the Civil Aviation Orders and that flight crew are adequately trained to operate the ADS-B equipment, including knowledge of the appropriate phraseology and correct entry of Flight ID, and correct lodgement of flight plans including RMK/ADSB in the remarks field when ADS-B equipped.

Civil Aviation Order (CAO) 20.18 para 9B.6 requires ADS-B transmissions to be disabled before flight if the avionics is not compliant with the CASA standards and requirements. Airservices still retains the ability to suspend ADS-B services for any aircraft transmitting incorrect ADS-B data.

Operators who become aware their aircraft have non-compliant ADS-B related avionics fitted should contact Airservices as soon as possible.

Airservices is already seeing significant take-up of ADS-B services by domestic and international airlines ahead of the December 2013 mandate. The continued roll-out of ADS-B in Australia will continue to deliver enhanced safety benefits for aircraft operating into and out of Australian airspace.

Further information on ADS-B can be found at: www.airservicesaustralia.com/projects/ads-b

International accidents/incidents 10 June – 17 July 2012

Date	Aircraft	Location	Fatalities	Damage	Description
10 June	Let L-410UVP	Borodyanka, Ukraine	5	Written off	Skydiving plane (first flight 1981), carrying 18 skydivers and two crew members, crashed into a field as it returned to the airfield because of an approaching rainstorm. The plane appears to have been caught in a downdraft about 2km short of the runway.
10 June	DHC-8-311	Antigua-Coolidge Int. Airport	0	Written off	Passenger plane (first flight 1990) and its hangar destroyed in a nighttime fire.
11 June	Antonov 2R	near Serov, Sverdlovsk, Russia	13	Missing	Biplane (first flight 1986) disappeared after being taken on an illegal flight by a group of drunken revelers, allegedly including the chief of the local police, three police inspectors, an airport security guard and others.
12 June	HS-748-264	Sandy Lake Airport, ON, Canada	0	Destroyed	Cargo plane (first flight 1970) destroyed when it caught fire on the ground after arriving on a routine fuel drop off.
18 June	Beechcraft 400A	Atlanta-DeKalb Airport, GA, U.S.A	0	Written off	Executive jet (first flight 1993) ran off the end of the runway and through a fence after landing. Both pilots and the two passengers suffered minor to moderate injuries and required hospital treatment.
20 June	Boeing 767-381ER	Tokyo-Narita Airport, Japan	0	Substantial	Passenger plane (first flight 2002) sustained 'severe wrinkling of the forward fuselage' when it made a hard landing in strong gusty cross winds and bounced on its main and nose landing gear. Wind shear had been reported at the airport at the time.
21 June	Fokker F-27	1km north of Jakarta-Halim Airport, Indonesia	7 + 4	Destroyed	Indonesian Air Force transport plane on a training flight destroyed when it crashed on approach, coming down into a housing complex near the airport. All the crew, and four people on the ground, were killed in the ensuing fire.
23 June	Cessna 208B	near La Leona, Tocaima, Colombia	4	Written off	Military aircraft (first flight 2007) crashed en route, killing all four people on board.
29 June	Embraer ERJ-190LR	Hotan Airport, China	2	Destroyed	Passenger jet returned to Hotan after an apparent hijacking attempt. According to media reports the 'hijackers' carried explosives and had attempted to break into the cockpit with a crutch. Two of them later died from injuries sustained while being overpowered by passengers and crew. The crew, passengers and two security guards have received generous cash and/or apartment and car rewards from the airline and the Civil Aviation Administration of China.
1 July	Lockheed C-130H	near Edgemont, SD, U.S.A.	4	Written off	Modular Airborne Fire Fighting System (MAFFS)-equipped transport aircraft (first flight 1994) supporting firefighting efforts in South Dakota crashed during a mission, apparently killing four of the six people on board.
4 July	Rockwell Sabreliner 75A	El Palomar Airport, Argentina	0	Substantial	Military jet (first flight 1974) damaged when the LH main gear collapsed on landing.
6 July	Bell 206	near Bawata, Papua New Guinea	3	Destroyed	Helicopter crashed in a remote area of PNG after a mayday call about five minutes after it left an oil well site in Gulf Province en route to refuel in Hou Creek and then travel to Mount Hagen. The crash site and the bodies of the three crew members were found after an extensive week-long search.
9 July	DHC-6 Twin Otter 300	Conrad Resort, Rangali, Maldives	0	Substantial	Seaplane (first flight 1975) experienced a LH float collapse after striking the dock at the resort while on taxi, and became partially submerged. The three crew and 14 passengers were able to escape uninjured.
12-July	Harbin Yunshuji Y-12-II	Nouakchott Airport, Mauritania	7	Written off	Transport plane destroyed when it crashed shortly after take-off, killing all on board. Aircraft operated by the Mauritanian Air Force on behalf of the Kinross Gold Corporation.
13-July	Gulfstream G-IV	Le Castellet Airport, France	3	Written off	Corporate jet (first flight 1987) destroyed when it overshot the runway on landing and broke in two, with the front part ending up in a pond and the rear in a clump of trees, where it caught fire. A photo of the crash scene showed that the jet's thrust reversers were deployed.
17 July	CRJ-200ER	St George Airport, UT, U.S.A.	1	Substantial	Passenger jet (first flight 2001) damaged when it hit the terminal building and ended up in a car park after being stolen and started at night by a commercial pilot wanted by police in connection with the death of his girlfriend. The pilot then shot and killed himself inside the plane.

Australian accidents/incidents 4 June – 11 July 2012

Date	Aircraft	Location	Injuries	Damage	Description
4 June	Cessna 182Q	Coonabarabran Aerodrome, 264° M 38km, NSW	Fatal	Destroyed	The aircraft was reported missing and was subsequently found to have crashed and caught fire. Investigation continuing.
9 June	Robinson R44 II	Horn Island Aerodrome, N M 83km, Qld	Nil	Substantial	During the cruise, the alternator fail light illuminated. Subsequently, the pilot noticed unusual engine noises and abnormal engine indications and therefore conducted a precautionary ditching at sea. Investigation continuing.
10 June	Robinson R44	Alice Springs Aerodrome, S M 93km (Maryvale), NT	Serious	Destroyed	Helicopter reported to have crashed. Investigation continuing.
12 June	Robinson R44	Maryborough Aerodrome, 107° M 21km, Vic	Nil	Substantial	After take-off, the helicopter struck a single power line and then crashed. Investigation continuing.
17 June	Robinson R22 Beta	Tennant Creek Aerodrome, 336° M 43km, NT	Minor	Destroyed	During low-level flight, the low rotor RPM horn sounded and the helicopter then crashed.
18 June	Schweizer 269C-1	Redcliffe Aerodrome, Qld	Minor	Substantial	During a simulated forced landing, the helicopter landed heavily and rolled onto its side. The helicopter was substantially damaged and both crew members suffered minor injuries. Investigation continuing.
19 June	Cessna 182P	Cunnamulla Aerodrome, 070° M 53km, Qld	Serious	Substantial	Aircraft reported to have crashed soon after take-off, seriously injuring the pilot. Investigation continuing.
19 June	Eurocopter AS.350BA	Ceduna Aerodrome, 267° M 56km, SA	Nil	Destroyed	During the cruise, the pilot and passenger detected fuel fumes in the cockpit and conducted a precautionary landing. After landing, the helicopter caught fire and was destroyed. Investigation continuing.
23 June	Beech 58	Bathurst Aerodrome, NSW	Nil	Substantial	During departure from Bathurst, the landing gear failed to fully retract. The aircraft subsequently landed at Bankstown with the landing gear partially extended, resulting in substantial damage. Engineers found that the sector gear in the landing gear gearbox had failed.
2 July	Amateur-built Lancair IV-P	Adelaide Aerodrome, 250° M 272km, SA	Nil	Substantial	During the cruise, at FL 250, the right window detached from the aircraft. The crew donned their oxygen masks, conducted an emergency descent and diverted to Adelaide. Aircraft sustained substantial damage.
2 July	Piper PA-25-235	Ayr (ALA), N M 2km, Qld	Nil	Substantial	During approach, the engine failed due to fuel exhaustion and the pilot conducted a forced landing on a nearby road. The aircraft landed hard and the pilot lost directional control. Aircraft substantially damaged but pilot uninjured.
6 July	Robinson R22 Beta	Miranda Downs (ALA), 037° M 23km, Qld	Serious	Substantial	Helicopter crashed during cattle mustering. Pilot sustained serious injuries. Investigation continuing.
9 July	Robinson R22 Beta	Victoria River Downs (ALA), E M 370km (Tanumbririni Station), NT	Minor	Substantial	During mustering operations, the engine lost power and the helicopter crashed. The pilot suffered minor injuries and the helicopter was substantially damaged.
9 July	Robinson R22 Beta	Tennant Creek Aerodrome, NW M 37km, NT	Nil	Destroyed	During mustering operations the helicopter struck a powerline, crashed, and was substantially damaged.
11 July	Piper PA-34-200	near Broome Aerodrome, WA	Fatal	Destroyed	Aircraft crashed and its pilot was fatally injured. Investigation continuing.

Australian accidents

Compiled from the Australian Transport Safety Bureau (ATSB).
Disclaimer – information on accidents is the result of a cooperative effort between the ATSB and the Australian aviation industry. Data quality and consistency depend on the efforts of industry where no follow-up action is undertaken by the ATSB. The ATSB accepts no liability for any loss or damage suffered by any person or corporation resulting from the use of these data. Please note that descriptions are based on preliminary reports, and should not be interpreted as findings by the ATSB. The data do not include sports aviation accidents.

International accidents

Compiled from information supplied by the Aviation Safety Network (see www.aviation-safety.net/database/) and reproduced with permission.
While every effort is made to ensure accuracy, neither the Aviation Safety Network nor *Flight Safety Australia* make any representations about its accuracy, as information is based on preliminary reports only. For further information refer to final reports of the relevant official aircraft accident investigation organisation. Information on injuries is not always available.

A Christmas tragedy

When families gather for their Christmas celebrations they hardly imagine that an aircraft is going to crash and burn less than a kilometre from their home but, just occasionally, the unthinkable happens.

Robert Alan How owned and flew a Cessna 172M and had a landing strip on his property at The Gurdies, to the south-east of Melbourne.

On Christmas morning 2008, he went for a solo flight in his plane. He flew from his private airstrip to Tyabb airport to refuel, and then headed back towards home. About three kilometres from his property, he flew very low over a neighbour's house, where Christmas festivities were underway. Hearing the loud sound of the engine, David Gill, the neighbour, looked out of his window and saw the undercarriage of the plane, which he estimated was only about fifty feet off the roof of his house.

Gill was on the phone, but about five seconds after Gill saw the plane, the phone went dead. His teenage daughter told him that the plane had 'landed' in a nearby paddock, so Gill and his father hopped on their motorbikes and rode over to investigate. Unfortunately, the plane had clipped a power line about eighty-six feet above the ground, crashed, and, within seconds, had burst into flames. Robert How was already dead.

Gill told the inquest into How's death that the pilot had often done a 'flyover' of their property at previous Christmases. His daughter confirmed this and added that she had sometimes seen the same plane 'flying over the property and doing somersaults'.

The wreckage of the plane was examined by licensed aircraft maintenance engineer, Barry Foster. He found no mechanical failure that might have caused or contributed to the accident. The subsequent Australian Transport Safety Bureau (ATSB) investigation found that How had no operational reasons, such as adverse weather, or take-off or landing manoeuvres, to be flying below the required 500 feet at the time of the accident. There was also no evidence of any flight control failure before the wire strike.

The power lines did not need to be marked because they were under 90 metres (295 feet) from the ground.

How's GP said that during all her, and previous, medical assessments of him, 'there was no sign of any cognitive disturbance, thought disorder, altered affect or response to internal stimuli'.

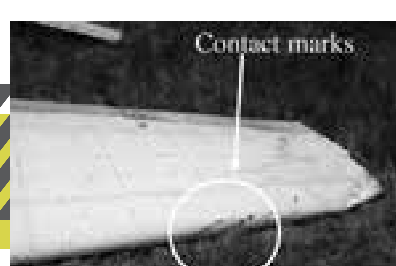
Mr How held a private pilot's (aeroplane) licence, issued on 3 September 2003, and endorsed for VFR flights. He also had a valid class 2 medical certificate. He had an estimated 600 hours total flight time, but did not have any low flying qualifications or ratings.

The ATSB report reinforced the inherently hazardous nature of low flying and also concluded that 'although the pilot probably knew about the power line, it is apparent that he did not see it in enough time to avoid the wire strike. Power lines are inherently difficult to see, especially when unmarked as they were in this case. Compounding the problem can be factors such as sun glare and windscreen visibility. However, given the position of the sun at the time of the accident and the pilot's southerly track, it was unlikely that sun glare was a factor. Windscreen visibility was unable to be established'.

History of low flying complaints

January 2006: Ms Kim, who lived on a property about 100m from How's airstrip, made a complaint of 'reckless flying', saying that he had flown so low that he was almost level with the windows in her house.

February 2007: A further complaint was made by Ms Kim about Mr How's reckless flying. She said that a plane took off from the airstrip, turned sharply back towards her property and was flying only about 40-50m over her head. She described the plane as banking so sharply that the wings were vertical to the ground. It then flew back directly over her house, almost touching the



roof. 'It was extremely noisy, frightening and very dangerous'.

December 2007: Leigh Charlton described a plane that was flying so low he could clearly see its letters, and said that it could not have been taking off or landing as it was at right angles to the landing strip. He added that his wife had told him she no longer liked living at their home because she feared that Mr How would crash into their house.

January 2008: Ms Kim details another four incidents of unnecessary and dangerous low flying, saying that she only wants Mr How to 'take off properly and then there would be no bother'.

Mr Gary Morrison, the owner of Tooradin Airport, told the inquest that How had landed and parked his plane there from time to time and used its re-fuelling facility. However, after a couple of years of near misses and other incidents, he had finally banned How from Tooradin Airport for his lack of judgment, safety and airmanship. The catalyst for this was an incident when How overshot the runway, ditched his plane with its propeller stuck in the mud and then refused to have his plane properly checked before taking off again.

After being banned from Tooradin Airport, How joined the Peninsula Aero Club, which operated out of Tyabb Airport. Alexander Robinson, the CFI at the club, said that they kept a complaints book and acknowledged that incidents had been recorded in it about How's low flying. He described How as a very good flyer but admitted that he would 'push boundaries', especially when it came to landing.

He said that Mr How would 'brag about how he could land in a short distance. People were just not willing to go with him'.

After a number of such occurrences How was asked to undertake a 'check flight' with the chief flying instructor to demonstrate that he had a reasonable knowledge of the visual flight rules and the club's 'Fly Neighbourly' policy. He participated in the required tasks and demonstrated his understanding of what was required of him, but a few months later was again reported for taking his approach to the airstrip too short.

One of the coroner's conclusions was that, 'Mr How, whilst an apparently capable and experienced pilot of light aircraft, had a poor attitude to some aspects of air safety. This poor attitude was well known by the two clubs he had belonged to and resulted in him being banned from one and disciplined by the other'. There was, however, some uncertainty about whether any report about How's low flying had been made to CASA by the Peninsula Aero Club, because they 'had no way to substantiate that and therefore could not report it, other than it is hearsay, but there was an awful lot of hearsay'.

Questions raised

Robert How did not kill anyone apart from himself, but the outcome could have been very different. In one of Ms Kim's complaints she wrote, 'I hope I don't have to wait until there is a newspaper report of a tragedy in The Gurdies or elsewhere because he has misjudged one of his flying tricks and crashed into a house, or caused a bush fire'.

In these cases reports from members of the public may need to be supplemented by information from industry members with professional knowledge of the issues involved.

If experienced CFIs and other aviation professionals feel that they have tried but failed to exert enough influence to change a fellow pilot's irresponsible behaviour it is important to submit a report to CASA, so that follow-up action can be taken.

The coroner raised the questions: should there be mandatory reporting obligations on flying clubs to report breaches of safety or unsafe conduct by pilots? Should incidents only be notifiable if someone is injured or killed, or the aircraft is significantly damaged? We welcome our readers' feedback …
fsamagazine@casa.gov.au

If someone is putting safety at risk – report it!
CASA confidential hotline 1800 074 737

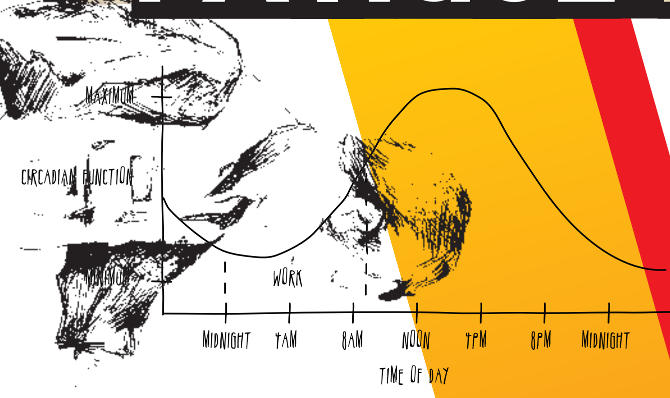
The rules covering fatigue are changing. Civil Aviation Order (CAO) 48, which regulates flight and duty times, has been in force from around the early 1950s, and it is tired. Along with other global regulators, CASA is creating new standards to manage fatigue, in keeping with International Civil Aviation Organization requirements. The proposed new CAO 48 is anticipated in late 2012, with a transition period for compliance by December 2013.

WAKE-UP CALL ON FATIGUE RULES

In the half-century or so since these original fatigue rules were introduced the demands of a 24-hour society, and fatigue research within the aviation industry generally, have led to an increasing number of exemptions to CAO 48. These exemptions have complicated the rules, which no longer meet the needs of contemporary aviation safety.

CASA has used the standard industry exemptions as the foundation for the new CAO 48, in line with ICAO's fatigue management standards, but believes there is a need to go beyond simple prescription to manage fatigue safely. The new CAO 48 therefore will have three tiers, ranging from simple prescription to the more complex and sophisticated fatigue risk management system (FRMS):

1. The basic prescriptive level (basic limitations)
2. Fatigue management—using prescriptive rules, but improving safety through a greater emphasis on operator-managed risk control and requirements for training and promotion of awareness regarding fatigue
3. Fatigue risk management system—the most sophisticated level.



The first tier, the basic duty periods and flight time limits, may well suit smaller 'his and hers' operators with few staff and simple operations. However, mid- and larger-sized operators, whose businesses are more complex, with changing 24-hour operational demands, are likely to work under more flexible rules. These introduce higher risk management requirements, including hazard ID, and continuous monitoring and improvement of fatigue management, as well as the need to provide flight crew with fatigue training and to promote awareness of fatigue.

CASA anticipates that the majority of operators will fall into this group, with only a small percentage applying to operate under a fatigue risk management system. Operators wishing to operate under an FRMS will need to demonstrate that their systems are mature, data driven, integrated with an existing SMS where possible; with comprehensive policies, documentation, risk management, safety assurance to monitor the system's effectiveness, and safety promotion. They will also need to demonstrate they have dedicated sufficient resources to implementing and maintaining their FRMS. People who have an intimate working knowledge and experience of the complex operational environment to which it will apply should be the ones who develop, implement and maintain the FRMS. An FRMS is not just a manual, although documentation is obviously one of the important parts of an FRMS.

The new CAO 48 not only defines the obligations for operators, but importantly, also those for individual flight crew members.

Managing fatigue is a shared responsibility: both operators and individuals must play their part.

Managing fatigue—CAO 48 timetable

December 2012	New CAO 48 rules made – flight crew members and operators
December 2013	Standard industry exemptions no longer available after December 2013
2013	Operators will be expected to commence transition to the new rule set over this year. Operators may apply for an FRMS
December 2013	Transition to the new flight crew member fatigue rules complete
2013	Cabin crew fatigue management rules anticipated
July 2014	Cabin crew fatigue management rules due to come into effect

Individuals, including private pilots, must not fly when they are fatigued, or likely to become fatigued. Pilots also have a responsibility to use their off-duty time responsibly, in order to gain adequate rest.

SIX FATIGUE MYTH BUSTERS

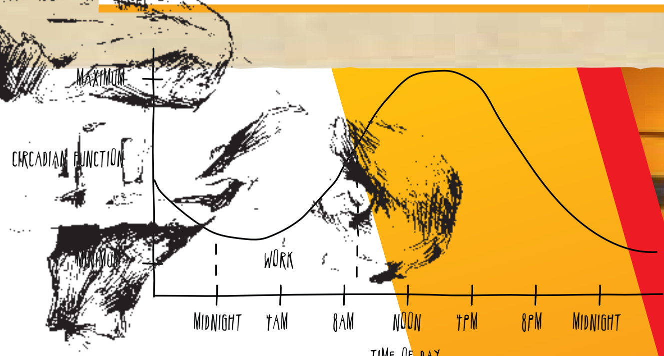
- There is no magic anti-fatigue bullet
- Fatigue is not a sign of weakness
- Fatigue is not something you can overcome with coffee and willpower
- A can-do attitude—'we're paid to do the job—we can handle it'—can be dangerous
- You cannot train yourself to need less sleep, nor can you 'store' sleep
- Just because you have experience with fatigue, does not mean you are immune to its effects.

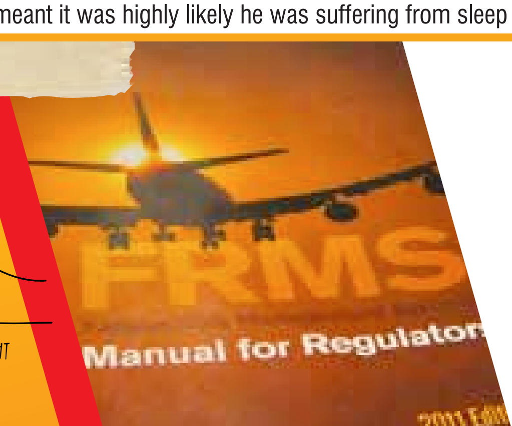
The proposed new rules address a number of issues:

- The increasing demands of global aviation, and the pace of contemporary travel. Flying today's A380s or B787s places very different demands on pilots, compared to flying Constellations or Comets. The old rules related more to the beginning of the jet era, not to one of ultra long-haul aviation, where flight crew can cross up to eight time zones in 24 hours.
- Improved scientific understanding of fatigue and related issues.
  - The past ten years have seen a rapid growth in knowledge about fatigue. Various studies have looked at the human body clock, and how this affects fatigue and performance. Humans are basically diurnal creatures – in other words we are awake during the day and sleep at night, as distinct from nocturnal creatures such as owls. Many of our body's physiological functions: variations in body temperature, production of enzymes to digest our food, production of hormones, and wakefulness and sleepiness, operate on a roughly 24-hour cycle. These are known as circadian rhythms (circadian means 'about a day').
  - The growth in shift work affects our circadian rhythm because it means we work at times when our bodies are programmed to be asleep. One especially critical time for shift workers is from 0200-0500, also known as the window of circadian low (WOCL). At this time our body temperature is at its lowest, and our mental alertness can be at its poorest. (There is another peak in sleepiness with implications for fatigue—in the early afternoon—sometimes called the afternoon nap window [around 1500-1700 for most people]. Restricted sleep at night, or disturbed sleep, make it harder to stay awake during the next afternoon nap window.)
  - Shift work not only has the potential to disrupt the body clock, but also often prevents employees from getting enough sleep, and, importantly, can affect the quality of that sleep.
  - Fatigue risk can result from not enough sleep, combined with the quality of that sleep. Most of us need on average between seven and eight hours of uninterrupted sleep a day to perform at our best. Then you have to consider 'the time awake' as a contributor to fatigue. How long you have been awake, how long you have been at work, and the time of day are all factors contributing to fatigue.
- Recognising the complexity of fatigue as an aviation safety issue – that there is no 'one-size-fits-all' solution, hence the tiered approach of CAO 48.
- The increase in the number of flight crew commuting longer distances to work, and the resulting impact on fatigue.

