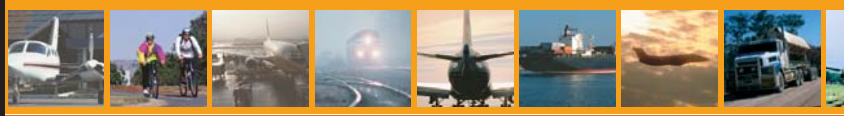
Australian Government
Australian Transport Safety Bureau

The Australian



Executive Director's Message

The ATSB's aviation research team has released seven aviation research reports this financial year with the three most recent covering Ageing Aircraft issues, Human Factors Analysis of accidents, and Pilot Incapacitation events.

The last of these found that the most common cause of the relatively rare in-flight incapacitations involved unforseen acute events, such as gastro-intestinal illnesses. None of the pilot incapacitation events examined in the report resulted in an accident in two-pilot operations, but the risks are obviously more serious for single pilot operations. Between 1975 and March 2006, ten fatal accidents resulted from pilot incapacitation, with heart attacks the most common cause of incapacitation.

The Human Factors Analysis and Classification System (HFACS) was developed for US military aviation, but has since been used widely in the analysis of civil aviation accidents. HFACS seeks to associate the accident sequence with different types of errors or violations, known as 'unsafe acts'. The errors are classified as either skill-based errors, decision errors, or perceptual errors.

For both Australia and the US, around 70% of all accidents could be associated with some type of unsafe act. The most common type of error was skill-based errors, accounting for around 80% of the errors identified using HFACS. In fatal accidents, decision errors and violations were more frequent, although the percentage of decision errors in Australia declined over the 10 year period examined. Around 11% of accidents in Australia involving unsafe act resulted in a fatality, compared with 21% in the US. The ATSB plans further safety research using the HFACS framework and database.

The most recent research report released by the ATSB examines aircraft age and its implications for safety. You will not be surprised that the study finds that large turbofan aircraft form the youngest aircraft fleet in Australia. The aircraft in the B737 and A320 category are an average now of just 6 years old. By contrast, the piston-engine general aviation fleet have an average of age of around 30 years. Excellent maintenance is crucial if these aircraft are to continue provide safe and reliable service.

Kym Bills, Executive Director

Is an uninterrupte continued flight?

At about 1708 Eastern Standard Time on 26 September 2002, the pilot of a Piper PA-32-300 (Cherokee Six) aircraft reported taxiing for departure from runway 14 at Hamilton Island, Queensland. On board the aircraft were the pilot and five passengers.

Witnesses to the east of runway 14 reported that, shortly after the aircraft became airborne, the engine began 'coughing' and 'misfiring', before 'cutting out' and then 'starting again'. Shortly after, the aircraft commenced a right turn, and the engine was heard 'spluttering' and misfiring'. Witnesses reported that, when part way around the turn, the engine again 'cut out', and the aircraft descended and impacted the ground. The pilot and passengers were fatally injured, and the aircraft was destroyed.

The investigation by the Australian Transport Safety Bureau (ATSB) into the circumstances of the accident determined that a mechanism that might have resulted in the symptoms reported by the witnesses was fuel supply-related. After confirming that sufficient fuel of the correct specification was on board the aircraft for the planned flight, the investigation considered the possibility that the delivery of fuel to the engine may have been compromised.

The position of the fuel selector control on the cockpit floor of the Cherokee Six family of aircraft, increased the risk of a pilot or front seat passenger inadvertently knocking the control from its intended selection when entering or exiting the cockpit area. As highlighted in the Cherokee

Position of the Cherokee Six fuel selector

d fuel supply guaranteed for

Six Service Manual, there is the risk that, should the fuel selector not be in a positive selector detent position, there could be more than one fuel supply port open at the same time. In order to mitigate that risk, the Take-off Checks in the Cherokee Six require a pilot to confirm the selection of the correct fuel tank by the position of the fuel selector control and by detent 'feel'.