Aviation accidents in which fatigue was implicated

Date	Airline/location	Description
21 December 1994	Air Algerie/ Warwickshire UK	Five people killed: flight crew and passengers. The flight crew were fatigued—they had had 10 hours of flight duty, with five flight sectors which included six approaches to land.
6 August 1997	Korean Air/Guam	Boeing 747-300 crashed on approach to Guam's international airport, killing 223 passengers and crew at the crash site. Captain's fatigue was cited in the report as a contributing factor.
18 August 1998	Kalitta DC-8-61F/ Guantanamo Bay	The Guantanamo Bay accident was the first in which pilot fatigue was cited as the primary cause. The pilot stalled a perfectly serviceable aircraft into the ground on approach. His inability to monitor the aircraft's safe flight was accepted as being the direct result of fatigue. The flight crew had been on duty for 18 hours, and flying for nine hours, and were suffering from circadian rhythm disturbance and lack of sleep.
1 June 1999	American Airlines/ Little Rock USA	Douglas MD-82 overran runway on landing and crashed, killing the captain and 10 passengers. Knowing that they were approaching their 14-hour duty limits, the pilots might have exhibited 'get-there-itis'.
25 June 2007	Cathay Pacific 747F/ ground collision at Stockholm (Arlanda)	Swedish investigator said crews had been awake for 18-20 hours; the time was 0330 local; and fatigue was a factor. Hong Kong CAA dissented, saying the crew had been given sufficient rest opportunity, so it was not fatigue.
12 February 2009	Colgan Air/Buffalo	Fifty people killed in the crash of a Bombardier Dash 8-Q400. Fatigue was cited as a factor—the young co-pilot frequently commuted across the USA to report for duty.
22 May 2010	Air India Express/ Mangalore	All six crew members and 152 passengers killed when the **Boeing 737-800 crashed at Mangalore**. The report found that the chief cause of the accident was the captain's failure to discontinue the 'unstabilised approach' and his persistence in continuing with the landing, despite three calls from the first officer to 'go around' and a number of EGPWS alerts. The report also identified that in spite of the availability of adequate rest before the flight, the captain slept for a prolonged one hour and forty minutes during flight, which could have led to sleep inertia. The relatively short time between his awakening and the approach possibly led to impaired judgement, accentuated because he was in the window of circadian low.
14 January 2011	Air Canada/ Boeing 767-333/ North Atlantic	Approximately halfway across the Atlantic, at night, the aircraft experienced a 46-second pitch excursion. This resulted in an altitude deviation of minus 400ft to plus 400ft from the assigned altitude of 35,000ft above sea level. Fourteen passengers and two flight attendants were injured. The first officer had reported not feeling altogether well. The father of young children, his home sleep was frequently interrupted, and his 75-minute controlled rest (nap) on the aircraft meant it was highly likely he was suffering from sleep inertia.



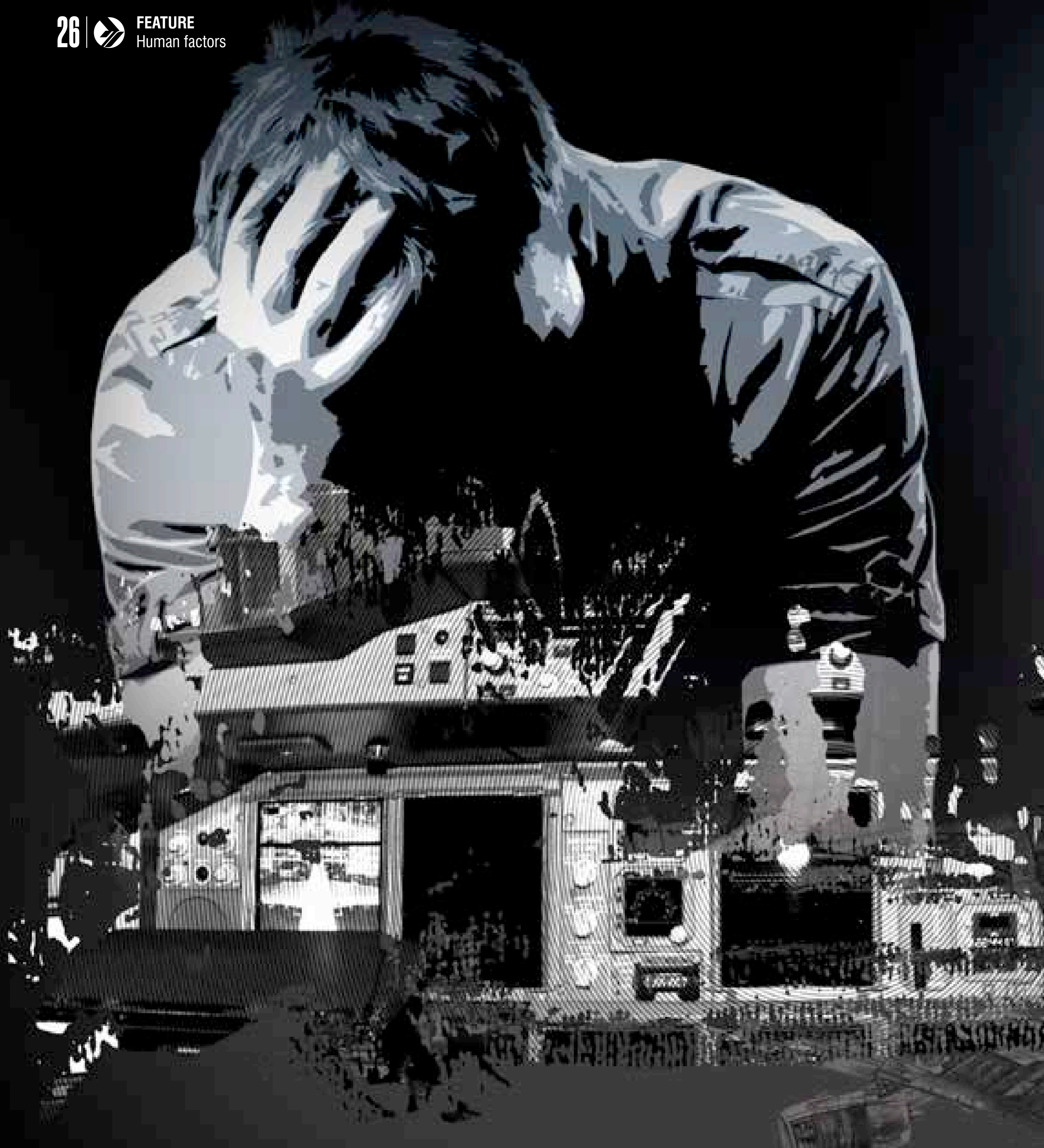


The terms of fatigue

Acclimatisation	Process of adapting to a new time zone after the body clock (circadian) disruption that is part of crossing numerous time zones.
Bio-mathematical models	Tools used to evaluate group work schedules (generally based on group average data) to help identify how some aspects of fatigue exposure are distributed. They can be used as one of a number of tools in managing fatigue, but should never be used to make 'go, no-go' decisions for crew members.
Circadian rhythms	Our body clock—our body's physiological functions: variations in body temperature, production of enzymes to digest our food, production of hormones, and wakefulness and sleepiness, operate on a roughly 24-hour cycle. These are known as circadian rhythms (circadian means 'about a day')
Jet lag	Physical and psychological discomfort caused by disruption to the body's circadian rhythms by travelling across time zones. Eastbound travel shortens the day or night, so 'west is best' because it produces less jet lag.
Sleep inertia	The period of confusion when you wake, or are awakened, from sleep, which generally lasts from 5–20 minutes. Performance and alertness can be impaired during this time.
Sleep cycles	Sleep varies during the night, cycling through different stages, each with distinctive brain wave patterns. Each cycle of between 90–120 minutes comprises five stages: 1–falling asleep; 2–light sleep; 3–4 deep sleep; and 5–REM (rapid eye movement). Stages 3–5 contribute to physical restoration, and the REM stage is also important for mental health and learning.
Sleep apnoea	A breathing-related sleep disorder, which can reduce your alertness at work, driving, or at play. It is the best known of over 50 sleep-related disorders, which also include dyssomnias such as narcolepsy and insomnia; hypersomnia, sleep walking and night terrors.
Time zone	Any of the regions of the globe that vary in local time from one another by one hour.
Window of circadian low (WOCL)	The time from 0200-0500, when our body temperature is at its lowest, and our mental alertness is most reduced.

FURTHER INFORMATION

Go to the 'operator' section of CASA's website (**www.casa.gov.au**) for a wide selection of frequently asked questions on fatigue management and the new CAO48



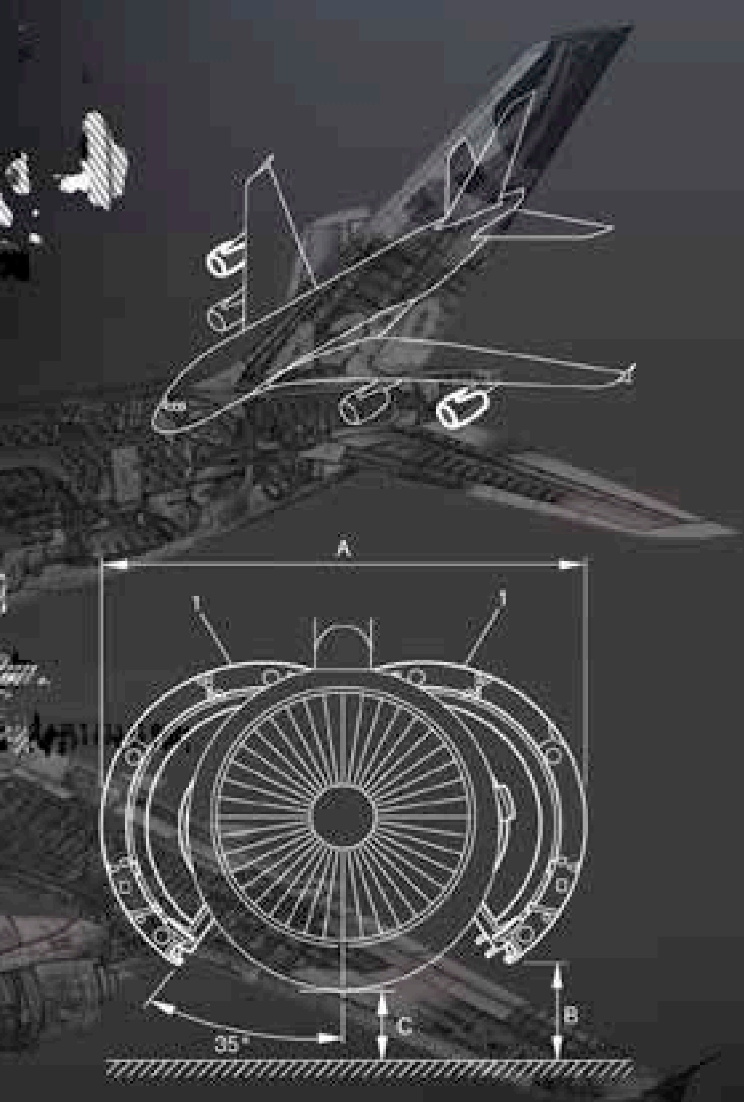
QF32 AND THE BLACK SWAN

Qantas pilot Richard de Crespigny's account of the QF32 engine failure offers some useful insights that apply to all aircraft and pilots. They are about the effects of massive stress, both on complex systems and human emotions.

The two most celebrated airline incident survival stories of recent years have been bird strikes—sort of. US Air flight 1549 hit a flock of geese over New York in January 2009, and on November 4 the following year Qantas flight 32 hit a metaphorical bird on climb-out from Singapore—a 'black swan'.

A black swan event is an improbable event that causes massive consequences. Like the black swans of Western Australia—which were unseen by European eyes for centuries, so all swans were presumed to be white—it exists, but can only be guessed at.

The author of *The Black Swan*, Nassim Nicholas Taleb, argues that it is pointless trying to predict such extreme events. All that can be hoped for is that societies and systems are robust enough and have adequate redundancy to withstand them. The crew of QF32 and the design of the Airbus A380 proved this point eloquently.



The facts at the time of writing were incomplete, pending the final Australian Transport Safety Bureau report, but the narrative is well known, and disturbing. QF32 suffered an intermediate stage turbine disc failure—the first in the 40-year and 200-million-hour history of the Rolls-Royce RB211 family of turbofan engines.

Shrapnel from the disintegrating engine cut more than 600 wires and left more than 100 impacts in the wing, about 200 impacts on the fuselage and 14 holes in the fuel tanks. The No.1 and No. 2 AC bus systems failed, the flight controls reverted to alternate law and two other engines, in addition to the destroyed one, went into what the ATSB preliminary investigation called 'degraded mode'. Fuel was streaming from the wing. One of the projectiles that passed straight through the wing was later found to have missed the top of the fuselage by 2cm.

The captain of QF32, Richard de Crespigny, has written a book on the event. Predictably, its launch publicity on TV and radio played up the 'steely-eyed aviator' stereotype, but in speaking to *Flight Safety Australia* de Crespigny emphasised several very different messages. For a start, he says any Qantas crew would have been just as successful.

Lesson 1. The nuances of CRM

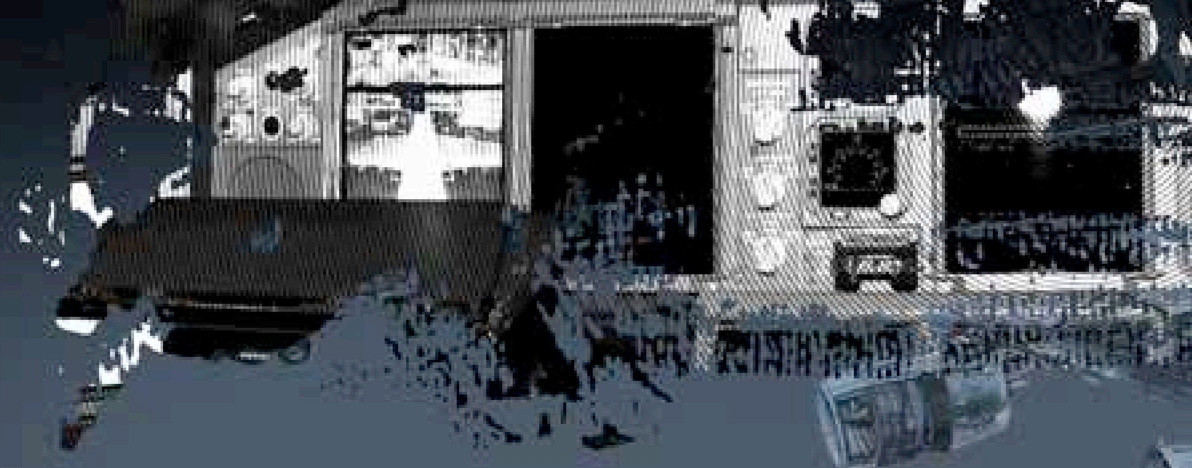
Crew resource management is a concept that de Crespigny strongly believes in. It's a conviction that goes back to his air force days when, after a career in multi-crew aircraft (Caribou and Iroquois), he realised he had become a different sort of pilot to the fighter pilots whose ranks he had once aspired to join. But he is also aware of its limits. Because de Crespigny was undergoing a line check, there were two other pilots on the flight deck of QF32: a check captain, Harry Wubben, and a senior check captain, David Evans, supervising Wubben. With first officer, Matt Hicks, and second officer, Mark Johnson, there were five pilots on the flight deck.

De Crespigny pays tribute to his colleagues and says the successful landing was a team effort. But his point is that even a team needs a leader. 'The flight deck is not a committee', he says.

The pilot in command has ultimate responsibility for the aircraft. Their seat is where the proverbial buck stops. But at the same time control is often best exercised through delegation.

In the book *QF32* de Crespigny writes of his standing order to the pilots in the second-row seats, 'If we are all up front looking down, you look up. If we are all looking up, you look down.'

The ever-shifting balance between authority, delegation and consultation meant de Crespigny took some cockpit decisions himself, and consulted the entire extended crew when there was time.



Lesson 2. The cliché is true: aviate, navigate, communicate

The crew of QF32 was faced with an unprecedented number of checklists from the A380's electronic centralised aircraft monitor (ECAM). De Crespigny estimates there were more than a hundred and twenty.

'We were just getting checklist after checklist telling us what was going wrong. It took us an hour to know what all the threats were—then we had to mitigate them.'

Despite this, the crew adhered to one of aviation's most hallowed (and wise) clichés: 'aviate, navigate, communicate', meaning that the first priority should always be to keep control of the aircraft.

'Every 10 minutes we reassessed the fuel and we reassessed whether we should continue doing checklists, or ignore the checklists and just (somehow) get the aircraft down on the ground. We all discussed it', says de Crespigny.

With threat and error management you have to fix the problem—or mitigate for its loss. It's a see-saw: if the aircraft wing had been on fire I would have put it straight on the ground or into the water. But we didn't have a wing fire so we had more time – but how much more time? '

The threat of landing an aircraft in an unknown state ... I think if we had thrown the aircraft down straight away people might have died.'

An important principle was to act after consideration, rather than blindly obeying checklists.' No checklist was actioned immediately,' de Crespigny says. 'We discussed everything. We were trying to assess the threat and either fix it, or work out how we would mitigate it.'

A habit from de Crespigny's military career asserted itself as they made their initial approach. He insisted on a control check. 'It's bred into the air force psyche.' He was also thinking of El Al flight 1862, a Boeing 747 freighter that crashed into a block of flats in Amsterdam in 1992, killing the crew and 47 people on the ground. "They slowed down to configure and because they were asymmetric, went into an unrecoverable roll. You have to check the ability of the aircraft to fly and remain in control at the speed you want to land.'

'We did a dress rehearsal of the landing at 4000 feet. If we had been losing control we would have sped up and brought the flaps up one step. What that meant was that a few minutes later, when we got speed and stall warnings they were certainly unexpected—but deep down I knew the aircraft would fly.

De Crespigny is an enthusiast for all Airbus and Boeing and fly-by wire aircraft generally, but he says automation can make it more difficult for pilots to honour the command to always aviate.

'Flying is getting so much harder because there is so much more automation and so many more systems. There are four million parts in an A380. Manufacturers may say automation makes flying easy, but I maintain that if pilots are to recover an aircraft from an unimaginable position they still need to have knowledge of that aeroplane, much the same as pilots did in the 70s and 80s.'

Lesson 3. It's not over after you touch down

De Crespigny has an endearing nerdish delight in analysing complex systems. (The Singapore incident interrupted his *magnum opus*, a technical book on new generation fly-by-wire airliners). The aftermath of QF32 required him to turn that gaze on himself.

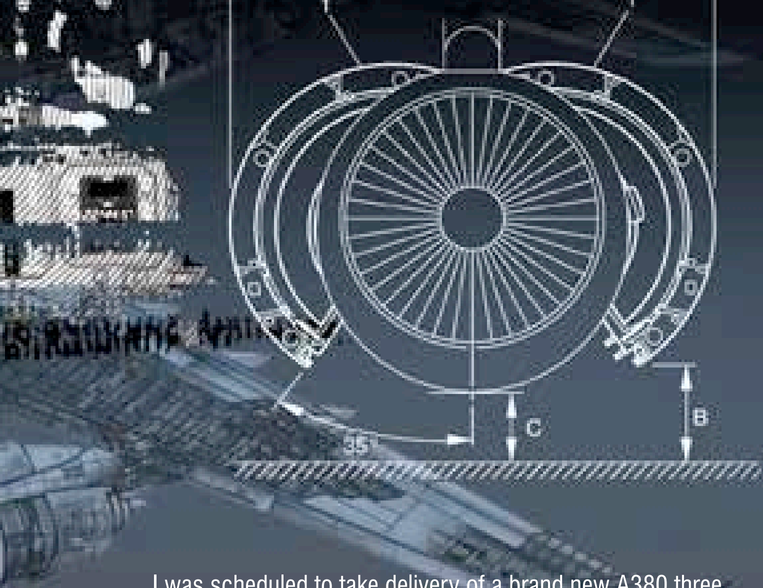
Weeks after the event he found himself weeping, for the first time since his mother died decades earlier, while recounting parts of the event to ATSB investigators. There was another bout of tears and a six-hour car trip where he hardly spoke to his wife, Coral. Instead he went over and over the flight in his mind. De Crespigny was confronting post-traumatic stress.

'Pilots who have these incidents ... we've never been told what to expect, nobody around us knows how to handle us and we're totally blind as to how our emotions are affecting our lives and our work,' he says.

'Even for pilots who think they're OK, the stress they thought they were handling can reemerge.'

'I insisted that it go in the book. I, and all male pilots are alpha males; we think we're indestructible. When something happens we think "let's toughen up and get through it".'

De Crespigny instinctively knew it was more than a question of toughening up.



I was scheduled to take delivery of a brand new A380 three weeks after QF32. I called up my manager and said, "I am not in a condition to assess whether I am safe to fly. You have to take me off this trip." It turns out I wasn't in a fit state at all. I was so preoccupied with the aftermath of QF32.'

He visited aviation psychologist Ron Zuessman who, with a bluntness appropriate to his speciality, said: 'I know pilots: what's your problem?'

Zuessman explained how de Crespigny's tears were a delayed expression of the stress he felt during the emergency.

'He said, "revisit it, keep doing it – it will go away – if you don't revisit it then it will stay there in your mind for ever, and every time it re-emerges, it will be just as painful as it was the first time".'

'I went away, thought about it and realised the crying was just natural'.

Zuessman then started working on what de Crespigny calls 'the loop'—his endless mental replaying of the flight. 'He said: "You're probably talking to investigators, or writing a book—once I clear you from the loop you'll start forgetting things. Do a deal with Coral that you'll stay in the loop for another three or four weeks, as long as you need to write down all the details of the flight for the investigators. After three weeks you'll run this process I'm going to teach you and you'll get out of the loop and start forgetting.'

The method was simple, but took advantage of recent research on brain function: 'Just as I'm about to serve in a game of tennis I think QF32', or when I'm mowing the grass I suddenly think QF32, de Crespigny says. 'Anything that needs intense concentration, I think of QF32. It's a way of making new synapse connections and breaking the older, post-traumatic stress synapse connections in my brain.'

'In the weeks before I returned to flying I was looking up whenever an aircraft went over: I was ready for normal flying duties. I've been flying now for the past sixteen months. I'm sane, content and not afraid of anything because I took time to handle the PTS. Most importantly I'm not afraid of the aircraft. My message in putting this long description of post-traumatic stress in the book was to let others know that these issues are real and that they can be fixed.'

De Crespigny's account of QF32 is published by Pan Macmillan Australia ISBN 1742611174

A key moment, says de Crespigny, was when the pilots used Apollo 13 inverted logic that prompted them to abandon attempts to work out what had failed in the aircraft's complex fuel system and instead look at what was still working. The plane had only three usable fuel tanks out of 11 and this was a crucial calculation. www.theaustralian.com.au

Simple, scalable tool control starts with centralised access control

Tool control systems control tool shrinkage and replacement cost. They also help reduce lost-tool downtime. In critical industries and applications such as aviation and nuclear power, tool control is an essential step toward eliminating FOD (Foreign Object Damage in aviation) and implementing FME (Foreign Material Exclusion in the power industry). Unlocked and open access tool boxes can result in FOD/FME problems. Snap-on puts you in control with two choices. Our Level 5™ NTC system (N042-N043) allows you to specify access to boxes, audit when they are used, and manage it all over a network.

Our Level 5™ ATC system provides the simplest and most user-friendly solution for detecting tools issued from and returned to a tool box, providing a critical enhancement to your FOD/FME program. Using advanced digital imaging technology and proprietary software, the tool box automatically keeps track of its inventory by user, and records which tools are removed and replaced, and when.

LEVEL 5 ATC™
Tool Control System

Level 5™ ATC Advanced technology that makes tracking tools simple. Level 5™ ATC is a true tool control system. Based on the tool list that you supply, each drawer in the tool box is organized and each tool assigned to a unique space in the foam drawer liner. That information is then programmed into the scanning hardware fitted to the top of the box. As each drawer is opened and closed it is scanned digitally, and the image is instantly compared with the baseline stored image of that drawer. Any tool that has been removed or returned is identified and the computer makes an audible announcement: a tool has been removed or replaced.

Additionally, the computer tracks each tool removed and replaced by its part number and by user, and creates an audit trail in database format. Both the digital images and the data entries are stored for review in an audit trail of the last 15,000 transactions. Not only do you get detailed information, but you have access to the actual pictures of the drawer contents for verification.

Plug and Play vs. Some Assembly Required

Some solutions to FOD and FME problem involve attaching RFID tags, sensors or bar codes to the tools to track them. Additional operations and attachments can create significant additional cost and limitations by:

- Interfering with the normal use of the tool
- Using up additional real estate in the drawers
- Having limited usability on small tools like sockets
- Dislodging and becoming a new source of FOD

Level 5™ ATC Features

- No individual tool scanning required
- No RFID tags to install or replace
- No limitations on tool size-if it fits in the drawer, it works
- Intuitive interface-easy-to-use touchscreen
- Audible voice confirmation of tool removal and replacement
- Automatic locking
- Errors announced and displayed for incorrect tool position or drawer not closed

The Snap-on Level 5™ ATC system is delivered with your predetermined set of tools already installed in one of two basic platforms, the KRL1056 36″ framework, or the KRL1021 54″ framework. Each is offered in eleven color choices, three different drawer configuration options, with and without casters, and in 110V or 230V Australian Power Options.

To order, work with your Snap-on Industrial Account Manager or Customer Service Center to determine:

- Tool Set Contents
- 36″ or 54″ platform
- Color choice
- Drawer configuration
- Casters/no casters
- Voltage 110V/230V
- Standard or extended warranty
- Administrative software, with or without remote HID scanner

COMMUNICATION IN THE HANGAR

One of the most important items in your toolkit has no little recess in which to store it between jobs. This vital tool is invisible, but without it you can't work safely. It is communication. There are at least three areas where accurate communication is essential for the safe maintenance of aircraft.

Redundant and rich—the handover

Shift handover is when one group of workers passes their task on to another group. It is vital that both the details (everything being done) and the context of the task (why it is being done) are passed on to the new crew. On oil rigs and in hospitals the lessons of poor handovers have been learned the hard way.

In the 1988 Piper Alpha disaster, an offshore oil platform in the North Sea exploded and burned, killing 167 men. It was high summer, the maintenance season on an oil rig, and there had been a engineering shift change at 6pm, four hours before the explosion. But in that change a detail went missing. The day shift had removed a pressure safety valve on a condensate gas pump and replaced it with a blind flange—a loosely bolted steel disc. The day engineer found his night counterpart busy and left a notice about the pump on the night engineer's desk, where it got lost. Later that night, the other condensate pump failed and the night crew switched on the dismantled pump. The disaster began within seconds.

In 2006, an Aboriginal elder, Peter Limbunya, died alone and forgotten at an outback airstrip in the Northern Territory after being discharged from hospital in Katherine, where he had been treated for pneumonia. His discharge paperwork had been faxed to the community health centre in Kalkaringi on a Friday, advising of his arrival by air the following Monday. However, the fax went unseen, and the health centre was unaware of his return. The coroner found the health centre's systems to be haphazard. 'Faxes were taken off the machine by whoever sighted them and pinned on a notice board,' her report says.

Nor did the hospital have any checking system to confirm that the discharge paperwork had been received; instead its staff assumed that the fax would be acted on and someone would be there to collect the patient from the remote airfield. As it happened, there was no one to meet him. Mr Limbunya tried to walk home, but was found dead from pneumonia and dehydration three days later. He had managed to cover 400 metres.

In 1991, Continental Express Flight 2574 crashed in a field in Texas, killing all 14 people on board. The National Transportation Safety Board investigation found bolts had been removed from the Embraer Brasilia's tail plane during maintenance the night before the accident. There had been a shift change, and the bolts on the high-mounted T-tail had not been replaced. The plane crashed on its second flight of the day, when the leading edge of the tail plane came off, causing a sudden pitch down that quickly led to in-flight break-up.

All three cases are examples where what might be called the cardinal rule of shift handover had been broken.

That rule is: make sure the new guys understand what's happening. The best way to do that is to make the handover face to face, with confirmation.

However, this is seldom done in aviation. Writing for the Australian Transport Safety Bureau, consultant Alan Hobbs concluded: *Authorities on shift handover recommend face-to-face handovers by the people doing the work, instead of verbal briefings filtered through a shift lead, as is currently the case in many maintenance facilities. Face-to-face handovers are standard operating procedure in many high-risk industries such as nuclear power, offshore oil, and air traffic control, yet are relatively rare in aircraft maintenance.*

Shift handover is a major operational issue for NASA's robotic missions to explore other planets. On a mission of months or years, shift handovers happen thousands of times. The agency has studied the issue and concluded: 'Face-to-face handover is a best practice that is agreed upon in all guidelines and reviews of the literature and is aimed for in most domains studied. The reason is that handover errors are due to differences in the mental models of the outgoing worker and the incoming worker. Two-way communication enables the incoming worker to ask questions and rephrase the material to be handed over, so as to expose these differences.'

NASA found the human touch to be essential, even for robot-based exploration. 'Face-to-face handovers enable gestures, eye contact, tones of voice, degrees of confidence, and other redundant and rich aspects of personal communication to be utilized in conveying possible different mental models.'

A rivet here, a rivet there … maintenance documents

Vague words in a maintenance instruction were one of the things that blew the top of the fuselage off an Aloha Airlines Flight 243 Boeing 737 near Maui, Hawaii in April 1988. An extraordinary performance from the flight crew landed the aircraft safely, but a flight attendant was killed by the initial outburst.

A Federal Aviation Administration airworthiness directive issued in 1987 said: 'Repair all cracks and tearstrap delaminations found as a result of the above inspections prior to further flight in accordance with Boeing Alert Service Bulletin 737-53A109, Revision 3, dated August 20, or later FAA-approved revisions.

Boeing Alert Service Bulletin 737-53A109 said: 'Repair fatigue cracks using a repair similar to that shown in 737 Structural Repair Manual Subject 53-30-3, Figure 16, and replace all remaining upper row flush joint-fasteners in that panel joint with oversized protruding head solid fasteners per Part IV-Repair Data.'

In other words: engineers were not only to follow the structural repair manual, but also to go beyond its recommendations. Not all did. Aloha put protruding head solid fasteners only in the repair area.

What the FAA meant, the agency later said, was that the fasteners were to be installed throughout the skin panel joint where cracking was found.

The US National Transportation Safety Board concluded: 'In the case of this AD [airworthiness directive], it is believed that the repair instructions could have been presented more explicitly. This was, in fact, done in subsequent ADs pertaining to the same subject.'

The few studies that have looked at communication in aircraft maintenance suggest that it is a safety concern. In 2002, the British Civil Aviation Authority looked at maintenance communication and maintenance-related accidents. Of 102 maintenance-related events, 74 involved inadequate data or communications. Twelve of these events were fatal accidents, which killed 143 people and injured 92.

As part of an agency-wide campaign on plain language, the FAA has begun to take the clarity of maintenance bulletins seriously. It is a good example to follow. Here is an airworthiness directive from July 2012 that verges on being blunt, but is also simple and clear:

We are adopting a new airworthiness directive (AD) for all The Boeing Company Model 777 airplanes. This AD was prompted by four reports of retaining cross bolt hardware not fully engaged into the fuse pins of the forward trunnion lower housing of the main landing gear (MLG), which could result in an incorrect MLG emergency landing break-away sequence.

Analyse this: logbook entries

Anyone who has been involved in aviation for more than a few months invariably encounters the maintenance log joke. It's an oldie but a goodie, with entries such as: 'Pilot: autoland very rough. Engineer: autoland not fitted on this aircraft'.

But the joke shines a light on a serious issue—communication between pilots and engineers.

Surveys have found that this communication is often disorganised. A survey of Australian regional airlines found maintenance personnel reported that flight crew write-ups of deficiencies were often of little help in identifying a problem. The same survey found pilots sometimes recorded deficiencies on loose pieces of paper, or made verbal reports to engineers, instead of formally documenting maintenance problems.

Hobbs quotes a study where pilots and maintenance engineers at two U.S air carriers were asked about their use of the aircraft logbook. 'The results indicated a distinct split between the two groups', Hobbs said. 'Engineers reported that they frequently wanted more information from pilots' logbook entries, yet pilots were generally satisfied with the level of detail in maintenance write-ups. A common complaint from engineers was that pilots make logbook entries in which a component is simply described as INOP (inoperative), with no further details.'

So, in defining the problem, what simple techniques can be used within any size of organisation to improve both the quality and quantity of communication?

1. Have a structured, handover procedure that includes a pre-formatted sheet to improve consistency. See a sample below.* This will ensure that all the critical information is included or considered during a face-to-face handover. While this sheet is never intended to replace the aircraft's technical logbook, it does provide a valuable reference to ensure information passed on verbally during the handover is not forgotten.
2. Develop supervisors' briefing and de-briefing skills as part of your human factors training course. Remember: effective communication is a skill and like any skill must be practised to improve. Ideally, if you can identify 'good' communicators within your organisation, use them as mentors to raise the quality throughout your organisation.
3. Get pilots and engineers together with sample logbook entries (good and bad) to discuss the impact of poor write-ups and show how they can help each other with clearer language and agreed terminology.

Above all, educate the entire organisation so everyone knows that the crucial part of communication is not what is said, it is what people hear and understand. The person attempting to convey information is responsible for making sure that the recipient of that information accurately understands it.

* Handover sheet

AIRCRAFT/EQUIPMENT NO:	TIME/DATE:
TASK DETAILS:	
MAINTENANCE MANUAL REFERENCE:	

STEPS/TASKS COMPLETED:	
STEPS/TASKS REQUIRED:	
RESTRICTIONS/SAFETY HAZARDS:	
ITEMS/EQUIPMENT DISCONNECTED OR REMOVED FOR ACCESS:	
EQUIPMENT/GSE IN USE:	
ADDITIONAL COMMENTS, INCLUDING FAULT FINDING CARRIED OUT:	
NAME:	CONTACT:

SELECTED SERVICE DIFFICULTY REPORTS

17 May – 13 July 2012

Note: Similar occurrence figures not included in this edition

AIRCRAFT ABOVE 5700kg

Airbus A320232 Galley station equipment odour. SDR 510014943
Hot plastic smell in aft galley. Investigation found no definitive cause for the odour.

Airbus A330303 Escape slide failed test. SDR 510014988
Door 2 LH escape slide partially deployed but hung up on girt bar for a few seconds before finally deploying. Time to full deployment – 16.8 seconds. Maximum time allowed is 16 seconds. P/No: 7A1539125

Airbus A330303 Fuselage keel beam cracked. SDR 510014908
LH centre wing box keel beam fastener holes cracked at frame 40. Cracking evident in fuselage skin to lower doubler interface. Investigation continuing. Four similar defects

Airbus A380842 Air conditioning system smoke/fumes. SDR 510014819
Fumes in cabin after take-off. Fumes ceased after approximately 15 minutes of flight. Investigation could find no definitive cause.

Airbus A380842 Flight control system power supply faulty. SDR 510014955
Control system back-up power supply (FIN 2CJ2) faulty. Found during inspection iaw EA SA08544. Investigation continuing. P/No: 41100103001

Airbus A380842 Passenger station seat locking device out of calibration. SDR 510014968
First-class passenger seats (4off) found to have incorrect functioning 16G locks.

Airbus A380842 Pitot/static system MFP faulty. SDR 510015027
Captain's pitot static system multi-function probe (MFP) faulty. Initial investigation found angle of attack portion missing. Investigation continuing. P/No: 0859BB26.

BAE 146100 Engine vibration sensor faulty. SDR 510015018
No. 4 engine vibration pick-up sensor (accelerometer) faulty.

BAE 146100Fire Detection system terminal block failed test. SDR 510014929
Fire detection system 10-way ceramic terminal blocks (3off) failed resistance test. Found during inspection iaw ISB 24-143. Terminal blocks located in engine pylons. Five similar defects. P/No: S3409872.

BAE 146RJ100 Flight compartment windshield shattered. SDR 510015061
Captain's LH B windshield outer pane shattered. Investigation continuing. P/No: NP1701021. TSN: 72 months.

BAE 146RJ100 Passenger/crew doors cabin door unlocked. SDR 510014999
Cabin door warning. Investigation found door handle mechanism stiff requiring lubrication. Upper door hinge pivot tight. Loose terminals on TB strip 251-00-00.

Beech 1900D Flight control wiring short circuit. SDR 510014835 (photo following)
Flap wiring system short-circuited to ground. Water in wiring following heavy rain caused short circuit. TSN: 9473 hours/9555 landings.

Beech 1900D Fuselage skin cracked. SDR 510014900
Lower fuselage skin cracked. Corrosion found between stringers and skin.

Beech 1900D Passenger oxygen system nut cracked. SDR 510014899
Oxygen fill line nut cracked. Copper pipe seam also leaking.

Boeing 737376 Crew station locknut missing. SDR 510015013
Captain's seat track lock broken. Nut missing from bolt.

Boeing 737376 Wing, plates/skin nut cracked and leaking. SDR 510015006
RH wing fuel tank access panel 7th from inboard dome nut cracked and leaking.

Boeing 737476 Crew oxygen mask failed. SDR 510014893
Captain's oxygen mask difficult to breath through due to restricted flow in 'emergency'. Second observer's mask had erratic flow. Investigation continuing. P/No: MC1025104. TSN: 49,135 hours. TSO: 1271 hours.

Boeing 737476 Wheel bolt sheared. SDR 510015098
No. 2 main wheel tie bolt sheared. P/No: 6558256262. TSN: 27,041 hours. TSO: 327 hours.

Boeing 7377FE Air distribution system filter dirty. SDR 510014936
Strong smell from rear of aircraft. Investigation found a dirty recirculation filter. P/No: CD01068F2.

Boeing 73782R Detection system control panel unserviceable. SDR 510014891
Engine and APU fire control panel unserviceable. P/No: 693707300. TSN: 31,993 hours/19,570 cycles.

Boeing 737838 Attitude gyro and indicating system battery charger failed. SDR 510015016
Integrated standby flight display (ISFD) battery charger failed. Investigation continuing. P/No: 312BS1011. TSN: 16,677 hours. TSO: 69 hours.

Boeing 737838 Wheel failed. SDR 510015030
No. 2 main wheel seized on axle. Initial investigation found the inner hub shattered and axle sleeve damaged. Investigation continuing. P/No: 277A6000204. TSN: 13,729 hours/221 cycles.

Boeing 7378FE Landing gear retract/extension system suspect faulty. SDR 510014953
Uncommanded nose landing gear extension when the landing gear control lever was selected to 'off' position. Investigation could find no definitive cause for the defect.

Boeing 7378FE Pressure control system PRSOV leaking. SDR 510014982
Trim air pressure regulating and shut-off valve (PRSOV) leaking. PRSOV had been locked out due to ruptured duct downstream. P/No: 32149721 – Duct P/No: 213A150145. TSN: 6695 hours/4014 cycles.

Boeing 7378FE Weather radar suspect faulty. SDR 510015070
Investigation found no faults.

Boeing 7378FE Wheel bolt failed. SDR 510014858
No. 3 main wheel assembly tie bolt failed approximately halfway along the threaded area. One similar defect. Wheel: P/No: 277A6000204. TSN: 17,031 hours/9784 cycles. TSO: 1932 hours/1018 cycles.

Boeing 767336 Engine cowling system panel separated. SDR 510014923
RH engine outlet guide vane infill panel separated in flight.

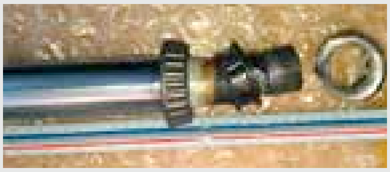
Boeing 767336 Cargo equipment wiring loom burnt. SDR 510014956
Power Drive Unit (PDU) wiring loom burnt/short circuited. Burn damage to surrounding insulation blankets. Investigation continuing.

Boeing 7773ZGER Galley oven smoke/fumes. SDR 510014937
Rubbery/smokey smell from ovens F107 and F108. Investigation found the ovens serviceable, but the packaging of the meals in them was unsuitable. P/No: 820216000001.

Boeing 7773ZGER Leading edge slat bird strike. SDR 510014839
No. 10 leading edge slat had bird strike damage in area of wing anti-ice access panel 2. P/No: 114W4150Y112. TSN: 6842 hours/523 cycles.

Bombardier CL604 Trailing edge flap control system failed. SDR 510014837
Numerous reports of flap system failing over the previous six months. Various components in the flap system replaced during extensive troubleshooting. No more recurrences since replacement of the flexible drive shafts.

Bombardier DHC8402 Wheel bearing failed. SDR 510014969 (photo below)
RH nose wheel noticed to be slightly inclined inwards. Investigation found that that the outboard wheel bearing had suffered a catastrophic failure, resulting in significant damage to the axle. Suspect may have been caused by incorrect torque of the axle nut. Investigation continuing. TSN: 3458 hours/3853 cycles.



CVAC 340 Flight compartment window cracked. SDR 510014918
LH main window cracked. Investigation found evidence of a bird strike on the top of the fuselage, with impact close to the edge of the window. P/No: 34031103019.

Embraer EMB120 Flight compartment windshield overheated. SDR 510014935
Pilot's forward windshield overheated with electrical burning smell. Initial investigation found heat damage/discolouration on the terminal block earth leads. Investigation continuing. TSN: 3602 hours/2644 cycles/51 months. TSO: 3602 hours/2644 cycles/51 months.

Embraer EMB120 Fuselage door hinge bracket damaged. SDR 510014917
Passenger/crew entry door forward actuator inboard attachment bracket top and bottom intercostals at stringer 19 damaged. Attachment bracket rivets pulled through outer skin.

SELECTED SERVICE DIFFICULTY REPORTS ... CONT.

Embraer EMB120 Ice and rain protection wiring terminal overheated. SDR 510014934
De-ice system current sensor wiring terminals discoloured due to overheating. SB 120-30-30 had previously been carried out. P/No: 36160.

Embraer EMB120 Landing gear failed – extend. SDR 510015025
Nose landing gear indicated unsafe following landing gear extension. Landing gear cycled, with nose gear eventually indicating down and locked. Investigation could find no definitive cause for the defect.

Embraer EMB120 Trailing edge flap actuator suspect faulty. SDR 510015002
RH outboard flap actuator suspect faulty. During lowering flaps for access, the RH outboard flap only extended to 15 degrees when all other flap segments fully extended to 45 degrees. Flap failed to extend correctly three more times. Flaps left for approximately 20 minutes, and the flap then operated correctly.

Embraer EMB120 Trailing edge flap control system annunciator faulty. SDR 510014905
Flap annunciator unit faulty. Investigation continuing.

Embraer ERJ170100 Hydraulic pump failed. SDR 510015029
No. 3 electric hydraulic pump failed. Investigation continuing. P/No: 5116603.
TSN: 5673 hours/4711 cycles/37 months.

Embraer ERJ170100 Trailing edge flap actuator locked. SDR 510014832
Flap 2 caution light illuminated during approach. Initial investigation found the RH inboard flap actuator torque limiter pin tripped. Investigation also found manual rotation of the input splines to be difficult and rough, suggesting a problem with the flap actuator gearbox.
P/No: C1548152.
TSN: 7582 hours/5146 cycles/82 months.

Embraer ERJ190100 Hydraulic system O-ring failed. SDR 510015084
RH inboard brake lower bleed fitting O-ring seal failed, causing loss of hydraulic fluid.
P/No: ABP0046.

Embraer ERJ190100 Pitot/static system sensor unserviceable. SDR 510014920
Integrated pitot/static/AOA sensor unserviceable.
P/No: 2015G2H2H8A. TSN: 2 hours/2 cycles.

Embraer ERJ190100 Pressure regulator/outflow valve restricted.SDR 510015034
Cabin pressurisation system outflow valve operation interfered with by insulation blanket due to five missing blanket-to-frame retaining clips. Blanket residue found in valve and belly fairing.

Fokker F27MK50 Landing gear retract/extension system lockplate damaged. SDR 510015010
LH main landing gear upper member outboard pivot pin lock plates broken and bent. Suspect caused by restricted rotation in the airframe bracket bushes.

Fokker F28MK0100 Landing gear retract/ extension system terminal loose connection. SDR 510015082
Landing gear selector anti-retraction solenoid terminal loose. Investigation found two flat washers P/No: MS35338-40 and lock-spring washer P/No: AN960KD3L not installed at the anti-retraction solenoid terminal connection. Solenoid fitted by a previous operator.

Fokker F28MK0100 Wheel/ bolt sheared. SDR 510014993
LH No. 2 main wheel tie-bolt sheared.
Tie-bolt found on runway. P/No: MS21250.

Fokker F28MK0100 Wheel cracked. SDR 510015064
Nose landing gear wheel inboard hub cracked in bead seat. Crack length approximately 44.5mm (1.75in). Found during eddy current inspection.
P/No: 50081331.

Fokker F28MK0100 Wing, control surface attach fitting bolt sheared. SDR 510014829
No. 2 lift dumper lever mounting bracket attachment bolt head sheared. Lift dumper rod assembly locknut loose and safety wire broken.

Fokker F28MK1000 Flight compartment windshield shattered. SDR 510014945
Co-pilot's windshield outer pane cracked and then shattered. P/No: D20543406.

Gulfstream GV Passenger compartment window cracked. SDR 510014897
Cabin window outer pane cracked along edge. Caused by inadequate clearance between window and fuselage skin.
P/No: 1159CE5000117. TSN: 5912 hours/2282 cycles/2282 landings/144 months.

Saab SF340B Elevator control system servo unserviceable. SDR 510014901
Elevator control system went to nose-down without pilot input. Pulling back on LH control column had no effect until control suddenly released. RH control column had normal input. Investigation found servo had a seized bearing which allowed the clutch shaft to continue spinning, wearing the inner bearing and causing end play. The servo mount was also found to have an incorrect torque setting.
P/No: 622-2027-002.

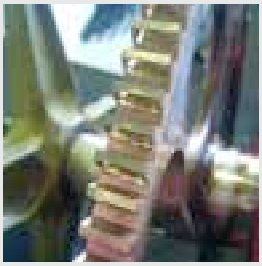
Saab SF340B UHF communication system controller odour. SDR 510014957
Intermittent burning smell in cockpit. Investigation found a faulty Comm 1 controller. Controller had been fitted just prior to flight. Investigation found the smell on the replacement controller was a residual smell left over from the previous repair.
P/No: 6226520009.
TSN: 23,136 hours. TSO: 23,136 hours.

BELOW 5700kg

Beech 200 Aileron tab control system out of adjust. SDR 510014840
Excessive RH aileron trim required for straight and level flight. Investigation continuing.
TSN: 22,524 hours/17,685 cycles.

Beech 200 Hydraulic pump electric motor short-circuit. SDR 510015078
Hydraulic pack electric motor internal short-circuit.
P/No: 481. TSN: 156 months. TSO: 156 months.

Beech 58 Landing gear gearbox failed. SDR 510014972 (photo below)
Landing gear failed to retract. LH and RH main landing gear and nose landing gear stuck in transit position. Emergency gear extension lever reported not engaging. Emergency landing carried out with landing gear not extended. Damage caused to aircraft structure, engines and propellers. Investigation found a failed gearbox had caused the landing gear motor to burn out. P/No: 958100175.



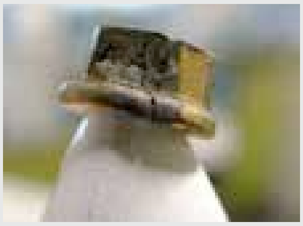
Beech 58 Mixture control cable failed. SDR 510014996
RH engine lost power and fuel flow needle dropped to zero. RH engine feathered. Engine able to be restarted on the ground. Investigation found mixture control inner cable snapped at swaged end (FCU).
P/No: 5038901223.

Beech 58 Power lever cable broken. SDR 510014866
LH engine throttle cable broken at swaged end fitting. Cable had only 779 hours TSN.
P/No: 5038901223.

Beech C90 Elevator tab control system cable failed. SDR 510014881
Elevator trim cable failed at pulley in floor located forward of door. P/No: NASJ0266577D.

Cessna 172E Control column corroded. SDR 510014997 (photo below)
Significant internal corrosion of control yoke found during inspection iaw Cessna SEB01-3. (SDRer AWB 27-4) P/No: 05117821. TSN: 5314 hours/576 months.

Cessna 172R Aileron control system nut cracked. SDR 510015093 (photo below)
LH and RH aileron bellcrank nuts cracked.
P/No: MS21042L4.



Cessna 172R Aircraft fuel line rubbing. SDR 510014827
Fuel system return line worn due to rubbing on nose landing gear steering RH pushrod. Investigation also found the fuel return check valve hinge position at base could allow valve to stay open if the spring weakened. Found during inspection iaw AD 2012-02-02. Aircraft has only 25 hours TSN. P/No: 05160311.

Cessna 172R Aircraft fuel line worn and damaged. SDR 510015058
Numerous fuel supply lines and wiring connectors worn and damaged.

Cessna 172R Flight control system cable worn. SDR 510015055
Rudder cables, elevator trim cables and aileron cables worn beyond limits. Elevator and aileron rigging and travel incorrect.

Cessna 172R Fuselage skin distorted. SDR 510015059
RH skin lap joint between side and belly skins located at FSTA 8.12 below the lift strut attachment point buckled and distorted. Lift strut supporting frame flange had two drilled holes, with rivets removed/not fitted. P/Nos: various.

SELECTED SERVICE DIFFICULTY REPORTS ... CONT.

Cessna 172RG Fuselage tunnel cracked. SDR 510014916
LH nose landing gear/control yoke support tunnel P/No: 2413001-5 cracked from rudder torque tube bearing attachment hole. Investigation also found the RH tunnel P/No: 243001-8 cracked in the same location. P/No: 24130015L2430018R. TSN: 10,326 hours.

Cessna 172R Horizontal stabilizer nut plate missing. SDR 510014976 (photo below)
Elevator down stop bolt anchor nut plate missing. Sheared rivet tails still in the mounting. Stop bolt had been fastened to the vertical stabiliser casting with AN970-3 washers and loose nuts. Aircraft had only 28 hours TSN. P/No: MS210783.

Cessna 182P Main landing gear leg corroded. SDR 510015088 (photo below)
RH main landing gear leg corroded in area of step bracket attachment. Area of corrosion approximately 31.75mm by 6.3mm (1.25in by 0.25in) in area and 2.54mm (0.1in) in depth. Investigation found the glue attaching the step bracket was partially delaminated allowing moisture ingress between the bracket and leg that contributed to the corrosion. P/No: 07416302. TSN: 10,779 hours.

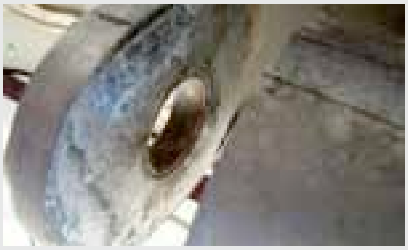
Cessna 208B Trailing edge flap bracket broken. SDR 510014926
Flap actuator support bracket twisted and torn. P/No: 26111447. TSN: 4881 hours.

Cessna 210L Landing gear door actuator bolt broken. SDR 510015019
LH and RH main landing gear actuator attachment bolts (three per actuator) broken or loose. Only one bolt per actuator was tight. P/No: NAS464P4A29.

Cessna 210N Control column screw separated. SDR 510014963
Pilot's control column internal glide screw fell out and glide separated. Found during inspection iaw SEB-27-01. TSN: 5284 hours.