If a pilot does not confirm the position of the fuel selector by 'feel', there is the risk that an inadvertent or intermediate fuel tank selection might remain unnoticed, and of the attempt to use fuel from an empty or almost empty tank. Depending on the amount of fuel remaining in an aircraft's tanks, an indeterminate fuel-air mixture would result sometime after the unnoticed selection was made. Any such interruption to the delivery of fuel to an aircraft's engine would result in temporary power loss. That was consistent with the witness reports of abnormal engine performance shortly after takeoff in the accident at Hamilton Island.

An examination of the ATSB occurrence database for the period 1969 to 2001 determined that, of the 369 power loss events involving PA-32-300 and -260 aircraft, 48 were due to pilot fuel tank mis-selection and 3 to the unserviceability of the fuel selector mechanism (table 1).

A similar examination of the instances of fuel system failure or mismanagement in that family of aircraft identified a total of 134 events during that period. Of those, 46 were due to the mis-selection of the intended fuel tank by the pilot, and 6 were due to the unserviceability of the aircraft's fuel selector (table 2).

The gravity of the risks associated with incorrect fuel management does not rest with the Cherokee Six family of aircraft alone. A research study by the ATSB titled Australian Aviation Accidents Involving Fuel Exhaustion and Starvation identified that, over the period 1991 to 2000, there were 12 fatalities attributed to fuel starvation. That was, where the fuel supply to an aircraft's engines was interrupted, although there was adequate fuel on board that aircraft for the planned flight.

Table 1: Cherokee Six Power Loss Events

Event	Frequency	Percentage (of total events)
Fuel tank selection	48	13 %
Fuel tank selector unserviceability	3	0.8 %

Table 2: Cherokee Six Fuel System Failure or Fuel System Management

Event	Frequency	Percentage (of total events)
Fuel tank selection	46	34.6 %
Fuel tank selector unserviceability	6	4.6 %

The ATSB study found that, of the 78 accidents in which fuel starvation was identified as a contributory factor, 42 per cent involved the mismanagement of the aircraft's fuel system by the pilot, 22 per cent involved the failure of an aircraft component and 12 per cent involved the malfunction of a fuel system component. The remaining accidents involved multiple contributory factors.

The relatively constant number of fuel starvation-related accidents over the last 20 years has frustrated the aviation industry in its attempts to enhance aviation safety. In his presentation to the Safeskies 2005 conference, the Executive Director of the ATSB, Mr Kym Bills highlighted that frustration:

> Despite the many safety improvements that have been made, I know we are all frustrated by the number of repeat occurrences such as …fuel exhaustion and starvation, especially where these lead to fatalities and serious injuries.
>
> It is not sufficient to just keep doing the same old things. Increasingly, collaboration, partnerships, education and better publicity will be crucial to further gains to complement improved technology, risk management, analysis, and safety culture.

The challenge for pilots is to continue to apply the existing regulated and other operational requirements and procedures to the management of their aircraft's fuel system and supply, while being prepared to contribute to the development of appropriate safety of flight innovations as alluded to by Mr Bills. ■

By Suzanne Garniss, Senior Transport Safety Investigator, Australian Transport Safety Bureau.

Australian Transport Safety Bureau Aviation Safety Investigation Report 200204328, Hamilton Island Aerodrome is available for download at www.atsb.gov.au

Safety briefs

Engine failure

Occurrence 200502231

During a flight from Essendon to Armidale, the left engine of a Piper PA31P-350 (VH-IGW) failed during cruise at 17,000 feet. Examination of the engine revealed that the crankshaft had fractured in two locations: through the web between the No.4 main bearing journal and the No.4 connecting rod journal; and through the web between the No.3 main bearing journal and No.3 connecting rod journal. It is evident that the event that initiated the multiple fractures of the crankshaft and the subsequent engine failure, was the creation of surface damage in the No.4 main bearing journal fillet radius through rubbing contact between the main bearing insert and the fillet radius. The factors that contribute to this event may be related to the retention of the main bearing insert in its housing and the crankshaft loading conditions that act to displace the bearing insert from its location in the bearing housing.

The movement of main bearing inserts during engine operation is a function of the magnitude of the forces that resist movement (created by establishing an interference fit) and the magnitude of forces acting to move the insert (crankshaft bending moments).

One factor that lowers the resistance of an insert to movement, the inclusion of material between the parting faces of the main bearing housings during engine assembly, was identified. However, other factors that may contribute to bearing insert movement, such as the magnitude of crankshaft bending moments, could not be established from an examination of the physical evidence.