Cessna 210N Nose/tail landing gear attach trunnion cracked. SDR 510014888
Nose landing gear lower trunnion cracked. P/No: 124340216.

Cessna 210N Wing spar corroded. SDR 510014836 (photo following)
Wing main spar carry-through forging corroded on lower lugs. Investigation found corrosion caused by contact with the rear cabin vent Sceet ducts. Duct clips left undone, allowing ducts to sag and rest on lower lugs. AD Cessna 210/61-2 carried out in 2009. P/No: 21100013. TSN: 3256 hours/384 months.



Cessna 310R Aircraft fuel distribution system hose fitting broken. SDR 510014870
Fuel smell in cockpit. Investigation found a broken LH fuel bleed hose fitting under the co-pilot's dash. P/No: 3112D.

Cessna 310R Vertical stabiliser rib corroded. SDR 510014922 (photo below)
Fin root rib and skin attachment rivets corroded. Initial investigation found an AN3 bolt instead of a rivet attaching skin. When paint removed, more rivet heads separated.
P/No: 08313031. TSN: 6842 hours.

Cessna 402B Rudder damaged. SDR 510015049
Rudder hard to trim for straight and level flight. Investigation found lower rudder pivot attachment point bracket angle damaged. Trim tab actuator rod bent approximately 35 degrees to 40 degrees, causing jamming of the screw jack. Suspect caused by wind gusts when aircraft was parked.

Cessna 402C Hydraulic line split. SDR 510014818
Main pressure supply line to hydraulic manifold split at first bend upstream of manifold. Split approximately 10mm (0.39in) long, causing loss of hydraulic fluid. P/No: 520010766.

Cessna R182 Landing gear actuator piston worn and damaged. SDR 510015077
Nose landing gear actuator piston shaft gland seal P/No: MS28775-112 leaking and piston shaft worn beyond limits. P/No: 12802412. TSN: 9216 hours/396 months.

Cessna T337G Trailing edge flap cable unserviceable. SDR 510015062
LH and RH inboard flap cables beginning to fray. Found during inspection iaw AWB 27-003. P/No: 14601007.

Diamond DA42 Fuel transfer valve connector faulty. SDR 510014821
RH auxiliary fuel tank wiring connector faulty. Investigation found a poor wiring connection with the pins not mating correctly. Plug disturbed at previous 100-hourly inspection.

Gulfstream 500U Trailing edge flap cable unserviceable. SDR 510014880 (photo below)
LH inboard flap cable almost broken with two strands intact. Damage in area of flap bellcrank. P/No: 50000439.

Kavanagh B350 balloon envelope melted. SDR 510014994
Hot air balloon envelope load tape P/No: KP2327, K-27 fabric P/No: KP1320, and flying wire P/No: KP2701 melted. TSN: 347 hours/51 months.

Lancair Legacy Main landing gear strut failed. SDR 510014987
Main landing gear strut hydraulic actuator attachment fitting weld cracked and partially failed. Suspect caused by insufficient penetration of weld. TSN: 76 landings. TSO: 76 landings.

Pilatus PC12 Crew station equipment system cable broken. SDR 510014989
Pilot's seat adjustment cable broken. Suspect caused by items stowed on top of cable. P/No: 9593012221.

Pilatus PC12 Elevator tab actuator suspect faulty. SDR 510014864
Pitch trim actuator suspect faulty. Investigation continuing.

Piper PA31350 DC alternator failed. SDR 510015001
LH and RH alternators failed. Investigation found wiring loose on the back of the LH alternator, and the RH alternator not producing any power. P/No: ALU8521R. TSO: 1746 hours.

Piper PA31350 Elevator control spring failed. SDR 510015036
Elevator down spring failed at point where radial winding bends at 90 degrees to form the hook. Suspect forming mark in area of failure. Another forming mark found on the other end of the spring. P/No: 7105603. TSN: 103 hours/2 months.

Piper PA31350 Engine oil distribution (airframe) system hose failed. SDR 510014967
RH engine oil pressure hose chafed on fuel line in area outboard of the wing root, causing loss of engine oil.
P/No: 2267372. TSN: 17,745 hours/22,001 landings.

Piper PA32300 Stabiliser control cable separated. SDR 510014970
Abnormal elevator control during taxi. Investigation found forward RH elevator cable separated at terminal at approximately FS 230.0. Failure resembled other failures, as described in AWB 27-001 issue 3 figure 2. P/No: 62701037. TSN: 4404 hours/420 months.

Piper PA32300 Vertical stabiliser bracket corroded. SDR 510014862
Fin upper bracket corroded. P/No: 63502000. TSN: 8632 hours.

Piper PA34200 Rudder control cable frayed. SDR 510014856 (photo below)
LH and RH forward rudder control cables excessively worn, with broken strands in area where they pass beneath the forward-most cable pulley bank. P/No: 6270181.

Reims F406 Rudder control system out of adjust. SDR 510014975
Take-off aborted due to excessive amounts of rudder and trim required to keep aircraft straight. Investigation found rudder and trim cables had slightly low tensions.

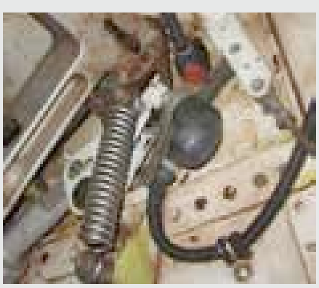
SELECTED SERVICE DIFFICULTY REPORTS ... CONT.

Swearingen SA227AC Hydraulic pipe unserviceable. SDR 510015033
Hydraulic pipe broken, causing loss of hydraulic fluid. Pipe in RH flap actuator retraction circuit.
P/No: 5510008E110Y.
TSN: 30,466 hours/38,812 cycles.

Swearingen SA227AC Landing gear retract/extension system safety override seized. SDR 510014919
Landing gear handle safety override jammed in pedestal.

Swearingen SA227AC Wing structure corroded. SDR 510015020 (photo below)
Lower wing badly corroded. TSN: 29,893 hours/45,760 cycles/45,760 landings.

Swearingen SA227DC Landing gear actuator bearing damaged. SDR 510015009 (photo below)
Nose landing gear actuator bellcrank forward roller bearing outer race missing.
P/No: YCRS12OR. Alternate P/No: CYR34S.
TSN: 18,293 hours/13,685 cycles.



Tecnam P2006 Stabilator control rod worn and damaged. SDR 510015050
Stabilator control rod worn and damaged.
Aircraft only had four hours TSN. P/No: 2695402.

Vulcan P68C Cabin smoke/fumes. SDR 510014979
Fumes in rear cabin with CO_2 detector indicating 'Caution'. Fumes seemed worse when flaps deployed. Investigation could find no cause for the fumes but minor gaps found in both firewalls. Aircraft does not use an exhaust shroud for cabin heating. TSN: 1924 hours.

Vulcan P68C Elevator trim system slipped. SDR 510014849
Stabiliser trim system slipping when operated electrically, causing insufficient nose-down trim. Three similar defects. TSN: 1865 hours.

COMPONENT

Altimeter illegal modification. SDR 510014872
Altimeter found to be faulty during calibration, so internal inspection carried out. Scale found to have been changed from in inches Hg to Mb by attaching a printed paper scale over the original scale. Manufacturer contacted and confirmed illegal modification had been carried out.
P/No: 10173511807.

Autopilot servo bearing worn. SDR 510014938 (photo following)
Autopilot servo clutch bearing seized, allowing shaft to spin and wear inner bearing race.
P/No: 3091997010.

Fuel pump bearing worn. SDR 510014894
Engine fuel pump bearings worn beyond maximum limits. Pump had nil time since overhaul.
P/No: RB9084.

Locknuts faulty. SDR 510014915
Starter-generator main cable attachment locknuts P/Nos: MS21042-5 and MS21042-6 did not appear to have any locking properties and could be wound down the studs using only finger pressure. Nuts were new. Investigation continuing. P/No: MS210425.

PISTON ENGINE

Continental GTSIO520M crankcase cracked. SDR 510015011
RH engine RH crankcase half cracked between No.1 and No. 3 cylinders.

Continental IO360K piston incorrect part. SDR 510014946
During inspection of new cylinder/piston kit, it was noticed that the new piston was a high-compression piston, while the old one was a low-compression type. Investigation found the pistons fitted to the other five cylinders were also low-compression, but they all should have been high-compression.
P/No: 655478A5. TSO: 734 hours/107 months.

Continental IO520C piston ring seized. SDR 510014927
Engine shutdown due to low oil pressure. Investigation found piston rings tight in ring grooves due to carbon build-up following cylinder replacement.

Continental IO520M crankshaft cracked. SDR 510014855
Crankshaft cracked in two places on alternator gear flange. Found during magnetic particle NDT inspection following engine removal and strip for overhaul. P/No: 649895.

Continental IO550N Engine fuel system clamp broken. SDR 510015023
Engine fuel injection line clamps (2off) broken. Found during inspection iaw AD/Con/60 Amendment 4. P/No: 6524361. TSN: 956 hours/110 months.

De Havilland Gipsy Major 1 Carburettor float unserviceable. SDR 510014981
Carburettor float contaminated by fuel due to softening of the float coating. Flooded carburettor leaking from gasket and manifold. Aircraft operates on MOGAS.
P/No: CHA31267. TSO: 350 hours/480 months.

Jabiru JABIRU2200B connecting rod failed. SDR 510014914
No. 3 cylinder connecting rod failed in area of little-end bearing. Broken connecting rod damaged crankcase and starter motor. TSO: 15 hours/1 month.

Lycoming IO360L2A Fuel control servo contaminated. SDR 510014952
Numerous fuel servos contaminated with fuel dye residue in area behind air diaphragms and venturis.
P/No: 25765362.

Lycoming IO540AE1A5 Magneto distributor worn. SDR 510015091
LH magneto distributor block worn excessively.
P/No: 10357426. TSN: 1235 hours/108 months.
TSO: 348 hours/8 months.

Lycoming IO540AE1A5 cylinder inlet valve broken. SDR 510014887 (photo below)
No. 5 cylinder inlet valve failed in collet area and entered cylinder.
P/No: SL13622. TSN: 121 hours/14 months

Lycoming IO540AE1A5 cylinder nozzle separated. SDR 510014825
Engine piston cooling nozzle separated, causing damage to two pistons. Some camshaft damage also found but not attributed to the nozzle separation.
P/No: 73772. TSO: 1385 hours.

Lycoming LTIO540J2BD rocker failed. SDR 510014867
RH engine No. 1 cylinder rocker cover holed due to failure of rocker. Investigation found rocker tight on shaft, dislodging shaft from rocker boss and flattening retaining plate integrated into rocker hat. Investigation also found two small cylinder tie-down studs sheared off and lower through bolt sheared off at nut.
P/No: LTIO540J2BD. TSO: 944 hours/60 months.

Lycoming O235L2C cylinder cracked. SDR 510014851
No. 2 cylinder base cracked separated from cylinder barrel. P/No: 05K23037. TSN: 3150 hours/60 months.

Lycoming O320 Manifold gasket damaged. SDR 510014848
Engine inlet manifold gaskets excessively hard and brittle, allowing air leakage.
P/No: 71973. TSN: 490 hours/12 months.

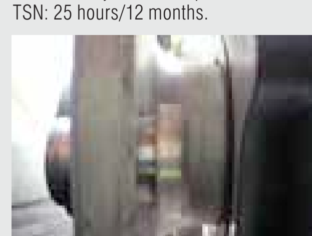
Engine fuel pump bearing worn. SDR 510014894
Engine fuel pump bearings worn beyond maximum limits. Pump had nil time since overhaul. Numerous reports. P/No: RB9084.

Crankcase cracked. SDR 510014980
Crankcase cracked from through stud above No. 4 cylinder. Investigation continuing.
P/No: LW11026. TSO: 1678 hours.

PROPELLER

Hartzell PHCJ3YF2 Propeller hub corroded. SDR 510014859
Propeller hub corroded under paint in area of two blade sockets. Investigation suspects that corrosion had been there for some time, as area had been sand blasted and repainted. Investigation also found the paint used was not an approved type.
P/No: E71693. TSO: 1977 hours.

McCauley 1C235LFA Propeller incorrect fit. SDR 510014817 (photo below)
Propeller incorrectly installed 60 degrees out of position. The incorrect positioning caused two mounting nuts to be pushed out of the crankshaft flange, with two indents made in the propeller spacer P/No: C-7726, making it unserviceable. Aircraft had just been imported from overseas.
TSN: 25 hours/12 months.



SELECTED SERVICE DIFFICULTY REPORTS ... CONT.

ROTORCRAFT

Agusta A109E Engine exhaust pipe cracked. SDR 510014910
No. 1 engine exhaust tube cracked from rear edge. Crack eventually split into two cracks of 8mm (0.31in) and 15mm (0.59 in) lengths.
P/No: 109060150201. TSN: 1662 hours.
TSO: 1662 hours.

Agusta A109E Main rotor blade delaminated. SDR 510014853 **(photo following)**
Main rotor blade delaminated at tip cap. Area of delamination approximately 100mm by 100mm (4in by 4in) from Stn 5420 to tip cap.
Suspect caused by water ingress. P/No: 7090103109.
TSN: 2041 hours.

Bell 412 Emergency exit window separated. SDR 510014977
LH cabin window (emergency exit) separated from aircraft. Suspect tall patient's foot came into contact with the window during an aeromedical operation. Investigation also found seal installation stretched, contributing to the incident. P/No: 412670101.

Bell 412 Rotorcraft tail boom longeron cracked. SDR 510014826
Tail boom LH upper longeron cracked.

Eurocopter BK117C2 Helicopter vibration absorber unserviceable. SDR 510015043 **(photo below)**
Vibration absorber cracked and resting on fuselage floor below cabin. P/No: B183M1005104.
TSN: 1218 hours.

Eurocopter AS332L Hydraulic filter leaking. SDR 510014822
Hydraulic oil leaking from drain. Investigation found leaking autopilot pencil filter. Investigation continuing.
P/No: 704A34621013.

Eurocopter AS332L Landing gear failed – extend. SDR 510014877
Landing gear failed to extend in both normal and emergency electrical extension modes, but finally pumped down manually. Investigation continuing.

Eurocopter AS350BA Tail rotor blade FOD. SDR 510015099
Tail rotor blades damaged due to FOD.
Helicopter about to land on pad when the rubber matting covering the pad was blown into the tail rotor by the downwash. Investigation also found tail rotor gearbox and driveshaft damage.
P/No: 355A12004008. TSN: 2482 hours.

Eurocopter AS350BA Tail rotor drive shaft support cracked. SDR 510014974
Tail rotor driveshaft support and bearing bracket found to be cracked. P/No: 350A23105344.

Robinson R44 Horizontal stabiliser top skin cracked. SDR 510015094
P/No: C0441. TSN: 1,335 hours/74 months.
TSO: 1335 hours/74 months.

Robinson R44 Horizontal stabiliser top skin cracked. SDR 510015095
P/No: C0441. TSN: 730 hours/22 months.
TSO: 730 hours/22 months.

Robinson R44 Main rotor transmission mount fuselage frame cracked. SDR 510014966 **(photo below)**
Main rotor gearbox RH rear upper frame cracked. Crack length approximately 19.05mm (0.75in), running along the lower edge of the weld bead.
P/No: C0201. TSN: 1798 hours.

TURBINE ENGINE

Allison 250C20B combustion section heat shield broken. SDR 510014971
Engine needing longer, warmer starts; normal operating temperature had increased by about 40 degrees C. Investigation revealed that the No. 8 bearing heat shield had completely broken off and fallen into the burner can, affecting flame control and air distribution. TSO: 1252 hours.

Allison 250C40B Turbine engine compressor support damaged. SDR 510015039
No.1 engine compressor rear support assembly damaged. Metal contamination of chip detector. Investigation continuing. P/No: 6896025.

Garrett TPE33110 combustion section plenum cracked. SDR 510015083
RH engine casing (plenum) split for 180 degrees around circumference. Investigation found split was along a machining mark where plenum modified to accommodate a de-swirl vane. Investigation continuing. P/No: 31037006.
TSN: 7985 Hours/8018 Cycles. TSO: 4886 hours.

Garrett TPE33112UH Turbine engine oil pump failed. SDR 510014902
Engine rear turbine bearing oil scavenge pump failed.
P/No: unknown.

GE CF3410E turbine engine odour. SDR 510014865
Strong odour in aircraft with engines running. Investigation could find no definitive cause, but an engine wash had been carried out overnight.

GE CF680C2 Turbine disc eroded. SDR 510014933
Stage 1 high-pressure turbine disc eroded beyond limits in armpit radius. P/No: 1531M84G12.
TSN: 42,005 hours. TSO: 42,005 hours.

GE CFM563C Turbine engine oil tube cracked and leaking. SDR 510014869
No. 2 engine leaking oil. Engine removed. Further investigation found a cracked aft sump, No. 5 bearing squeeze film tube cracked and leaking, one HPT blade tip missing and extensive downstream damage to other turbine blades.
Suspect oil tube cracked due to vibration caused by damaged turbine blades. P/No: 3351043090.

GE CFM567B Thrust reverser suspect faulty. SDR 510014834
No. 2 engine thrust reverser warning light illuminated in cruise. Investigation found no faults with the thrust reverser; aircraft returned to service.

Lycoming ALF502R5 Engine bearing seal leaking. SDR 510015022
No. 4 engine oil quantity dropped to zero, with associated loss of oil pressure. Ground run confirmed loss of oil. Suspect internal bearing pack leaking. Investigation continuing.

Lycoming ALF502R5 Turbine engine stator band fractured. SDR 510014892
No. 4 engine No. 1 stator assembly stator band detached from end bolt fastener. Investigation continuing. P/No: 204314803.

Lycoming LTS101750B1 FCU failed. SDR 510015047
No. 2 engine uncommanded acceleration.
Following removal of the fuel control unit (FCU) it was found to be seized due to drive bearing failure.
P/No: 430128308. TSO: 2050 hours.

PWA PT6A41 Turbine engine reduction gearbox failed. SDR 510014995
Momentary engine chip detector light illumination, followed by torque fluctuations. Propeller stopped rotating before engine could be fully shut down. Investigation found metal contamination of the reduction gearbox. TSN: 9123 hours/9795 cycles.
TSO: 6208 hours/6743 cycles.

PWA PW123B Fuel injector nozzle leaking. SDR 510014857
LH engine No.13 fuel nozzle leaking. Investigation found a faulty No.14 nozzle allowed the centre fuel transfer tube to bottom out. This extra travel allowed fuel to flow past the O-ring on No.13 nozzle due to insufficient sealing.
P/No: 304578801. TSO: 26 hours/19 cycles.

PWA PW206C Engine exhaust pipe cracked. SDR 510014910
No.1 engine exhaust tube cracked from rear edge. Crack eventually split into two cracks of 8mm (0.31in) and 15mm (0.59 in) in length.
P/No: 109060150201. TSN: 1662 hours.
TSO: 1662 hours.

PWC PW207D1 Engine fuel filter contaminated. SDR 510014960
No.1 and No. 2 engine fuel injector manifold filters contaminated with a 'rubber-like' compound. Investigation continuing. Two similar defects.
TSN: 54 hours.

Rolls Royce RB211 thrust lever suspect faulty. SDR 510014884
LH and RH engine thrust levers split during climb.

Rolls Royce TAY65015 Engine accessory drive gear failed. SDR 510014947
Following LH engine starter turbine failure, a new starter turbine was fitted which then had another failure, with the turbine spline shearing. Initial investigation suspects failure of the starter drive gear in the high-speed gearbox. Investigation continuing.
TSN: 4073 hours/3919 cycles.
TSO: 1136 hours/966 cycles.

Rolls Royce Trent 97284 Turbine faulty. SDR 510014838
High vibration levels from No. 1 engine LP turbine. Inspection of the engine found metal in the tailpipe. Engine removed for further investigation.
P/No: TRENT97084.

APPROVED AIRWORTHINESS DIRECTIVES

18 – 31 May 2012

ROTORCRAFT

Bell Helicopter Textron 412 series helicopters
2012-0086-f Equipment and furnishings – hoist hook – inspection

Eurocopter EC 135 series helicopters
2012-0085-E Main rotor system – main rotor hub – inspection/replacement

Eurocopter EC 225 series helicopters
2012-0087-E Main rotor drive – main gearbox bevel gear vertical shaft – inspection/limitation

BELOW 5700kg

Aerostar (Piper/Ted Smith) 600 and 700 series aeroplanes
AD/TSA-600/36 Amendment 4 – engine exhaust systems and installation of fire detection system for turbocharged aircraft

Beechcraft 55, 58 and 95-55 (Baron) series aeroplanes
2012-10-02 Fuel vapour return and/or fuel vent lines

Cessna 206 series aeroplanes
2012-10-52 Hartzell Engine Technologies (HET) turbochargers – insufficient oil flow to bearings

Cessna 207 series aeroplanes
2012-10-52 Hartzell Engine Technologies (HET) turbochargers – insufficient oil flow to bearings

Cessna 210 series aeroplanes
2012-10-52 Hartzell Engine Technologies (HET) turbochargers – insufficient oil flow to bearings
2012-10-04 Wing main spar lower cap – inspection

Piper PA-31 series aeroplanes
2012-10-09 Aircraft data plate – inspection

ABOVE 5700kg

Airbus Industrie A319, A320 and A321 series aeroplanes
2010-0046R1 Flight controls – elevator servo-control rod eye-end – inspection

Airbus Industrie A330 series aeroplanes
2012-0090 Air conditioning – bulk cargo isolation valve bonding lead and route 1M – modification

Airbus Industrie A380 series aeroplanes
2012-0089 Wings – die-forged front spar – inspection/repair

Boeing 747 series aeroplanes
AD/B747/140 Fuselage – lap joint upper nose section BS 400 to 520 – cancelled
2012-10-03 Fuselage skin – lap splice between BS 400 to BS 520 at stringers S-6L and S-6R – inspection

Boeing 777 series aeroplanes
2012-09-14 Forward cargo door – latch pin – inspection
2012-10-10 Horizontal stabiliser pivot pin – replacement/repetitive inspection

Bombardier (Canadair) CL-600 (Challenger) series aeroplanes
AD/CL-600/76 Pitch feel simulator input lever – cancelled
CF-2012-18 Defective horizontal stabiliser trim actuators

Bombardier (Boeing Canada/De Havilland) DHC-8 series aeroplanes
CF-2011-29R1 Hydraulic accumulators – screw cap/end cap failure
CF-2012-17 Aft entry and service doors – translating door handle jamming

Fokker F28 series aeroplanes
2011-0233-CN Fuel – wing and integral centre-wing tanks – inspection/modification

Fokker F100 (F28 Mk 100) series aeroplanes
2011-0233-CN Fuel – wing and integral centre-wing tanks – inspection/modification

Gulfstream (Grumman) G1159 and G-IV series aeroplanes
2012-11-06 Wing-to-fuselage attachment fittings – inspection/repair

PISTON ENGINES

Lycoming piston engines
AD/LYC/117 Amendment 2 – Lycoming crankshaft replacement

Rotax piston engines
2012-0093-E Engine – fuel and control – fuel pump – replacement

Teledyne Continental Motors piston engines
2012-10-13 Replacing CMI starter adapters due to fractures in shaft gears

TURBINE ENGINES

International Aero Engines AG V2500 series
2012-09-09 High-pressure compressor (HPC) stage 3-8 drum cracking

Rolls Royce turbine engines - RB211 series
AD/RB211/46 State of design airworthiness directives - 1
AD/RB211/47 State of design airworthiness directives - 2

Rolls Royce turbine engines - RB211 TRENT 900 series
2012-0057 (Correction) Engine – intermediate pressure shaft coupling – inspection/replacement

1 – 14 June 2012

ROTORCRAFT

Bell Helicopter Textron Canada (BHTC) 206 and Agusta Bell 206 series helicopters
CF-2012-19 Control box assembly manufacturing defect

Eurocopter EC 225 series helicopters
2012-0104 Main rotor drive – main gear box bevel gear vertical shaft – inspection/limitation

Eurocopter SA 360 and SA 365 (Dauphin) series helicopters
2012-0098-E Rotorcraft flight manual – emergency procedures – rush revision

BELOW 5700kg

De Havilland DHC-1 (Chipmunk) series aeroplanes
AD/DHC-1/12 Amendment 7 – wing spar booms and centre section – fatigue life limitation

Great Lakes Aircraft Company, LLC Model 2T-1A-1 and 2T-1A-2 aeroplanes
2012-11-08 Horizontal stabiliser spars – inspection

Pilatus PC-12 series aeroplanes
2012-0099 Time limits/maintenance checks – airworthiness limitation section – amendment/implementation

Robin Aviation series aeroplanes
DCA/R2000/41 Air filter – inspection/replacement

ABOVE 5700kg

Airbus Industrie A319, A320 and A321 series aeroplanes
2012-0100 Nacelles/pylons – aft pylon moveable fairing rib 5 – inspection/repair

Airbus Industrie A330 series aeroplanes
2012-0094 Engine – forward engine mounts bolts – torque check/replacement

Airbus Industrie A380 series aeroplanes
2012-0096 Airborne auxiliary power – suspension system assembly – replacement

Boeing 737 series aeroplanes
AD/B737/270 Amendment 1 – aft pressure bulkhead web 2

Boeing 767 series aeroplanes
AD/B767/163 Amendment 1 – door emergency escape system – cancelled

Boeing 777 series aeroplanes
2012-11-03 Main landing gear trunnion lower housing fuse pin cross bolts and fuse pins – inspection

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AGEING AIRCRAFT MANAGEMENT PLAN COMES OF AGE

CASA has recently released a discussion paper on how we manage ageing aircraft. The discussion paper provides information about ageing aircraft issues and, importantly, outlines several possible options for managing our ageing aircraft fleet in future.

Regular readers of *Flight Safety Australia* will have seen our series of articles on ageing aircraft, but as a refresher—did you know that:

- the average age of Australia's piston-engine aircraft fleet is around 40 years?
- this represents some 7000 aircraft in Australian skies that are 40 years or older?
- most of these aircraft were designed and built with a notional life of 20 years?

Given these statistics, it is no wonder that the Federal Government has asked CASA to increase its focus on ageing aircraft.

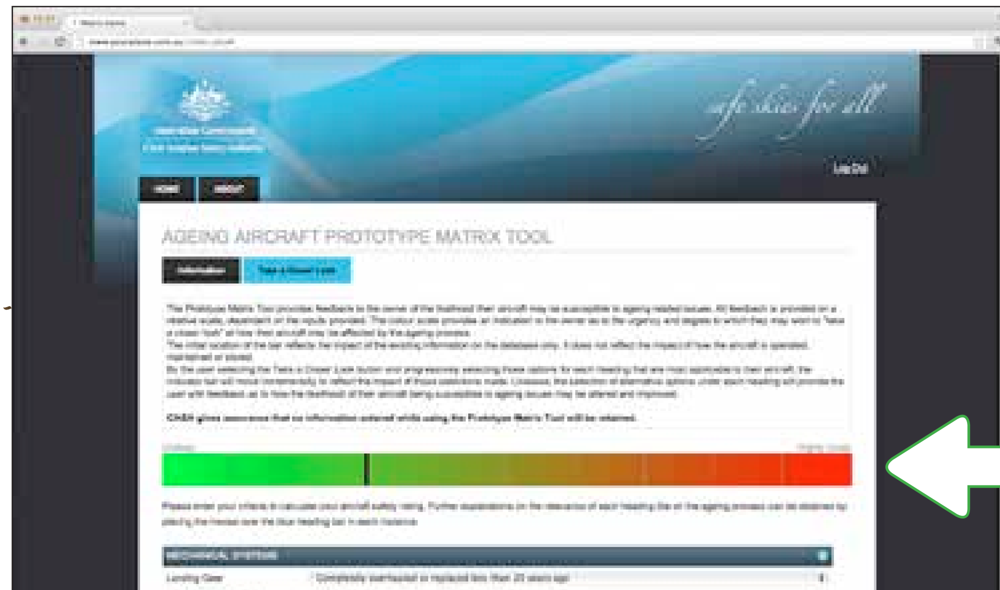
Then there is the added complexity that each and every aircraft ages, in its own unique way, from the day it is made. The rate at which each aircraft ages depends on a range of factors, such as how that aircraft is operated, maintained and stored over its life. As a result, no two aircraft on the Australian register age in the same way. Addressing the ageing process properly requires an individual, aircraft-by-aircraft approach, rather than sweeping fleet-wide initiatives. That type of one-size-fits-all approach merely deals with the most badly deteriorated aircraft, at the expense of those that have been well maintained, operated and stored throughout their lives.

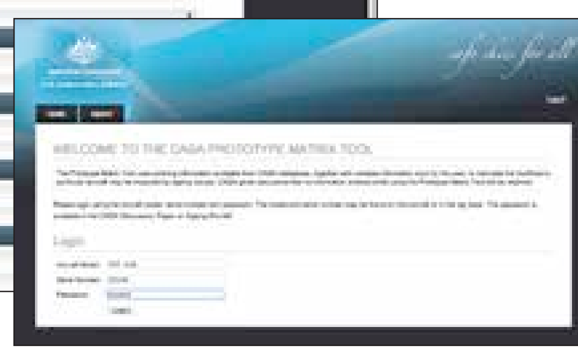
The recently released discussion paper provides a background to CASA's findings about ageing aircraft in Australia. It also introduces several CASA initiatives to help registered operators (that is owners) more fully understand general ageing aircraft concepts, and how they affect their own particular aircraft.

The discussion paper provides a hyperlink to the recently developed CASA e-learning course for registered operators. Do this course online before you respond to the discussion paper, so you, as an owner, will be across all the issues. After completing the course, which is available to all industry members and takes roughly an hour and a half, you will have a comprehensive overview of lifeing concepts, fatigue, corrosion and systems degradation. The e-learning also gives an overview of why CASA is considering options for the continued safe operation of these aircraft.

The paper not only includes a link to the new e-learning, but also a link to the recently developed prototype matrix tool. This tool is a world-first, locally developed, web-based CASA educational initiative for aircraft owners. It allows an owner (or potential owner) to enter objective engineering data for their specific aircraft and receive an indication as to how likely it is that their aircraft could be susceptible to ageing issues. The data includes factors such as how long ago certain components or systems have been overhauled or replaced, how the aircraft is operated, how and where the aircraft is stored, and so on. The cumulative impact of all these variables is displayed on a colour-coded continuum (from red to green) indicating how likely the individual aircraft is to need additional attention because of ageing issues.

The prototype matrix tool can only ever be general in nature and therefore is intended purely as an educational feedback tool for owners and industry generally. And of course, there is no substitute for a licensed aircraft maintenance engineer (LAME) physically inspecting an aircraft to determine its exact ageing status. Educating owners as to why they should





consider having a LAME inspect their aircraft, and the urgency for such an inspection, are the themes of CASA's 'Take a Closer Look' campaign.

You will find the discussion paper, including links to the e-learning for registered operators and prototype matrix tool, on the CASA web site. We invite all interested parties to respond to the discussion paper and help formulate CASA's future policy for the safe management of Australia's ageing aircraft fleet.

Further information

To trial the prototype matrix tool or view the discussion paper, go to **www.casa.gov.au/ageingaircraft**

APPROVED AIRWORTHINESS DIRECTIVES ... CONT.

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Boeing 767 series aeroplanes
2012-11-11 Door emergency escape system

Bombardier (Boeing Canada/De Havilland) DHC-8 series aeroplanes
CF-2010-28R1 Elevator power control unit – shaft (tailstock) swaged bearing wear

PISTON ENGINES

Rotax piston engines
2012-0097R1 Engine fuel and control – fuel pump pressure side hose – replacement

EQUIPMENT

Wheels and tyres
2012-05-01 Goodyear tyres – inspection/ replacement

15 – 28 June 2012

ROTORCRAFT

Bell Helicopter Textron 412 series helicopters
2012-11-13 Aft crosstube – life limit

Enstrom F-28 series helicopters
2012-11-05 Cyclic trim system relay failure

Eurocopter AS 332 (Super Puma) series helicopters
2012-0111 Door – cabin sliding and plugging doors – limitation/modification/inspection

Eurocopter EC 225 series helicopters
2012-0107 Main rotor drive – main gear box bevel gear vertical shaft – inspection/limitation
2012-0111 Door – cabin sliding and plugging doors – limitation/modification/inspection

Eurocopter SA 360 and SA 365 (Dauphin) series helicopters
2012-0108-E Fuselage – frame No. 9 – inspection/repair

BELOW 5700kg

TECNAM P92, P96, and P2002 series aeroplanes
2012-0113 Landing gear – main landing gear (MLG) locknuts – replacement

ABOVE 5700kg

Airbus Industrie A319, A320 and A321 series aeroplanes
2012-0100R1 Nacelles/pylons – aft pylon moveable fairing rib – repair

Airbus Industrie A330 series aeroplanes
2010-0109R1 Flight controls – flight control primary computer (FCPC) – dispatch restriction and operational test

Airbus Industrie A380 series aeroplanes
2012-0105 Equipment/furnishings – galley seat rail fitting – replacement

Boeing 717 series aeroplanes
2012-12-09 Centre section ribs – horizontal stabiliser – inspection

Boeing 737 series aeroplanes
AD/B737/250 Amendment 3 – forward entry door forward and aft side intercostals – cancelled
AD/B737/343 Cracks in fuselage skin – cancelled
2012-12-04 Cracking – fuselage skin at the chem-mill steps – inspection
2012-12-05 Fatigue cracking - intercostals on the fore and aft sides of the forward entry door cutout - inspection

Boeing 777 series aeroplanes
2012-12-08 Fuse pin – MLG retract actuator – inspection/replacement
2012-12-19 Ceiling support structure – installation

Boeing 767 series aeroplanes
2012-12-14 Lower main sill inner chord of the hatch opening of the over-wing emergency exit – inspection

Bombardier (Boeing Canada/De Havilland) DHC-8 series aeroplanes
CF-2012-21 Main landing gear up-lock wear

British Aerospace BAe 146 series aeroplanes
AD/BAe 146/125 Centre fuselage top aft longeron at rib '0' – cancelled
2012-0106 Fuselage – inspection of longeron at rib '0' – inspection/repair

Fokker F50 (F27 Mk 50) series aeroplanes
2012-0109 Time limits/maintenance checks – maintenance requirements – implementation

PISTON ENGINES

Thielert piston engines
2012-0112 Engine oil – gearbox oil filling plug – inspection

TURBINE ENGINES

Turbomeca turbine engines – Arriel series
2009-0236R1 Engine – gas generator 2nd-stage turbine – inspection/replacement

29 June – 12 July 2012

ROTORCRAFT

Bell Helicopter Textron Canada (BHTC) 206 and Agusta Bell 206 series helicopters
CF-1995-17R2 Crosstube assemblies – inspection

Eurocopter AS 332 (Super Puma) series helicopters
2009-0271R1 Equipment and furnishings – hydraulic hoist cable – limitation/modification
2012-0115-E Main rotor drive – main gearbox bevel gear vertical shaft – inspection/limitation

Eurocopter AS 350 (Ecureuil) series helicopters
2011-0116 Fuselage – tail boom/ fenestron junction frame – inspection

Eurocopter EC 225 series helicopters
2012-0115-E Main rotor drive – main gearbox bevel gear vertical shaft – inspection/limitation

Eurocopter SA 360 and SA 365 (Dauphin) series helicopters
AD/DAUPHIN/95 Main gearbox casing – corrosion – cancelled
2011-0127 Main rotor drive – main gearbox casing – inspection/repair
2TCD-7745-1-2011 Instrument control panel BARO adjustment knobs

Schweizer (Hughes) 269 series helicopters
2011-12-16 Tailboom after cluster fitting strut locknut

BELOW 5700kg

Aerospatiale (Socata) TBM 700 series aeroplanes
2011-0130 Navigation – standby compass lighting – modification

Fairchild (Swearingen) SA226 and SA227 series aeroplanes
AD/SWSA226/38 Amendment 1 – elevator return spring location – modification – cancelled

ABOVE 5700kg

Airbus Industrie A319, A320 and A321 series aeroplanes
AD/A320/71 Slide/slide raft release cable – cancelled
AD/A320/105 Amendment 1 – emergency escape slide frangible link – cancelled
AD/A320/182 Magnetic fuel level indicator – cancelled
AD/A320/189 Forward passenger doors – escape slide raft – cancelled
AD/A320/208 MLG door keel beam hinge and actuator fitting – cancelled
AD/A320/220 Emergency escape slide – cancelled AD/A320/221 Escape slide doors numbers 2 and 3 R and LHS – cancelled
2012-0100R2 Nacelles/pylons – aft pylon moveable fairing rib 5 – inspection/repair
2012-0118 Fuselage – centre fuselage/main landing gear (MLG) door keel beam hinge and actuator fittings – inspection
2012-0119 Fuel system – magnetic fuel level indicators – inspection/replacement/repair
2012-0122-CN Cancelled: equipment/furnishings – escape slides and rafts – inspection/ replacement/modification

Airbus Industrie A380 series aeroplanes
2012-0114 Wings – wing rib foot – inspection/ repair/replacement

Boeing 737 series aeroplanes
2011-12-13 (Correction) – testing of the stabiliser take-off warning switches
2012-13-07 Outboard trailing edge flap carriage spindles

Boeing 747 series aeroplanes
ad/b747/15 Amendment 2 – trailing edge flap track fuse bolt – inspection and replacement
2012-13-08 Tension tie channels – STA 740 and STA 760 – inspection

Bombardier (Canadair) CL-600 (Challenger) series aeroplanes
CF-2011-18 Integrated drive generator wire chafing in aft equipment bay

British Aerospace BAe 146 series aeroplanes
AD/BAe 146/135 Wing-to-fuselage and main landing gear door fairing panel grommets – cancelled
2012-0125 Fuselage – wing-to-fuselage and main landing gear (MLG) door fairing panel grommets – inspection/replacement
2012-0126 Fire protection – engine and auxiliary power unit automatic fire extinguishers – inspection/overhaul

Fokker F50 (F27 Mk 50) series aeroplanes
AD/F50/97 Fuel tank safety – fuel airworthiness limitations – cancelled

PISTON ENGINES

Thielert piston engines
2012-0116 Engine fuel and control – full-authority digital engine control (FADEC) software – modification

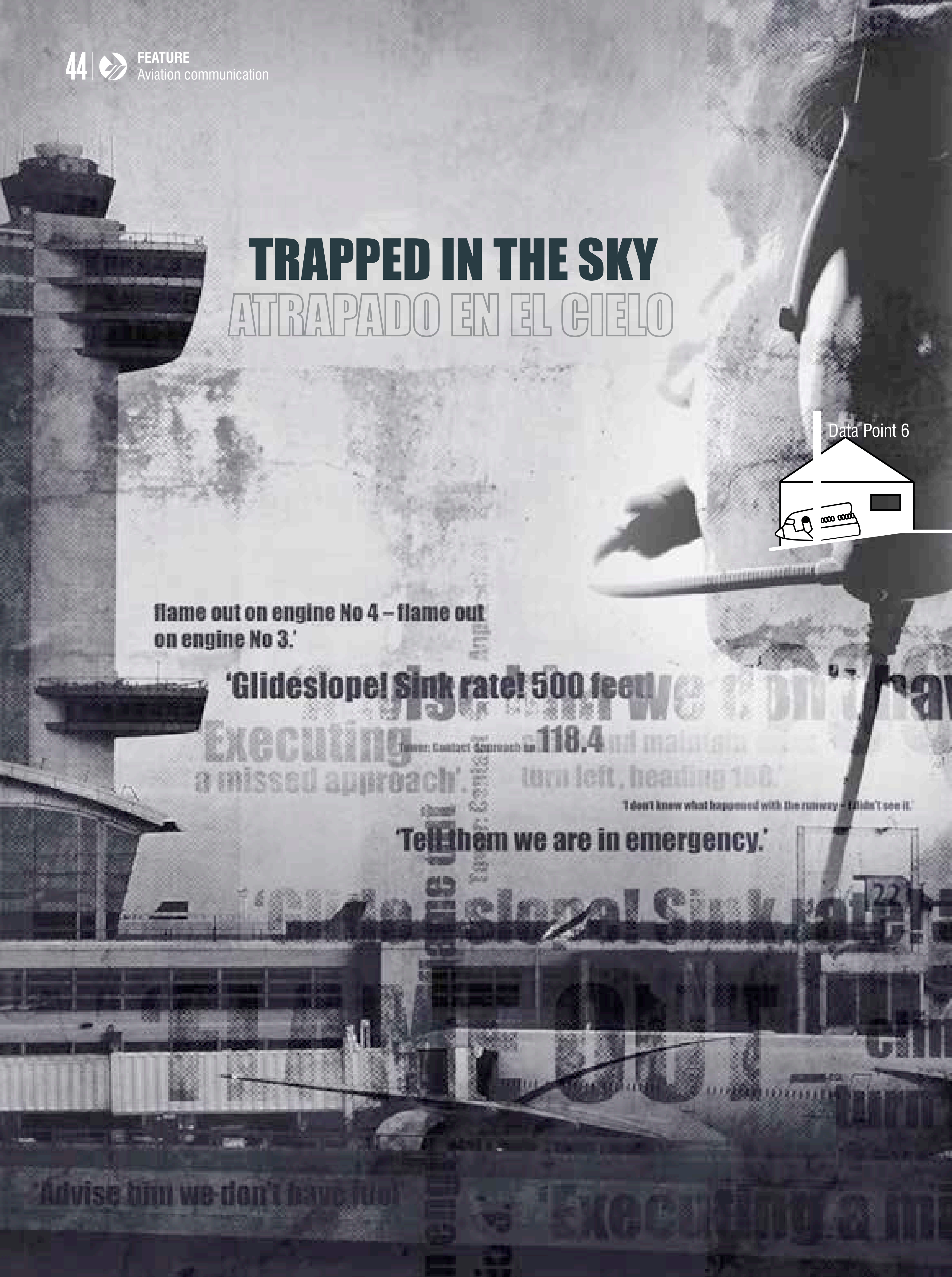
TURBINE ENGINES

Allison turbine engines – 250 series
2012-14-06 Turbine blades 3rd and 4th stages – inspection

CFM International turbine engines – CFM56 series
2012-0123 Engine fuel and control - hydro-mechanical units - operational limitation

Turbomeca turbine engines– Arriel series
2011-0128-E Engine fuel and control – hydro-mechanical metering unit (HMU) – inspection/replacement
2012-0117 Engine – gas generator rotating assembly and rear bearing – check/replacement
2012-0124 Engine – module M03 (gas generator) – turbine blade – modification

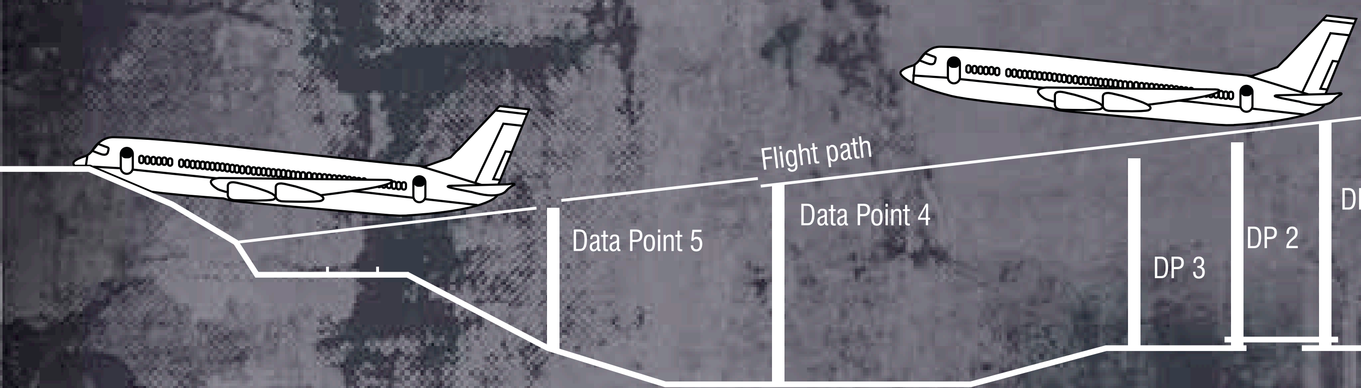
TRAPPED IN THE SKY
ATRAPADO EN EL CIELO



Macarthur Job looks at a tragic aviation case where words failed

Six little words could have saved everyone on board. Pan-Pan, Pan-Pan, Pan-Pan. Had the crew of Avianca flight 52 uttered these, the international code for an urgent but not yet life-threatening situation, when they realised they were critically low on fuel, all the mistakes in flight planning and misunderstandings in air traffic control that had conspired to trap them in the sky would still have been serious – but not fatal.

The weather over the north-eastern United States was anything but favourable on the afternoon a Boeing 707 was flying from Bogota, Colombia, to New York and it was held three times for extended periods. Communication on the flight deck and with ATC was ineffective, and during the second attempted ILS approach, all four engines flamed out for lack of fuel.



The flight

The Colombian Boeing 707-321B was operating Avianca Flight 052 from Bogota to John F. Kennedy Airport, on 25 January 1990. Taking off from Bogota at 1.10pm local time, the aircraft landed at Medellin just after 2pm and was refuelled. Departing again at 3.08pm, its flight was over the Bahamas towards the east coast of the USA. Routed via Norfolk, Virginia, New Jersey, and on to JFK, it cruised at flight level 370.

Just after 7pm, ATC required it to hold over Norfolk because of weather and conflicting traffic. This continued for 19 minutes. Again, at 7.43pm, nearing Atlantic City, the aircraft was held for a

continued on page 58

YESTERDAY'S PAPERS

Name withheld by request

An embarrassing incursion into controlled airspace taught a normally thorough private pilot the importance of having the latest charts and listening to his instincts

When something doesn't feel right, do you ignore it and press on, or do you use all the resources at your fingertips? In this case, this pilot thought he was doing all the right things, but he was on the wrong frequency and alarm bells were ringing. When things don't feel right what other resources are available?

THE TRIP

I planned a VFR trip from Bankstown to Mangalore with my wife, daughter and her fiancé, intending to stop over for a few days and then fly across to Merimbula, then back up the coast. I am usually meticulous in my flight planning and I spent some hours at home using the charts I had (VTC, ERC Low, ERSA etc.), as well as entering coordinates into my handheld GPS. I was fully aware that some of my charts were out of date and made a mental note to buy some new ones at Bankstown before the flight. We all know that changes do occur on charts, but the ones I was using were not too far out of date, and things don't really change that much—or do they? I therefore planned on my 'lapsed' charts and folded them for future use.

On the day of departure I checked the weather and quickly scanned the area notams. at Bankstown I ducked into the pilot shop, purchased an ERSA and the latest Canberra/Albury VTC and threw them into my flight bag. In the aircraft, I pulled out the folded charts I had planned with and left the latest charts in the flight bag, which was placed deep in the baggage compartment. Probably my subconscious telling me I had the correct charts on board (good), but when nothing much changes anyway, it's OK to use the old charts I had initially planned on.

I intended to fly though Canberra and Albury airspace. The clearance through Canberra was fine, but on the outskirts of Albury I called Albury tower on the 124.2 frequency listed on my 'old' charts. I got no reply and after a few more calls I changed radios, just in case one radio was not transmitting. I also checked the NDB, but the ATIS was not on the NDB. There was no tower response on 124.2. I then assumed that perhaps no one was in the tower (it was late in the afternoon and only a couple of days into the new year) and perhaps it had reverted to an after-hours CTAF. I therefore made the appropriate CTAF calls and traversed the edge of Albury airspace, keeping a good lookout. No problems!

After a few days in Mangalore, the weather deteriorated badly over the coast so we decided to go back to Bankstown direct. All the charts were in the plane and with my family impatiently waiting to get going, I quickly did some reciprocal planning on the charts I had come down on. Obviously, in my mind they were still good enough.

On approaching Albury airspace I started making calls out from a reporting point. Again, no response from the tower. This time the alarm bells were jangling. It just did not feel right that I could not get a response. After a quick check of my 'lapsed' charts and ERSA, calls on both radios (just in case) and because I had been here before, I thought that maybe the tower was inoperative for some reason and I had missed it when reading the notams. Nonetheless, I felt uneasy and decided to skirt most of Albury airspace, but still cross the edge. I made the appropriate CTAF calls, listening out on the Albury and Melbourne Centre frequencies, watching out of the window and keeping an eye on the aircraft TCAS.

About 25 miles to the north east of Albury I got a call from Melbourne Centre asking me to call Albury Tower on 123.25. Oops—that's why I could not contact them on 124.2.

Albury Tower were obviously concerned that there had been an incursion and advised me that there had been a frequency change. However, the tower did say they were still monitoring the old frequency, but I can only say that considering the number of calls I made, the radio was either turned down or there was a problem with it.

Nonetheless, I was on the wrong frequency in controlled airspace. I had the right charts in the plane (in the baggage compartment, not on my lap) and I had other resources available to check—but I did not use them. I felt like an idiot. How could this have happened to me, as I am normally so meticulous in how I plan and operate? Where was my mind?

SUBSEQUENT ACTION

On my return to Bankstown, I tracked down the tower controller in Albury and we had a good discussion. He was very professional and relaxed and we both put it down as one of those things you don't need to do twice. He seemed appreciative that I was concerned enough to talk directly to him after the event, but I had made a major error that could have had disastrous consequences so an incident report had to be submitted.

On reflection, when things started not to feel right, did I utilise the resources I had at my fingertips? NO. In fact, this makes me even more disappointed with myself. I had a fully functioning GPS in the plane with the latest card updates. I also had a handheld GPS. I did not even think about asking one of the rear passengers to delve into the baggage compartment for the latest charts. One call to Melbourne Centre would have given me the right frequency. Why didn't I check the ATIS on the VOR? I must have been in dreamland on that trip.

Things learnt from this incident

1. Never plan a trip on old charts lying around at home.
2. Never fly anywhere without all the current charts and current ERSA.
3. Have them at your fingertips for ease of use.
4. If you see something that appears not to be right, ask for assistance. ATC is there to assist and one quick call could have solved the matter immediately.
5. If in doubt, do not assume. If you can't raise local ATC – don't go there. Spend 10 minutes flying around the airspace. Making wrong assumptions can be deadly.
6. Check the ATIS – regardless of where it is on the frequency spectrum.
7. Know your plane and your equipment. While many of us are unlikely to know all the knobs and dials on our GPS, make it your goal to be familiar with the main functions that can assist you. That GPS is loaded with a huge amount of supporting information, so get into the habit of knowing how to access it quickly for everyday use.
8. Never assume that nothing changes. That's the very time when things suddenly do change.