The restoration of the surfaces of the main bearing housings indicated that main bearing insert movement was not an isolated case. ■

Research report on pilot incapacitation

Incapacitation of a pilot due to the effects of a medical condition or a physiological impairment represents a serious potential threat to flight safety. The purpose of this research project was to investigate the prevalence, type, nature and significance of in-flight medical conditions and incapacitation events occurring in civil aviation.

A search of the ATSB's accident and incident database was conducted for medical conditions and incapacitation events between 1 January 1975 and 31 March 2006. There were 98 occurrences in which the pilot of the aircraft was incapacitated for medical or physiological reasons (16 accidents, one serious incident and 81 incidents). Such events accounted for only 0.6 of a percentage point of all the occurrences listed in the ATSB's database. The majority of the events occurred in airline operations, with private flying the next most common (22.4 per cent of events). In 10 occurrences (10.2 per cent), the outcome of the event was a fatal accident. All of these accidents involved single-pilot operations, and in most cases, heart attack was the most common cause.

The majority (21 per cent) of in-flight medical and incapacitation events in Australian civil pilots for the study period were due to acute gastrointestinal illness (usually food poisoning), a finding consistent with other published studies. The next most common cause was exposure to toxic smoke and fumes on board the aircraft, of which 25 per cent were due to carbon monoxide.

The results of this study demonstrate that the risk of a pilot suffering from an in-flight medical condition or incapacitation event is low. However, if the pilot suffers a heart attack the risk of a fatal accident occurring increases. The aeromedical certification process must keep pace with the evolving nature of modern medical science to ensure that the risk of in-flight incapacitation remains low. ■

Breakdown of separation

Occurrence 200504338

On 31 August 2005, the crew of a Fairchild Industries Inc SA227-DC (Metro) aircraft had been issued a clearance for a visual approach to runway 14 at Brisbane Airport. At about the same time, the crew of a Boeing Company 717-200 (717) aircraft had been issued a take-off clearance from runway 01. The crew of the Metro commenced a go-around from runway 14 at about the same time the 717 became airborne from runway 01. The 717 crossed about 625 m in front of, and 580 ft above, the Metro. There was a breakdown of separation.

The Metro's descent to Brisbane had been restricted by another aircraft, which placed it above the normal descent profile. The crew of the Metro subsequently continued an approach that was unlikely to be conducted successfully. The aerodrome controller misjudged the position of the Metro, which resulted in the incorrect application of separation standards. This also meant that the controller did not give adequate consideration to the likelihood of a go-around by the crew of the Metro.

After the Metro crew commenced the go-around, the controller was unable to visually separate the aircraft. The controller had not provided traffic information to the crew of either aircraft, nor was he required to do so. The controller attempted to make the Metro crew aware of the 717, but did not provide the information in the form of a safety alert as required by the Manual of Air Traffic Services.

Without prior knowledge of the 717, the crew of the Metro found it difficult to identify the correct aircraft, as the 717 was initially below their level and masked by background lighting.

As a result of previous occurrences, the ATSB had previously issued a safety recommendation to Airservices Australia in October 2006 in relation to the provision of relevant traffic information, to enhance pilot situational awareness. ■

Wirestrike

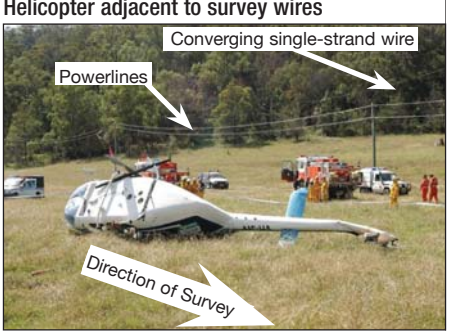
Occurrence 200601663

On 4 April 2006 a Bell Helicopter Company 206B III helicopter was being operated on a survey of powerlines in the St Albans area of New South Wales with a pilot, two power supply company personnel and a photographer on board. At about 1000 EST, the pilot observed a previously unseen single–strand telecommunication cable support wire rubbing against the copilot's door, and attempted to manoeuvre the helicopter clear of the wire. The helicopter lost directional control and commenced spinning to the right. The pilot cleared the wires and attempted a landing in an adjacent paddock. The helicopter came to rest on its right side and was severely damaged. One of the power supply company personnel received serious head injuries and the remaining occupants received minor injuries.