POWER LINE! MUCH TOO CLOSE FOR COMFORT

by Ross Knudsen

All too often we read or hear accounts of helicopters experiencing near-misses or collisions with power lines. If the crew survives to tell their tale, their explanations of these events are many and varied. We all know there are numerous factors including weather, mechanical problems, pilot/crew error, fatigue etc. However, I always thought my training and vigilance in this high-risk environment would never let a near-miss or collision occur on any of my flights

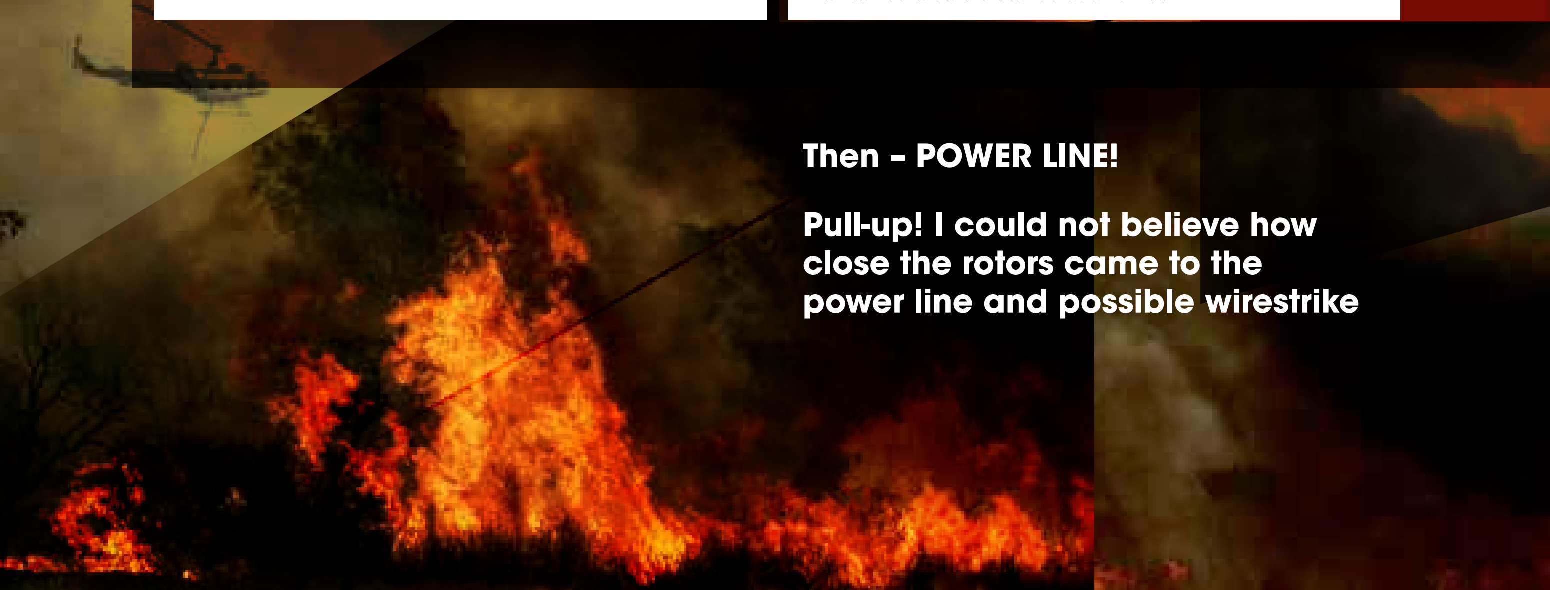
I had been deployed with my pilot to assist with firebombing duties as an air attack supervisor (AAS) on an active fire in the Gypsy Creek area of the Bunyip State Forest east of Melbourne. I was an accredited AAS with ten years experience in both rotary and fixed-wing aircraft. Our working platform at this fire was a Bell 206 Long Ranger. Training included briefs on hazards and power lines and safety was always a priority—for good reason. The helicopter was mechanically sound, the pilot and I were fit, healthy and hydrated and the weather conditions on the day were hot and sunny, with a moderate wind and good visibility.

The early autumn weather continued to be dry and the regular weather changes resulted in little if no rain. The fresh northerly wind that drove the fire for most of the day abated to calm conditions by early evening. The smoke from the fire settled into the valleys of the ranges and fire behaviour became quite sedate. Firebombing operations ceased by last light and we were instructed to land at Noojee and rest there for the night before continuing operations the following day. Not only had the day included firebombing, but also the plotting of the fire perimeter and reconnaissance required by the Incident Control Centre (ICC).

The following morning our first task involved intelligence gathering about the fire's behaviour and condition, mapping the new fire perimeter and reporting that information back to the ICC. Overnight, the fire had spotted over a bulldozed firebreak along a ridge and was burning slowly downslope into steep inaccessible terrain on the southern flank of the fire. We concentrated our efforts in this area as it was the only active fire perimeter. We used Helitack (a helicopter-delivered fire resources for initial attack on a wildfire) to assist in suppressing the active fire edge. This technique is often very concentrated and intense.

Private property bordered the state forest directly below this ridge and consisted of open, undulating terrain, with small vegetated areas. Cattle grazed on the grassland and a farmhouse was located up on a ridge close to the fire perimeter. During our operations, we had flown over and close to this house on numerous occasions.

Running east–west and downhill of the house was a single-strand power line. Being silver in colour, it was quite easy to see. The supporting timber poles were also clearly visible, as they stood alone on the open ridges. Another span ran from one pole up the ridge to the house. The pilot and I recognised the existence of the poles and power lines and maintained a safe distance at all times.



Then – POWER LINE!

Pull-up! I could not believe how close the rotors came to the power line and possible wirestrike

Late in the morning on the second day of operations, I had a call of nature. I asked the pilot to find a suitable spot to land so I could get out and relieve myself. An obvious level location to land the helicopter was on the creek flats a few hundred metres downhill from the house. Visibility was good and there was no turbulence in the lee of the range. We descended following the ridge, passed over the silver power line to the flats and came to a hover about 10 metres above the ground. The pilot then taxied to the left and towards rising terrain between two ridges at 10 knots ground speed. The silver power line was clearly visible up and away from us.

Then – POWER LINE!

The pilot and I saw the power line at the same time and a shiver pulsed through my body. Where did that come from? The power line was now under the rotor disk and just above the cabin. Pull-up! I could not believe how close the rotors came to the power line and possible wirestrike. Only the skill of the pilot averted disaster by pulling up and manoeuvring away from danger. 'That was much too close'. Apart from the pilot's skill, the only other thing that saved us was the slow forward speed of the helicopter.

The pilot quickly found a suitable spot to land and I jumped out. We looked at each other, realising just how close to calamity we had come.

The power line we almost collided with was not the one we had identified earlier. This was a separate span, black-insulated, quite narrow and running parallel to the silver strand, but further down the hill. It was almost invisible and had sadly slipped through our 'vigilance and situational awareness net'.

Once airborne, we followed the black power line to see where it went. One thing that made it difficult to identify was that its supporting poles were located in stands of trees growing on the ridges, with the long span drooping low into the valley it traversed. We hadn't anticipated or expected another power line running in close proximity and parallel to the other one. It was a potential trap for anyone!

This was a really close call and a disturbing incident that could have resulted in severe consequences. It highlights the importance of vigilance and the need for constant visual alertness when operating at low levels in unfamiliar terrain, particularly in helicopters. These are basic principles of operating safely!

THINK FIRST, FLY LATER

Name and address withheld

I was in Western Australia for navigation training to complete my private pilot's licence. The flight school was in a small-town airport and I was due to conduct my third solo navigation flight, which would take me near controlled airspace around Jandakot.

The trip there was fine. The weather was actually clear and as I came in over the boatyard I could see the city in the distance. I made my inbound call and was cleared to the airport, to join the circuit to runway 24R. OK, I had the ATIS, VTC, my CASA *Visual Flight Guide*, my *ERSA* notes and clearance. I maintained 1500ft and headed towards downwind. There was a bit of wind and a few bumps, but nothing out of the ordinary.

I was looking forward to approaching downwind and abeam the runway threshold, as I could go through my checks, relax and concentrate on the approach. I must have just passed the Kwinana Freeway when **I heard the tower call 'VH-XXX, EXPEDITE DESCENT!' That was me!**

I looked to my right, and the Twin Comanche I had seen a few seconds ago passing the runway threshold on take-off was now about 100ft below me, heading towards me and climbing really fast. We were so close that I could see the look of horror on both pilots' faces in the twin. As I shoved the yoke forward I felt the negative Gs lift me out of the seat. I saw and heard the twin go behind and above me. I'm not going to say how near it was, but it was closer than anyone with a healthy respect for mid-air collision avoidance would ever want.

The first thing I did was question what I had done wrong. Why were we so close to each other? 'VH-XXX expediting.' It sounded more like a question than a reply.

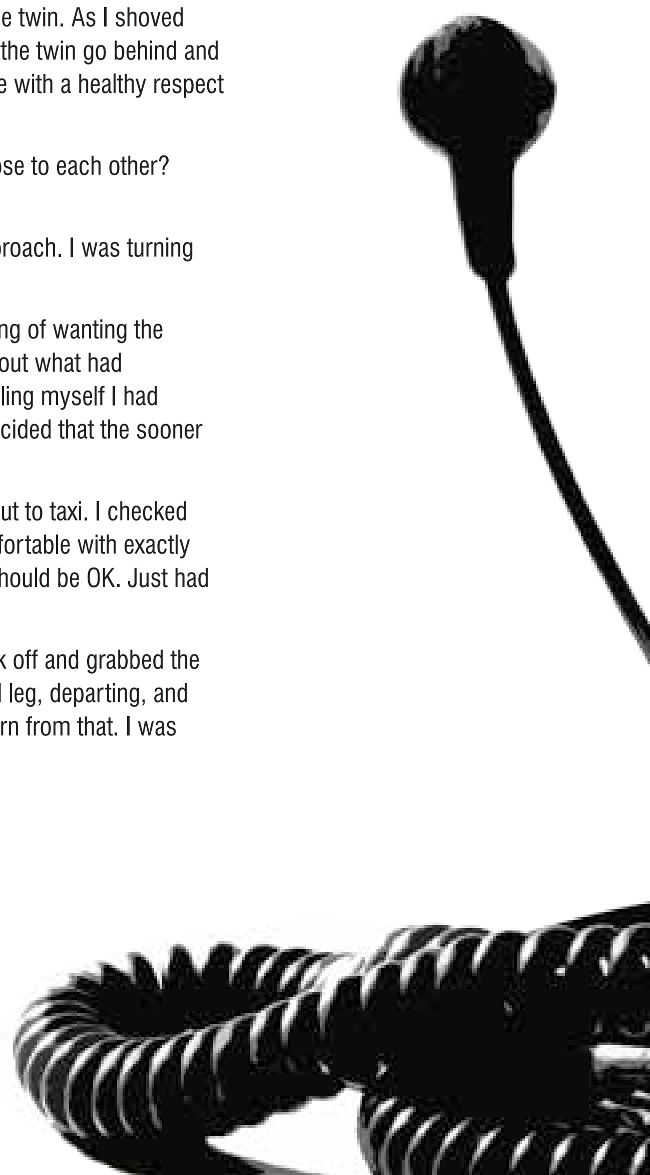
I started the downwind checks, gathered myself a little, and set up for the approach. I was turning base when I had my checks finished and clearance to land.

I made the landing without any more hiccups, just with an overwhelming feeling of wanting the flight over. I pulled in to get fuelled up again. The whole time I was thinking about what had happened on the trip in. All sorts of things went through my head. I started telling myself I had begun descending too late, or hadn't been paying close enough attention. I decided that the sooner I got out of there and completed my trip the better. Wrong.

I fuelled up, had a quick look at the charts and flight plan and made my way out to taxi. I checked the Armadale outbound procedure again. Looking back on it, I didn't feel comfortable with exactly what I had to do, but thought if I got up there and took it one step at a time I should be OK. Just had to remember what my instructor had drilled into me.

I was cleared to runway 24L for my southern departure. I did my checks, took off and grabbed the Visual Pilot Guide for Jandakot to get my bearings. It put me on the downwind leg, departing, and with the nose pointed at the prison I lost sight of it quickly. Darn. OK, I can learn from that. I was on top of the train lines and made a turn to my right for track to Armadale.

> "We were so close that I could see the look of horror on both pilots' faces in the twin."



I was now ready to make it over the hills and had just one more decision to make. I could see the television antennas on the top of the hills and remembered my instructor's voice telling me, 'Just keep the antennas on your right.' Hang on, or had she said, 'just keep to the right of the antennas'?

She had said it so many times! Why couldn't I remember?! I realised I had been so busy mulling over the inbound flight, and what had gone wrong, that I had done the worst thing possible. I had not planned properly for the next leg. I had absolutely no idea which side of the antennas I should be on! Fifty/fifty is a reasonable gamble, but I realised, all too late, that gambling was what I was doing.

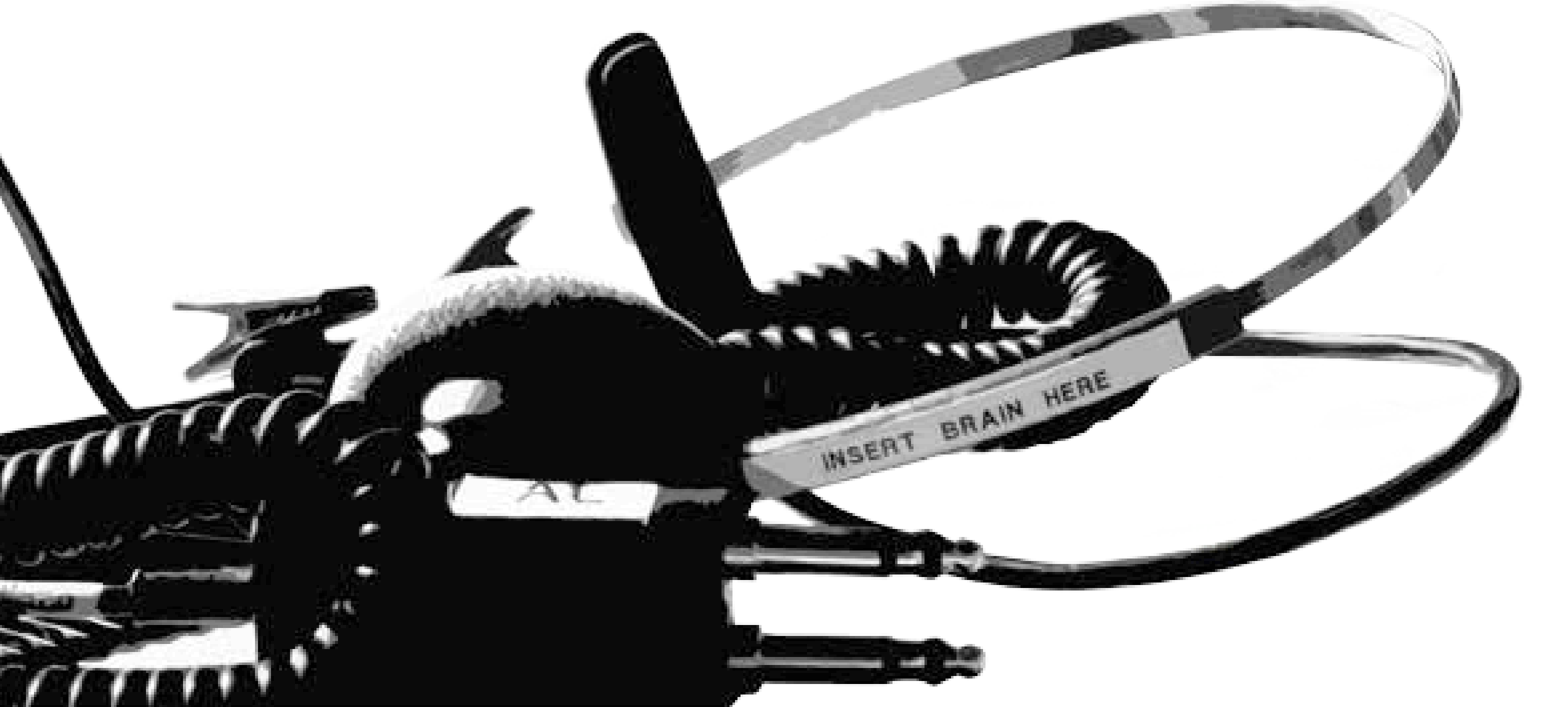
It was too late to change direction as the towers were coming closer every second. I decided to bite the bullet and track to keep the antennas on my right. I tuned into Perth Radar. Perhaps I could just keep out of Perth Class C airspace. It started out OK. A Qantas plane was cleared to 6000ft. Good, good. 'Aircraft north of Jandakot, identify.' My heart sank. I pressed the transmit button and meekly stated my call sign and position. After identifying I was confirmed as the culprit and told exactly where I was—in controlled airspace. As I put my finger on the VTC it all made perfect sense.

Air traffic control squawked and vectored me without any further incident and truth be told, they were incredibly considerate considering the position I had put myself, and potentially others, into.

I think that my troubles started by not fully assessing my near-miss after landing. I should have called someone and gone through what had occurred before I took off on the next leg of my flight. I hadn't resolved the mystery of what had happened, so I lost confidence in my own abilities and took that insecurity up on the next leg with me. There could have been much more serious consequences. I decided to use this as a case study on myself, to learn more about what my development areas needed to be and to work on them. I learnt a lot, and am now going through my commercial licence training.

In hindsight, my approach was by the book, and it was the pilots of the twin who were in the wrong. I don't know what happened to them, but hopefully they learnt from it too. There is no excuse though, for not being 100 per cent sure of what and where you are going to be flying on your next leg.

“There is no excuse though, for not being 100 per cent sure of what and where you are going to be flying on your next leg.”



Australian Government

Australian Transport Safety Bureau

Our plan for the year

We recently released our annual plan that highlights the ATSB's goals, targets and deliverables for 2012–13. The plan is important because it spells out what we'll do to make transport safer in Australia.

A significant part of the plan focuses on our safety awareness priorities for the aviation industry. These priorities reflect the broad safety concerns that come out of our investigation findings and from the occurrence data reported to us by industry.

You'll hear more about our safety priorities over the coming months. But it's worth briefly sharing with you what the ATSB sees as the main risk areas that need heightened attention from the Australian aviation community. They include:

- Avoidable accidents—GA pilots continue to die in accidents that are mostly avoidable. These accidents involve low-level flying, wirestrikes, flying visually into bad weather, mismanagement of partial power loss, and poor fuel management.
- Handling of approach to land—A worrying number of pilots are not adequately handling uncommon manoeuvres during their approach to land.
- Data input errors—Human error involving incorrect data entry continues to cause concern. In some cases, operators' flight management procedures are not catching these errors.
- Safety in the vicinity of non-towered aerodromes—Non-towered aerodromes continue to pose a risk to aircraft due to poor communication between pilots, ineffective use of see-and-avoid techniques and a failure to follow CTAF and other procedures.

We'll be regularly talking with industry about these concerns. We'll also dedicate a page on the ATSB website to give our safety awareness priorities greater visibility.

Martin Dolan
Chief Commissioner

24 Hours
1800 020 616
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Somatogravic illusion warning for pilots

In the wake of a fatal accident at Bathurst Island Aerodrome, the ATSB is alerting pilots to the somatogravic illusion – a powerful physiological illusion which can have dire consequences.

On 5 February 2011, the pilot of a Cessna 310R, was returning to Darwin from Bathurst Island. The pilot departed Bathurst Island Aerodrome at around 2140 CST and collided with terrain approximately one kilometre from the end of the runway. The pilot, the sole occupant of the aircraft, died in the accident and the aircraft was destroyed.

The ATSB investigators did not find any technical problems with the aircraft. However, the location of the wreckage, combined with the dark conditions, and the light load, suggested the pilot may have been affected by a powerful human physiological illusion – the somatogravic illusion.

The somatogravic illusion can develop under conditions of limited visibility, as the brain is unable to differentiate between the sensations associated with tilt and those associated with acceleration. Lacking outside visual references, pilots experience the sensation that they are climbing much more steeply than they actually are.

The illusion is generally felt at takeoff. The natural impulse is to lower the aircraft's nose in response to the sensation that it is climbing too steeply. However, this reaction increases the acceleration, compounding the illusion. If the illusion is not recognised and overcome, the pilot can continue to compensate for a steep climb that does not actually exist, with the aircraft ultimately descending into terrain.

Strategies for coping with the effect include recognising conditions under which it may occur, strict vigilance in the use of the attitude indicator (artificial horizon) as the primary source of aircraft pitch angle information, and correct instrument scanning techniques to verify the attitude and performance of the aircraft.

More information can be found in the ATSB Aviation Research and Analysis Report, *Dark night take-off accidents in Australia*. ■

Bulletin highlights safety lessons

The ATSB regularly releases a bulletin of short investigation reports. These reports provide useful safety messages and lessons.

Below are five of the occurrences from the most recent bulletin, issue 10.

AO-2012-008: Loss of separation assurance

On 8 January 2012, a Boeing B737-8FE and Boeing B737-838 were subject to a loss of separation assurance. The air traffic control's Short Term Conflict Alert was activated and the controller issued instructions that ensured vertical separation was maintained. The air traffic controller involved in the occurrence reported feeling mentally fatigued, following a very busy shift of continual high and complex workload, including multiple weather diversions and holding.

This incident highlights the need for awareness of the effects of high workload and sustained task complexity on performance. Taking regular breaks and monitoring performance is also an important safety lesson.

AO-2011-162: Breakdown of separation

On 9 December 2011, a breakdown of separation occurred between a S.O.C.A.T.A. Groupe Aerospatiale TBM 700 (VH-VSV) and a De Havilland Canada DHC-8. VH-VSV penetrated controlled airspace without a clearance, and the two aircraft came within 1.2 nautical miles at the same altitude. One of the key factors that led to this was a miscommunication between the pilot and the Bankstown air traffic controller.

This incident demonstrated various key points that pilots need to consider when operating at unfamiliar aerodromes. Among them, that the use of correct phraseology is vital. Also, it is the responsibility of both the pilot and the controller to ensure that any omissions and discrepancies are clarified.

AO-2012-043: Runway incursion

At Taree Aerodrome, on 23 March 2012, as a Van's RV-10 took off, another aircraft, a SAAB 340B, entered the runway. The pilot of the RV-10 decided that since his aircraft was already airborne, the safest option was to continue the takeoff. He passed directly overhead the other aircraft at about 300 ft.

The key safety message from the subsequent investigation was that when operating outside controlled airspace, it is the pilot's responsibility to maintain separation with other aircraft, both in the air and on the ground. For this, it is important that pilots utilise both alerted and un-alerted see-and-avoid principles.

AO-2012-002: Runway undershoot

A runway undershoot at Warnervale Aerodrome demonstrated the importance of establishing wind direction and strength using all available references, including those on the ground, while on approach. On 25 December 2011, due to the combination of too shallow an approach and a sudden loss of headwind, a Cirrus SR22 landed short of the bitumen runway.

This serious incident also highlights the unexpected nature of wind gusts and the need to identify an appropriate touchdown point on the runway that provides an adequate safety margin.

AO-2012-016: Partial power loss

On 25 January 2012, a Schweitzer helicopter 300C suffered a partial power loss while returning to home base after a day's aerial spraying activities. The helicopter impacted the tree canopy before coming to rest on the ground between several large trees. The cause of the partial power loss was not determined, in part because the helicopter was seriously damaged by the fire. However, this accident highlighted the value of pilots wearing helicopter safety helmets. The pilot reported impact damage to both sides of his helmet, and remarked that the helmet had saved his life. ■

Aviation Short Investigation Bulletins are available at: www.atsb.gov.au


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Aviation groups collaborate to improve safety

The ATSB, CASA, and the Aerial Agricultural Association of Australia have worked together to address a potentially significant hazard to turbine Dromader aircraft.

The issue was identified during the ATSB investigation into a fatal accident west of Dirranbandi in Queensland. On 19 July 2011, the PZL-Mielec M18A Turbine Dromader aircraft, was conducting spraying at a cotton station.

At 1138, the aircraft took off for its third spraying flight of the day. At about 1400 a ground staff member could not contact the pilot by radio. He raised the alarm.

A search was initiated and the wreckage of the aircraft was located in a ploughed field on the station. The pilot died in the accident and the aircraft was destroyed by impact forces.

ATSB investigators found that the aircraft had departed from controlled flight during a turn at low altitude, and the pilot was unable to recover before impact with the ground. The investigators could not conclusively determine the reasons why this had happened. However, they did identify a significant safety issue surrounding the potential for excessive shifting of the aircraft's centre of gravity as the contents of the aircraft's chemical/spray tanks were dumped or dispensed.

As a result, CASA and the owner/developer of the approval for operations at weights of up to 6,600 kg, which had effect during the flight, took action to improve operator and pilot understanding of the issue. CASA has distributed letters to operators, cautioning them of the potential danger. In addition, the owner/developer indicated that the design would be reviewed to address any excessive centre of gravity variations.

Although the hazard was not found to be a factor in the accident, the ATSB emphasises the importance of pilots maintaining their aircraft's weight and balance within limits throughout a flight. They should also understand the implications of changing weight and balance. ■

Wreckage of the Dromader in the cotton field

30 years of safer aviation

This year marks the 30th anniversary of operationally independent aviation safety investigations in Australia. While a lot has changed in that time, the fundamental model of transport safety investigations has largely remained the same.

On 7 June 1982, the Bureau of Air Safety Investigation (BASI) was created as an operationally independent agency, marking the start of a new era in aviation safety.

Now operating as the ATSB, Australia's national transport safety investigator plays an essential role—along with regulators and operators—in improving the transport safety system in Australia.

BASI was born out of the specialist Air Safety Investigation Branch that was part of the Department of Civil Aviation in the 1950s. The Air Safety Investigation Branch was an operationally independent unit, and helped to evolve aviation safety investigation.

'In BASI, you can really see the foundations of the ATSB,' said Richard Batt, editor of *Past Present Future,* a history of the Australian Transport Safety Bureau and its predecessors. 'So many important steps were made—steps that would inform not just how the ATSB works today, but how aviation investigations are conducted worldwide.' Among these was BASI's early adoption and research into human and organisational factors, which helped to set the benchmark for investigations.

On 1 July 1999, BASI combined with other national transport safety units to form the Australian Transport Safety Bureau.

Thirty years after the creation of BASI, its successor has become a world-leader in aviation, marine and rail safety investigations, continuing the tradition of operational independence, objectivity, and technical expertise.

Past Present, Future is available on the ATSB website. ■

Australia's voluntary confidential aviation reporting scheme

REPCON allows any person who has an aviation safety concern to report it to the ATSB confidentially. All personal information regarding any individual (either the reporter or any person referred to in the report) remains strictly confidential, unless permission is given by the subject of the information.

The goals of the scheme are to increase awareness of safety issues and to encourage safety action by those best placed to respond to safety concerns.

Non-standard radio procedures

Report narrative:

The reporter expressed safety concerns about non-standard radio communication procedure adopted by local pilots leading to radio congestion at an aerodrome. The reporter states that local pilots read back their squawk code, flight rules and destination when requesting a taxi clearance. However, this is not required under the Aeronautical Information Publication (AIP) as it has already been read back to ACD on the ACD discrete frequency.

The reporter states that this non-standard procedure has become problematic due to the increased traffic at [aerodrome] and due to the congestion on the SMC frequency at peak periods.

The reporter suggests that Airservices Australia ensures local operators are aware of and follow the standard radio procedures when requesting a taxi clearance.

Response/s received:

Airservices appreciates the opportunity to respond to the reported concerns regarding the radio procedures at [aerodrome].

The following extracts from the Aeronautical Information Publication (AIP) and the Manual of Air Traffic Services describe:

- the information ATC provide in an airways clearance;
- the standard phraseology used by a pilot requesting a taxi clearance;
- a pilot's requirement to read back all ATC clearances; and
- ATCs requirement to obtain a readback.

Airways clearance delivery

As per AIP ENR 1.1, Paragraph 3.21, an airways clearance normally contains the following items:

a. aircraft identification;
b. destination, area of operation, position or clearance limit;
c. route of flight;
d. assigned level, except when this element is included in the SID description;
e. for IFR flights, departure type;
f. SSR code;
g. frequency requirements
h. SSR codes, data link logon codes;
i. level instructions, direction of turn, heading and speed instructions.

Read back requirements

As per AIP GEN 3.4, paragraph 4.4, pilots must transmit a correct read-back of ATC clearances, instructions and information which are transmitted by voice. For other than Item a, only key elements of the following clearances, instructions, or information must be read back ensuring sufficient detail is included to indicate compliance:

a. an ATC route clearance in its entirety, and any amendments;
b. en route holding instructions;
c. any route and holding point specified in a taxi clearance;
d. any clearances, conditional clearances or instructions to hold short of, enter, land on, line-up on, wait, take-off from, cross, taxi or backtrack on, any runway;
e. any approach clearance;
f. assigned runway, altimeter settings directed to specific aircraft, radio and radio navigation aid frequency instructions;
Note: An 'expectation' of the runway to be used is not to be read back.
g. SSR codes, data link logon codes;
h. level instructions, direction of turn, heading and speed instructions.

Likewise, the Manual of Air Traffic Services states that Air Traffic Control should obtain a read back containing the above information in sufficient detail that clearly indicates a pilot's understanding of and compliance with ATC clearances, including conditional clearances, instructions and information transmitted by voice.

Taxi procedure

The reporter states that local pilots read back their squawk code, flight rules and destination when requesting a taxi clearance. Airservices notes that this is in accordance with AIP GEN 3.4-48 which states that the following standard phraseology should be used by pilots when requesting taxi clearance for departure at a controlled aerodrome:

> '[flight number] [aircraft type], [wake turbulence category if "Super or Heavy"] [POB (number)] [DUAL (or SOLO)] RECEIVED (ATIS identification) [SQUAWK (SSR code)] [aircraft location] (flight rules, if IFR] [TO (aerodrome of destination)] REQUEST TAXI [intentions]'

REPCON supplied CASA with the de-identified report and a version of the Airservces Australia's response. The following is a version of the response that CASA provided:

> CASA notes the response from Airservices Australia that the read back requirements are in accordance with instructions contained in the Aeronautical Information Publication. ■

How can I report to REPCON?
Online:
www.atsb.gov.au/voluntary.aspx

continued from page 45

second time for 29 minutes. Northbound again, it was cleared to lower altitudes, and at 14,000 feet, it joined a holding pattern at the CAMRN airway intersection, 39 nautical miles south of JFK at 8.18pm. Again it was held for 29 minutes, during which it was descended to 11,000 feet. At 8.44pm, New York Control asked, 'How long can you hold – and what is your alternate?'

First officer: 'We'll be able to hold about five minutes – that's all we can do.'

(The 27-year-old first officer was making all the radio transmissions. Using a headset, he was receiving ATC's instructions in English, but repeating them in Spanish for the captain and flight engineer).

Again the controller asked, 'What is your alternate?' and the first officer responded, 'Ah, we said Boston, but ah – it is full of traffic, I think.'

This transmission was evidently unclear, and the controller asked, 'Say again your alternate? The first officer answered, 'It was Boston but we can't do it now ... we run out of fuel.'

The controller's assistant immediately telephoned New York Approach Control to say, 'Avianca 052 can only do five more minutes in the hold – think you'll be able to take him?' Approach Control responded, 'Slow him to 180 knots and I'll take him.'

New York Control then relayed, 'Avianca 052, cleared to Kennedy Airport via heading 040, maintain 11,000 [feet], speed 180.'

The first officer contacted New York Approach, and was told to expect an ILS for 22 Left. The Boeing was then given descents and heading changes to place it in sequence with other aircraft. Seven minutes later, the controller transmitted, 'AVA 052 turn right, heading 220, I'm going to have to spin you sir.' (i.e. make an orbit). 'Windshear ... increase of 10 knots at 1500 feet, and then an increase of 10 knots at 500 feet.'

At 9.11pm, the final approach controller transmitted, '... maintain 2000 until established on the localiser. Cleared ILS 22 Left....contact Kennedy Tower 119.1'

The Tower told them they were 'No 3 to land, following a Boeing 727'.

At 9.22pm, with the aircraft about three miles from the threshold of Runway 22L, the first officer warned, 'Glideslope – 1000 feet above field.' Seconds later, he said, 'This is the windshear.'

Within 20 seconds, there were 11 'pull up' alerts from the ground proximity warning system and four 'glideslope' deviation alerts. At 200 feet and 1.3 miles from the threshold, the captain abandoned the approach. The first officer advised the tower of a missed approach.

Approach control directed them to, 'Climb and maintain 3000.'

Soon after, the approach controller said: 'I'm going to bring you about 15 miles north-east and then turn you back for the approach. Is that fine with you and your fuel?'

The first officer deferentially replied: 'I guess so – thank you very much.'

He told his captain: 'El man se calento'- 'the guy is angry.' (NTSB transcript)

Five minutes later, the first officer asked: 'Can you give us a final now ...?'

Approach said: 'Affirmative sir – turn left, heading 040 – climb and maintain 3000.'

For the first time in the flight the first officer rejected a direction: 'Ah negative sir – we just running out of fuel!

Approach responded immediately: 'OK – turn left heading 360 please. You're No 2 for the approach – I just have to give you enough room so you make it without having to come out again'.

But less than two minutes later the flight engineer announced: 'Flame out – flame out on engine No 4 – flame out on engine No 3.'

'Show me the runway!' called the captain.

The first officer told Approach: 'We just lost two engines – we need priority please.'

Approach replied: 'Turn to a heading of 250 – you're 15 miles from the outer marker and cleared for the ILS approach to Runway 22 Left -- maintain 2000 until established on the localiser.'

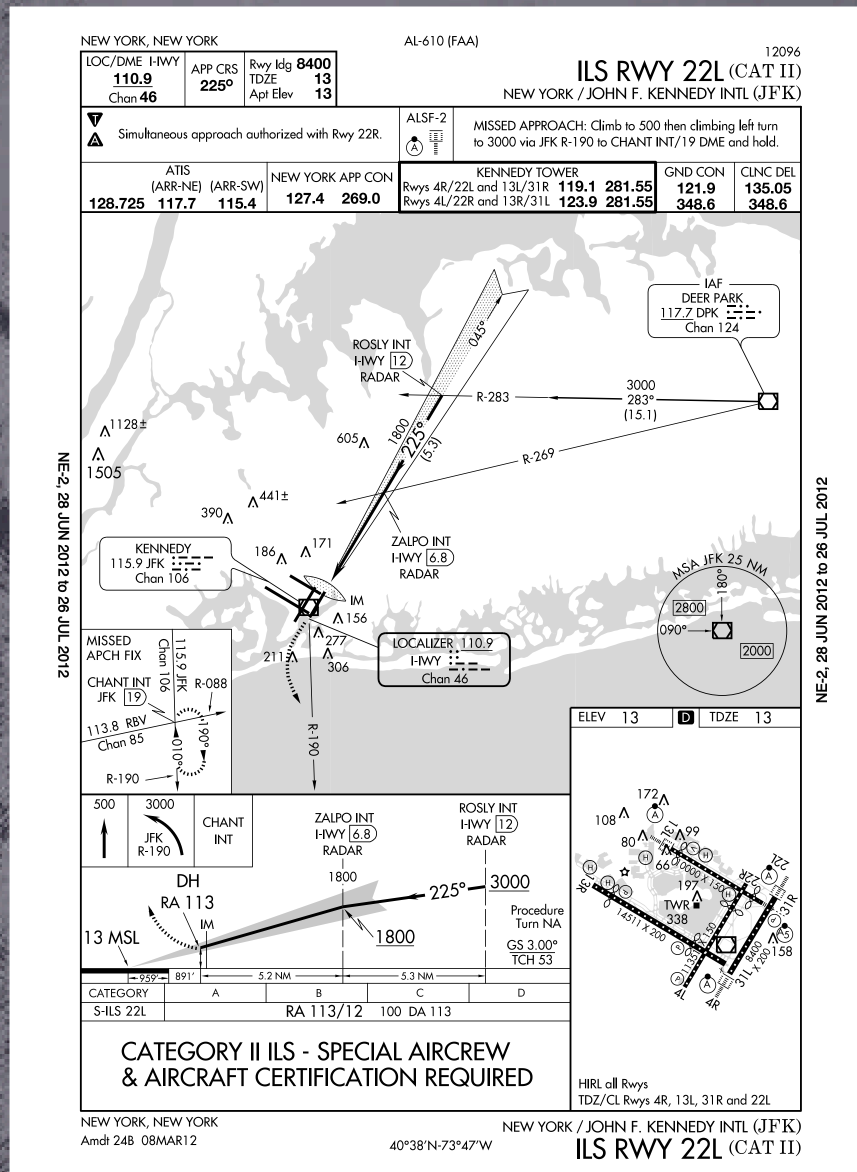
About a minute later, Approach spoke again: 'You have enough fuel to make it to the airport?'

There was no response. Avianca 052 had already flown into a hillside in a wooded residential area on Long Island's northern shore. It sheared off several trees and demolished part of a house.

There was no fire.

* * *

Of the 158 occupants of the aircraft, 73 were killed, including the three flight crew and five of the six flight attendants; 81 were seriously injured, including the surviving flight attendant and eight infants. Only four passengers escaped with minor injuries.



INVESTIGATION

The aircraft struck the ground on an up-sloping hill, breaking the fuselage into three sections. The nose section was badly damaged, leaving a trail of seats and interior fittings. The wings were severely damaged, with the port wing fractured into three major pieces. There was no rotational damage to any of the four engines, indicating that they had run down before impact, and only unusable residual fuel was left in the tanks.

The aircraft

The long-range Boeing 707-321B, previously operated by Pan American World Airways, was manufactured in 1967. It had flown nearly 62,000 hours, but maintenance records showed it had been properly maintained and inspected.

The flight-planned 'required fuel' load of 32,850kg included fuel to JFK, reserve fuel, fuel to its alternate, and holding fuel, and an additional 2750kg had been loaded.

Flight recorders

The flight data recorder was found to be inoperable, but the cockpit voice recorder held 40 minutes of excellent-quality recording. Communications among the crew were mostly in Spanish.

ANALYSIS

There were inadequacies in dispatching the aircraft, deficiencies in the crew's performance, both en route and during the attempted approach, and in ATC's handling of the aircraft. The analysis therefore focused on the planning of the flight, and both the crew's and the air traffic controllers' performances.

Flight planning

The Boeing had sufficient fuel to fly the scheduled route, conduct a missed approach, and continue to the Boston alternate. Yet when the flight plan was lodged, Boston was forecast to be below IFR minimums, and the weather there deteriorated while the aircraft was en route.

Weather data provided to the crew at Medellin was about 10 hours old. This, as well as weather data current at the time of departure, showed the flight's planned alternate would be below the landing minima by the time the Boeing reached the New York area. There was no record that the crew updated weather and traffic information en route. The investigation could not determine why the crew and the dispatcher did not communicate with each other. They could have done so on the Boeing's HF radio, or via dispatch services in Miami.

It was found that Boston was listed as an alternate only because it was part of a computer-generated flight plan for all flights to JFK, regardless of forecast weather because, being a reasonable distance from JFK, it was 'conservative' for fuel planning. This indicated inadequate dispatching by the airline. The Boeing's crew should also have been aware of the weather situation at Boston.

There were also deficiencies in the flight plan. The stipulated reserve fuel did not allow for the possibility of extensive en route and landing delays because of weather and traffic, and factored in only 28 minutes of reserve fuel, equating to 10 per cent of the planned en route flight time. If the captain had requested a new flight plan, the crew might have anticipated extensive delays in the JFK area and been more attentive to their fuel state.

Most international airlines – including Avianca – require crews and their dispatchers to keep each other informed of conditions that could alter the conduct of the flight. The dispatcher shares the responsibility for flight planning, fuel loading, weight and balance calculations, and weather information. This requirement is to provide a 'second opinion' in the operation of the flight.

... the captain again told the first officer to, 'advise him we have an emergency' ... 'Did you tell him?' ... 'Advise him we don't have fuel' ...

On beginning their descent from FL370, the crew should have estimated the distance and time remaining to ensure there was sufficient fuel for their destination, approach, diversion to alternate, as well as the reserve fuel required. The fuel quantity that the captain would want as he began the first approach should also have been included.

Referred to as the 'minimum approach-landing fuel,' this should be a part of a crew's calculations as a flight begins its descent. There was no indication that the crew established such a figure. Had the dispatch system been functioning, the dispatcher could have assisted with these calculations.

Communications

Because there was no record of contacts between the aircraft and FAA Flight Services during the flight, it was not possible to determine why the crew did not use these services. Their failure was serious because of the three holdings the aircraft encountered before its fuel state became critical. During the first two holding periods, the crew expressed no concerns to ATC and did not enquire about the situation at JFK.

By the time the crew finally realised their situation and requested priority, the fuel required to reach their alternate had already been exhausted. And by the time the Boeing was cleared from the CAMRN intersection to begin its approach, its fuel state had become critical. They should have declared an emergency then.

It was apparent that while holding at CAMRN, the crew became concerned about the fuel. However, at 8.54pm, when they were given a 360-degree turn for sequencing with other traffic, the crew should have realised they were being treated routinely and been prompted to report their critical fuel level. They could have declared an emergency, or at least requested direct routing to final approach.

Shortly afterwards however, the crew assumed ATC was aware of their situation and was providing 'priority' service. However, the time involved in being vectored for the approach should have indicated they were receiving only routine instrutions.

When the aircraft began its missed approach, the captain told the first officer, 'tell them we are in emergency'. But the first officer first acknowledged an altitude and heading before adding, '...we're running out of fuel'. He did not use the word 'emergency' as instructed.

When the tower controller instructed the aircraft to contact Approach again for vectors, he did not tell Approach that it was running out of fuel. But when the aircraft contacted Approach, the first officer said again, '...we're running out of fuel sir.'

Although the tower controller did not follow up the calls about running out of fuel, the approach controller turned the flight back on to a downwind leg and asked if it could accept a base leg 15 miles north-east of JFK. The first officer responded, 'I guess so'.

Shortly afterwards, the captain again told the first officer to, 'advise him we have an emergency'. Four seconds later, the captain asked, 'Did you tell him?' The first officer replied, 'Yes sir, I already advised him.' About a minute later, the captain said, 'Advise him we don't have fuel', and 20 seconds later he asked again, 'Did you advise him that we don't have fuel?' The first officer said again, 'Yes sir, I already advise him ...'

This indicated a total breakdown in the crew's attempts to convey the situation to ATC. The engines began flaming out seven minutes later, but it is obvious that the first officer had failed to convey the message the captain intended.

The crew's failure to notify ATC of their fuel situation, and a breakdown in communication between the crew and ATC, and among the crew members themselves, were the key factors leading to this accident. Much of the crew's failure resulted from limitations in their ability to speak English, and their failure to use standard ATC terminology.

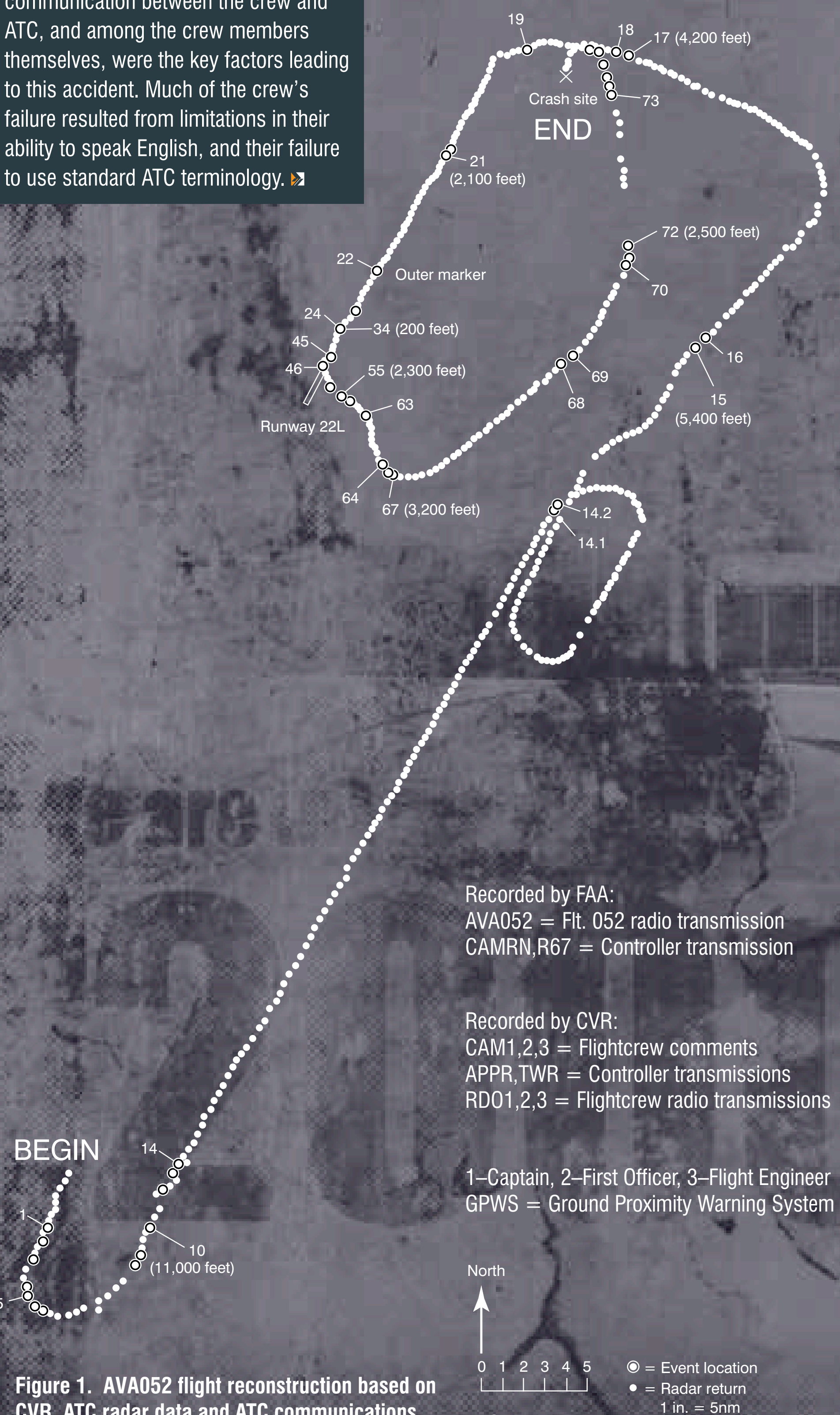


Figure 1. AVA052 flight reconstruction based on CVR, ATC radar data and ATC communications

Part two

IN PLANE SIGHT – HAZARD ID AND SMS

PASSENGER	DATE	CARRIER
CITIZEN / JOHN MR	SEPT 2012	CITY AIR

Once any hazards have been identified, reported, and recorded in the organisation's safety management systems, risk assessment and hazard mitigation occur. Risk assessments are performed in accordance with the individual organisation's safety system. Every organisation should have a risk tolerability matrix and hazards can be risk-assessed in accordance with this.

CASA safety systems inspector, Leanne Findlay, and ground operations inspector, David Heilbron, believe that information collected during this process will be useful for stakeholders throughout the organisation, whether large or small.

The following table lists some of the hazards that can be identified from the scenarios presented in the first article in this series, published in the July–August issue of *Flight Safety Australia*. The first column shows the hazards and the second column some questions that will assist in identifying specific components of them. More questions could be needed to ensure that the assessment complies with the requirements of your organisation's safety management system.

You may also note that in some cases the hazards relate to requirements that exist in regulations which have been established to address aviation hazards common to all operators.

BRISBANE ➡ CANBERRA

BNE ➡ CBR

FLIGHT FSA88 | BOARDING TIME 1615 | GATE 4 | SEAT NO. 14C | PASSENGER CITIZEN / JOHN MR

FLIGHT FSA88

Hazard	Questions that might assist in identifying specific components of the hazard
Unavailable cabin baggage test unit at check-in	How are check-in staff made familiar with the cabin baggage policy and restrictions, and how does the company ensure they understand them?
	How are check-in staff made aware of the tools available to monitor cabin baggage?
	What is the process to ensure redundancy if there are no cabin baggage test units available?
Passengers attempting to take cabin baggage on board the aircraft that does not comply with your company's requirements **Passenger on board aircraft trying ...**	What information on cabin baggage is easily accessible to passengers? How accurate is this information?
	How and where is information on cabin baggage policy displayed/available at check-in and boarding areas?
	Are enough cabin baggage test units available?
	How does the company try to ensure that passengers understand its cabin baggage policy?
	What is the redundancy process for cabin crew to deal with oversize baggage on board?
Dangerous goods being transported ...	Which information on dangerous goods is easily accessible to passengers? How accurate is this information?
	Do the dangerous goods examples provided make it easy for passengers and staff to recognise what dangerous goods are?
	How is information on dangerous goods legislation displayed/made available at the check-in and boarding areas?
	How does the company ensure that passengers understand what dangerous goods are?