Safety action undertaken as a result of this accident included:

- the power supply company acted to:
  - immediately suspend helicopter inspections
  - appoint an internal accident investigation team that would make recommendations for the recommencement of helicopter operations
  - engage an aviation risk management consultant to assess the hazards affecting the company's aerial surveillance operations and to assist the internal investigation team
  - implement a number of safety actions that were recommended by the internal investigation team.
- the telephone company removed the single-strand telecommunication cable support wire that was struck by the helicopter.
- The Civil Aviation Safety Authority in conjunction with the Aerial Agricultural Association of Australia, published a wirestrike article in the November–December 2006 issue of its *Flight Safety Australia* Magazine. ■

Helicopter adjacent to survey wires



Hardened cockpit doors

Occurrence 200504018

On 14 April 2005 a crew member of a SAAB Aircraft AB SF-340B suffered a minor injury as a result of coming into contact with the sharp edges of the aircraft's hardened cockpit security door. A similar injury was reported to have occurred previously in like circumstances. More significantly, reports were received from a number of aircraft operators regarding flight safety and operational hazards associated with the installation of hardened cockpit security doors in four different aircraft types.

The investigation determined that, to enhance security, regulation 4.68 of the Transport Security Regulations 2005 was drafted to combine a unique hardened cockpit security door requirement in aircraft having a passenger seating capacity of 30 to 59 seats, with the hardened cockpit door security requirements of Section 13.2.2 of Annex 6 to the Chicago Convention for application in aircraft with a seating capacity of 60 or more seats.

However, the development of regulation 4.68 did not take full account of the operational and flight safety requirements of the US Federal Aviation Regulations, or of other available international policy guidance. The result was a number of unintentional operational and flight safety hazards in affected aircraft.

Both the Office of Transport Security (OTS) and CASA have advised the ATSB that options are being explored to establish formal consultation mechanisms to ensure the consideration of the potential operational and flight safety hazards that might result from the development of national security requirements for application in the Australian aviation industry.

The OTS has advised the ATSB that amendments to the *Aviation Transport Security Regulations 2005* on a range of matters, including potential safety concerns with regard to flight deck door requirements, has been identified by the OTS as an important priority and that US FAA safety regulations will be considered in drafting amended regulations. ■

Collision with terrain

Occurrence 200404085

At 0944 Eastern Standard Time on 19 October 2004, the Gyroflug Speed Canard aircraft departed Bundaberg, Qld, on a private flight to Parafield, SA, with a planned refuelling stop at Bourke, NSW. At about 1145, the pilot, who owned the aircraft and was the only occupant, radioed another pilot who was operating in the St George, Qld, area and advised that he was feeling dizzy, faint and disoriented, and was having difficulty lining up the aircraft to land on the St George runway. The aircraft remained airborne in the vicinity of St George for approximately 90 minutes. At about 1335, the aircraft impacted terrain 20 km south-west of St George and the pilot sustained fatal injuries.

Gyroflug Speed Canard VH-ZXZ

There was no evidence that the aircraft was not capable of normal operation at the time of the accident. During a routine aviation medical examination in 2003, the pilot was diagnosed with diabetes. The pilot apparently became incapacitated during flight and was unable to manoeuvre the aircraft to a successful landing.

It could not be established why the pilot became incapacitated, however a diabetes-related condition could not be ruled out.

As a result of this investigation, the Australian Transport Safety Bureau and the Civil Aviation Safety Authority undertook a number of relevant safety actions. In 2005, the Australian Transport Safety Bureau released Aviation Research Report B2005/0027, titled *Diabetes mellitus and its effects on pilot performance and flight safety: A review*. The Civil Aviation Safety Authority completed a literature review of diabetes mellitus and aeromedical certification. This review compared the requirements of various regulatory authorities regarding aeromedical certification of pilots with diabetes. It also considered the medical reporting requirements for Designated Aviation Medical Examiners (DAMEs). ■