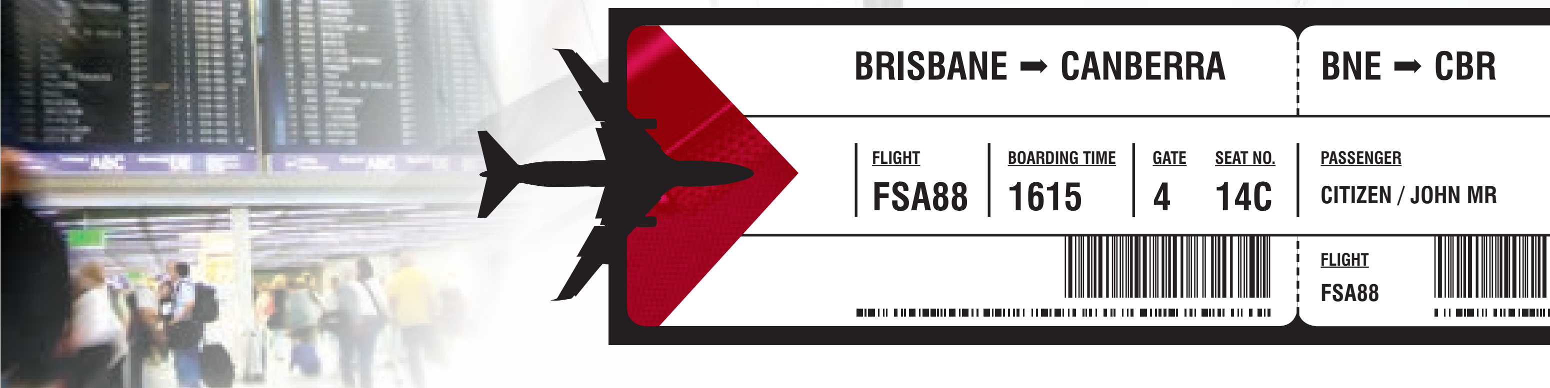
Changes to passengers seat allocation ...	Do staff (at check-in and gates) understand your emergency exit seat allocation policy?
	What are the contingencies for staff to make alternative arrangements in the event that a passenger does not meet the criteria for being seated in an emergency exit row?
	Is information on the emergency exit row seat allocation policy clear and accessible to passengers at the time of booking and/or when using web or mobile check-in?
	How does the company ensure that passengers understand the airline's emergency exit seat policy?
	How does the company ensure that cabin crew understand the potential consequences of not following the company's emergency exit seat policy?
	What contingency process is available to cabin crew to help them adhere to/implement emergency exit row procedures?
Passenger transporting approved medical equipment ...	How are staff and crew made aware of what medical equipment is accepted for transport on the aircraft (in both checked-in and cabin baggage)?
	How does your company distribute information about changes to medical equipment that is accepted for transport on board the aircraft (in checked-in baggage and the cabin)?
	What information on company policy re medical equipment accepted for transport as check-in and cabin baggage is made available to passengers at the time of booking?
Driver distracted by radio ...	What information on driver distraction is included in your human factors program?
	Do standard operating procedures (SOPs) indicate tarmac areas where drivers should not operate a radio because of continuous aircraft traffic? Are these areas clearly marked and identified?
Passenger wearing earphones ...	How are passengers made aware that they are entering a safety-critical area?
	What procedures are in place to ensure that passengers follow safety-related instructions from ground staff and cabin crew?
Passengers not following cabin crew's instructions ...	How do your SOPs ensure that passengers are made aware of the need to comply with crew instructions?
	What process is in place to ensure that all luminescent signs on board the aircraft are operational?
	Is sufficient information available to passengers advising them of their rights and responsibilities on board the aircraft?
How does the company measure the effectiveness of all these processes and procedures?	

Ground Accident Prevention (GAP)

Based on data developed by the International Air Transport Association (IATA), it is estimated that 27,000 ramp accidents and incidents – one per 1000 departures – occur worldwide every year. About 243,000 people are injured each year in these accidents and incidents – an injury rate of nine per 1000 departures. Ramp accidents cost major airlines worldwide at least US$10 billion a year. These accidents affect airport operations and result in injuries to personnel and damage to aircraft, facilities and ground-support equipment.

Once reported to the safety department, this information should be fed into the risk assessment and mitigation process and contribute to the continuous improvement of the safety system. Guidance on hazard identification released by the European Commercial Aviation Safety Team (ECAST) in 2009 explains that 'it is very difficult to declare a hazard identification process as complete and for this reason; hazard identification should be periodically reviewed. If there is a significant change in operations, the organisation, or its staff, the process should be repeated. Also, it is recommended that hazard identification be repeated when mitigation measures have been identified in order to detect unforeseen interactions between mitigation measures and other elements of the system or in the light of the outcomes of internal investigations'.

Measures might need to be applied to control/mitigate the hazard, in accordance with the airline's safety management system. Specific components of a hazard should be identified to find the most appropriate mitigating factors to assist in keeping the risk as low as reasonably practicable.



The reported hazards might be useful not only to departments such as engineering or flying operations, but also to other departments such as commercial, marketing or human resources.

The cabin crew and ground staff training departments could realise that important information is not being included in training syllabuses. For example, cabin and ground crew might have reported that they were unable to recognise the types of oxygen cylinders that passengers are allowed to carry in the cabin. The training departments might then review their curriculum and, as a result, include a more comprehensive module on oxygen cylinders that are acceptable as cabin baggage.

At first glance, the actions and processes of commercial and similar departments may not appear to have an effect on safety. However, once hazards have been reviewed, direct and indirect links to decisions made by various stakeholders may emerge. Sharing this information with other internal stakeholders could allow the collected data to contribute towards improving safety-related processes across the organisation.

Findlay and Heilbron recognise that interdepartmental communication and up-to-date training are integral to effective hazard identification. Understanding why certain interfaces may introduce hazards and potential risk is part of this awareness. The practicalities and culture around safety reporting will facilitate information flow to the safety department and to other departments which may initially appear not to have a directly safety-critical role. However, all departments and the decisions they make ultimately affect aviation safety.

For example, the department in charge of informing passengers of the company's cabin baggage policy might identify that many passengers are unaware of the company's cabin baggage allowances. If staff have identified a high number of hazards relating to cabin baggage, it might be decided that one way of mitigating these risks would be to involve the marketing department. Marketing analysts might then identify that the quality of information published on the company's webpage could be improved to better inform passengers about cabin baggage limits and their safety implications.

The ICAO *Safety Management Manual* notes that it is a common pitfall for safety management activities not to progress beyond hazard identification and analysis or, in other cases, to jump from hazard identification directly to mitigation deployment, bypassing evaluation and prioritisation of the safety risks.

In contrast, once sources of danger or harm have been identified, and their consequences analysed, prioritised and agreed, mitigation strategies to protect against them can certainly be deployed. This course of action would be correct if one were only to adhere to the notion of 'safety as the first priority', and focus entirely on the prevention of undesirable outcomes. However, under the concept of holistic safety management, agreeing on the consequences of identified hazards and describing them in operational terms are not enough for the deployment of mitigation strategies. It is also essential to evaluate the seriousness of the consequences, in order to define priorities for the allocation of resources when proposing mitigation strategies.

The ATSB maintains the safety information database (SIIMS) on accidents, serious incidents and other incidents, and publishes a weekly de-identified list of all incidents on their website: **www.atsb.gov.au/aviation/weekly-summaries.aspx**

Please send your feedback on this article to **fsa@casa.gov.au**

Further reading

Part 1 In plane sight–hazard ID and SMS, *Flight Safety Australia* issue 87 July–August 2012

CASA's safety management systems
http://www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC_91430

CASA's ground operations http://www.casa.gov.au/groundops

ICAO Doc 9859. AN/474 Safety Management Manual (SMM) Second edition, ICAO (2009), Montreal, Canada

ICAO Doc 9859. AN/474 Safety Management Manual (SMM) Third edition, ICAO (2012) is due for release shortly

SMS for aviation: a practical guide. CASA resource kit, published July 2012 **www.casa.gov.au/sms**.

FLYING OPS

1. A broadcast area is:

a) a designated area in G airspace in which broadcasts associated with all operations are made on an allocated frequency.

b) a designated area in G airspace in which all aerodrome broadcasts are made on an allocated frequency.

c) any area within 10nm of a non-towered aerodrome.

d) any area within 10nm of a certified or registered aerodrome.

2. The vertical upper boundary of a broadcast area is:

a) 5000ft (A050) by default.

b) 8500ft (A085) by default.

c) the base of the overlying CTA.

d) the base of overlying E airspace.

3. When an aircraft is parked for an extended period, wooden propellers are best positioned:

a) vertically, to allow for even UV exposure.

b) vertically, so that precipitation or condensation run off readily.

c) horizontally, to prevent the internal moisture from accumulating at the lower end and causing a propeller unbalance.

d) horizontally, to minimise precipitation or condensation entering the hub area.

4. At an aerodrome with a 1000m runway, an aircraft may take off only if the preceding aircraft has reached a point 600m ahead:

a) and both aircraft have a MTOW of less than 2000kg.

b) and it has a MTOW of less than 2000kg.

c) and the departing aircraft has a MTOW of less than 5700kg.

d) and the departing aircraft has a MTOW of less than 2000kg.

5. An exhaust gas temperature gauge (EGT) probe is located:

a) as far as possible from the exhaust ports, so as to measure the average of the gas temperatures.

b) in the combustion chamber as close as possible to the exhaust valve.

c) close to the exhaust port, where it measures the peak temperature of the pulses of exhaust gas.

d) close to the exhaust port, where it responds to an average of the peak temperature of pulses of exhaust gas.

6. On a turbo-charged piston engine the turbine inlet temperature probe is located:

a) at the end of the exhaust riser for the coldest cylinder.

b) at the end of the exhaust riser for the hottest cylinder.

c) close to the turbine inlet, and indicates the temperature resulting from the hottest cylinder.

d) close to the turbine inlet, and indicates the temperature resulting from the output of all cylinders.

7. **In radio communications, an unmanned aerial vehicle (UAV) uses the prefix:**
    a) 'UAV' as the first word in the call sign.
    b) 'UNMANNED' as the first word in the call sign.
    c) 'DRONE' followed by a three-digit call sign.
    d) 'DRONE' as the first word in the call sign.

8. **To avoid controlled airspace, VFR flights in G and E airspace by day must plan for a navigational tolerance of:**
    a) plus or minus 2nm between the levels of 2001-5000ft AMSL.
    b) plus or minus 2nm between the levels of 2001-5000ft AGL.
    c) plus or minus 1nm between the levels of 2001-5000ft AMSL.
    d) plus or minus1nm between the levels of 2001-5000ft AGL

9. **An aircraft with an indicated stalling speed of 41 KIAS will, during a 60 degree banked level turn, stall at approximately**
    a) 58 KIAS and this will increase with altitude.
    b) 58 KIAS and this will not change with altitude.
    c) 48 KIAS and this will increase with altitude.
    d) 48 KIAS and this will not change with altitude.

10. **ATC will provide separation between parachutists and non-parachuting aircraft:**
    a) in the vicinity of certified or registered aerodromes.
    b) in broadcast areas.
    c) in Class A, C and D airspace but not E and G airspace.
    d) in Class A, C, D and E airspace.

MAINTENANCE

1. **A three-spool jet engine has three:**
    a) separate combinations of compressor and turbine coupled by epicyclic gear boxes.
    b) separate combinations of compressor and turbine rotating independently.
    c) stages of both compressor and turbine rotating on a common shaft.
    d) stages of compressor.

2. **Referring to a turboprop engine, the starting electrical load is:**
    a) higher where the engine has a separately rotating gas generator because the starter has to drive the gas generator to a higher speed.
    b) higher where the engine has twin spools because the starter has to drive the propeller.
    c) lower where the engine has a separately rotating gas generator because the starter does not drive the propeller.
    d) lower where the engine has the compressor and turbine stages coupled on a single shaft because the starter does not drive the propeller.

3. **A compass which has deviation errors on the cardinal points of N -1 degree, E -5 degrees, S 0 degrees and W +2 degrees, has:**
    a) a coefficient A error of +1 degree. This can be corrected by rotating the compass on its mounting.
    b) a coefficient A error of -1 degree. This can be corrected by rotating the compass on its mounting.
    c) a coefficient C error of +1 degree. This can be corrected by adjustment of the corrector magnets.
    d) a coefficient B error of -1 degree. This can be corrected by adjustment of the corrector magnets.

4. **On an 'I' section wing spar, the top spar cap is in:**
    a) tension during flight, but on the ground the outboard section is in compression.
    b) tension during flight and when on the ground.
    c) compression during flight, but on the ground the outboard section is in tension.
    d) compression during flight and when on the ground.

5. **An instrument that reacts to the pressure differential across a calibrated restriction is:**
    a) an altimeter.
    b) the portion of an instantaneous vertical speed indicator (IVSI) that responds instantaneously.
    c) a vertical speed indicator (VSI).
    d) a manifold pressure gauge (MPG).

6. In an electronic amplifier, the function of a coupling capacitor is:

a) to couple the power supply to ground to bypass the supply impedance at the operating frequency.

b) to couple a portion of the output of an amplification stage to the input in order to provide feedback.

c) to transfer the DC component of a signal between stages, while blocking the AC component.

d) to transfer the AC component of a signal between stages, while blocking the DC component.

7. In an electronic amplifier, leakage in a coupling capacitor will have:

a) a significant effect on the power supply voltage.

b) no effect, in the case of a vacuum tube amplifier.

c) the potential to change the bias on the preceding stage.

d) the potential to change the bias on the following stage.

8. For its operation, an accelerometer relies on the:

a) density of a mass.

b) inertia of a mass.

c) length of a pendulum.

d) resonant frequency of a pendulum-mass combination.

9. ATA Spec. 100 Chapter 24-10-xx refers to:

a) a generator drive.

b) electrical load distribution.

c) buffet and galley installation.

d) fire protection.

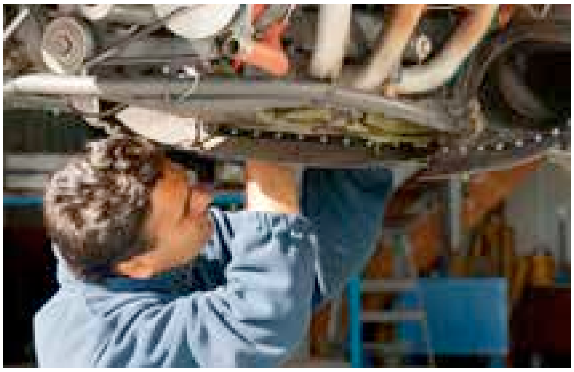
10. A part number standard hardware part number of MS20823 refers to:

a) an elbow, 45-degree flared tube and pipe thread.

b) an elbow, 90-degree flared tube and pipe thread.

c) a plug, square head

d) a reducer, external thread, flared tube.



IFR OPERATIONS

WAGGA WAGGA, NSW RWY 23 ILS OR LOC APPROACH

You are inbound to Wagga (YSWG) from overhead Corowa (COR) along W524 at 7000 in cloud.

Your aircraft, a Cessna 402 (Category B) is equipped with two ILS/VOR, one DME, one TSO 146 GPS and two fixed-card ADFs.

You are current on all these nav aids for instrument approaches. However, a defect in the maintenance release reads 'DME will not receive on frequencies below 112.0'.

You receive the AWIS, part of which reads '… cloud broken 500, visibility 3000…..'. Based on this AWIS you decide to do the RWY23 ILS.

The following questions relate to this approach (dated 28 June, 2012):

You select the appropriate approach plate and place it in the clip on the control column.

1. Which of the following is correct concerning this plate?

a) Either ILS-Z or ILS-Y plate can be used.

b) Only ILS-Z plate can be used.

c) Only ILS-Y plate can be used.

d) ILS cannot be flown because of the DME unserviceability. Therefore you would need to do an NDB, VOR or RNAV approach.

Approaching top of descent, all radio calls for this stage and pre-approach checks are completed. You are still IMC.

2. What altitude can you descend to enroute in preparation for this approach from overhead WG?

a) LSALT of 3200ft.

b) M.S.A. of 4700ft.

c) M.S.A. of 4200ft.

d) GPS. arrival M.D.A. of 1610ft (known QNH).

At 5 GPS. to run WG you consider the intercept of the initial approach track. Your present HDG is 035 M.

3. Which of the following is correct concerning this manoeuvre?

a) It is a Sector 3 entry. An entry to the hold would be required prior to commencing the approach.
b) It is a Sector 3 entry. The aircraft can be turned from HDG 035 overhead WG VOR to intercept the initial approach track.
c) Prior to the WG VOR the aircraft can be manoeuvred to the left to intercept the initial approach track.
d) Both a) and c) are correct.

Now established outbound on a track of 080 the descent is commenced.

4. To what height can the aircraft descend outbound?

a) 3000ft.
b) 4200ft.
c) Maintain 4700ft.
d) 2100ft.

Approaching 8 GPS. WG outbound, your groundspeed is 140kt. You consider the turn to position on base.

5. Which of the following would be correct concerning this manoeuvre?

a) Start turn to the right onto HDG 350 at 11.5 DME WG lead distance.
b) Start turn to the right onto HDG 170 at 8.5 DME WG lead distance.
c) Start turn to the left onto HDG 350 at 8.5 DME WG lead distance.
d) Start turn to the left onto 260 as an intercept HDG for the LOC at 8 DME WG.

Now established on the 10nm ARC at 3000ft.

6. What is the permissible tolerance on this ARC?

a) +/- 1nm
b) +/- 2nm
c) +/- 0.5nm
d) + 2 nm, – 0nm

NAV 1 selected to 111.1, LOC 230 set on O.B.S.
NAV 2 selected to 115.0, 245 set on O.B.S. Both NAVs were identified prior to the beginning of the approach.

7. What would the NAV 1 and NAV 2 C.D.I.s respectively be indicating at the 'lead radial'?

a) NAV 1 hard scale left, NAV 2 hard scale right.
b) NAV 1 hard scale right, NAV 2 hard scale left.
c) NAV 1 hard scale right, NAV 2 centred, FROM flag.
d) NAV 1 hard scale right, NAV 2 centred, TO flag.

Turning left now to intercept the LOC at 3000, you anticipate the glideslope intercept from 3000ft.

8. What is the name of this glideslope intercept position and at what mileage will it occur?

a) Final approach fix, 7.6nm WG DME/GPS.
b) Final approach point, 7.1nm WG DME/GPS.
c) Final approach point, 7.2nm IWG DME/GPS.
d) Final approach point, 7.6nm WG DME/GPS.

Now established on the ILS and descending. Both NAVs are selected to 111.1 to provide backup, when glideslope failure flags appear on both.

9. What action will you now take?

a) Continue the approach as LOC only, utilising the DME/GPS distance versus altitude scale to LOC M.D.A.
b) Execute the missed approach procedure, utilising the still serviceable LOC for track guidance.
c) Execute the missed approach procedure, using the WG VOR for track guidance.
d) Maintain the altitude at which the glideslope failed, track to the MAPt, then follow the missed approach procedure.

10. Which of the following is correct concerning the LOC approach? Note: R408 and R415 are not active.

a) The D.A. is 1370ft (known QNH), visibility 4.4km and MAPt is from the minima.
b) The D.A. is 1370ft (known QNH), visibility 2.4km and MAPt is at 2.4nm WG DME/GPS.
c) The M.D.A. is 1370ft (known QNH), visibility 4.4km and MAPt is at 2.4nm WG DME/GPS.
d) The M.D.A. is 1420ft (known QNH and PEC 50ft), visibility 4.4km and MAPt is at 1.9nm WG DME/GPS.

Landed safely Wagga.

UPCOMING EVENTS

September 17

Access all information areas seminars – Melbourne

Register online now!
go to www.casa.gov.au/avsafety

ACT/NEW SOUTH WALES

September 4
AvSafety Seminar – Canberra
www.casa.gov.au/avsafety

September 12
AvSafety Seminar – Warnervale
www.casa.gov.au/avsafety

September 14-16
AUSFLY 2012
Major GA fly-in – Narromine
www.ausfly.com.au

September 26
AvSafety Seminar – Jindabyne
www.casa.gov.au/avsafety

October 2
AvSafety Seminar – Gunnedah
www.casa.gov.au/avsafety

October 3
AvSafety Seminar – Narrabri
www.casa.gov.au/avsafety

October 9
AvSafety Seminar – Dubbo
www.casa.gov.au/avsafety

October 10
AvSafety Seminar – Bathurst
www.casa.gov.au/avsafety

October 16
AvSafety Seminar – Armidale
www.casa.gov.au/avsafety

November 14-15
Certification flight testing seminar – Canberra
nick.coulson@casa.gov.au

November 14-15
Quality and testing in aircraft maintenance seminar – Sydney
www.ndtboard.com

QUEENSLAND

September 5
AvSafety Seminar – Mackay
www.casa.gov.au/avsafety

October 10 – 12
Regional Aviation Association of Australia (RAAA) Convention
Coolum, Queensland
www.raaa.com.au/

October 23
AvSafety Seminar – Townsville
www.casa.gov.au/avsafety

October 24
AvSafety Seminar – Innisfail
www.casa.gov.au/avsafety

October 31
AvSafety Seminar – Gladstone
www.casa.gov.au/avsafety

WESTERN AUSTRALIA

September 25
AvSafety Seminar – Albany
www.casa.gov.au/avsafety

October 3
'Access all information areas'
Aviation Safety Education Forum – Perth
www.casa.gov.au/avsafety

October 10
AvSafety Seminar – Geraldton
www.casa.gov.au/avsafety

November 7 – 8
ATO Professional Development Program
www.casa.gov.au

SOUTH AUSTRALIA

September 28
'Access all information areas'
Aviation Safety Education Forum – Adelaide
www.casa.gov.au/avsafety

October 17
AvSafety Seminar – Broken Hill
www.casa.gov.au/avsafety

VICTORIA

September 17
'Access all information areas'
Aviation Safety Education Forum – Melbourne
www.casa.gov.au/avsafety

October 9
AvSafety Seminar – Hamilton
www.casa.gov.au/avsafety

October 10
AvSafety Seminar – Warracknabeal
www.casa.gov.au/avsafety

October 23
AvSafety Seminar – Shepparton
www.casa.gov.au/avsafety

INTERNATIONAL

September 17 – 18
Flight Safety Conference
London, UK
www.flightglobalevents.com/flightsafety2011

October 23 – 25
International Air Safety Seminar
Santiago, Chile
www.flightsafety.org/aviation-safety-seminars/international-air-safety-seminar

October 23 – 25
International Cabin Safety Conference
Amsterdam, The Netherlands
www.ldmaxaviation.com/Cabin_Safety/International_Cabin_Safety_Conference

To have your event listed here, email the details to **fsa@casa.gov.au**
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QUIZ ANSWERS

Flying ops

1. a) GEN 3.2 para 4.6 and ENR 1.4 para 3.3
2. a) ENR 1.4 para 3.3.1
3. c)
4. a) ENR 1.1 para 41.2.1
5. d)
6. d)
7. b) GEN 3.4 para 4.20
8. b) ENR 1.1 para 19.12
9. b) the KIAS does not change with altitude.
10. c) ENR 5.5 para 2.2. Traffic information is provided to jump pilots regarding known traffic in E.

Maintenance

1. b)
2. c)
3. b)
4. c)
5. c)
6. d)
7. d)
8. b)
9. a)
10. a)

IFR operations

1 c) Approach Plate ‘Y’. The DME will not receive on the ILS frequency as per defect so ILS ‘Z’ cannot be used, nor GPS permitted in lieu on this one.

2 b) Approach plate ‘Y’. DME (on WG VOR) and GPS to provide positive fix (25 and 10nm).
Note that the GPS arrival might be feasible if AWIS was indicating ‘fair’ conditions for en route cloud break.

3 d) AIP ENR 1.5-25 PARA 3.3.4
ENR 1.5-15 PARA 2.2.1
ENR 1.5-16 PARA 2.4.1b
However, the manoeuvring prior to the aid would be the most efficient method (traffic permitting) of commencing the approach.

4 a) Approach plate ‘Y’.

5 c) Approach plate ‘Y’. A good rule of thumb (and thus simple) is an initial 90 degree turn from your present track to get started. Also a good lead-in distance is 1 per cent of groundspeed i.e. 140kt, thus 1.4 nm prior to the 10nm ARC – that is 8.5 approx.

6 b) AIP ENR 1.1-38 PARA 19.6.2
CAO 40.2.1 APPENDIX 1 PARA 3.5(f)
Note that some ARCS may have only a 1nm tolerance due, for example, to airspace constraints. Check each approach plate e.g. Perth RWY 21 ILS.

7 d) The LOC needle on NAV 1 is command sense here but hard scale since you are still 15 degrees off the LOC. NAV 2 is centred because the lead is the 065 radial or 245 bearing to WG. The 245 selection is suggested since when you bring up the ILS as back-up on NAV 2 it is less OBS turning to put up the LOC of 230 in a higher workload situation.

8 d) AIP GEN 2.2-9
Definition of final approach point on a precision approach. Note carefully that 7.6 nm (ILS ’Y’) is the WG DME/GPS reference and not mileage from threshold or 7.2nm (ILS ‘Z’ which couldn’t be used due to DME unserviceability).

9 a) AIP ENR 1.5-35 PARA 7.2b
NAVs 1 and 2 on ILS frequency are thus a good back-up in that if one airborne unit were to fail completely then the ILS approach can be continued or, in this case, glideslope failure on both units would indicate a reversion to LOC only. A good rule of thumb for LOC descent is: DME or GPS distance times 3 plus elevation. e.g. 5 x GPS x 3 + 7 (WG elevation) = 22 i.e. 2200.
Note well that this little sum will not work everywhere due to DME siting on the aerodrome – check each location concerned.

10 c) Approach plate ‘Y’.
AIP GEN 2.2-13 Definition of non-precision approach.
AIP GEN 2.2-16 Definition of M.D.A.
AIP ENR 1.5-19 PARA 2.6.1c (MAPt fix)
AIP ENR 1.5-33 PARA 5.3.2 (QNH source) Note: PEC is only applied to a D.A. (full ILS)

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- ... and more close calls

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