Australian Government
Australian Transport Safety Bureau

A Digest of Aviation and Road Safety Research Reports for 2006

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ATSB Aviation Research and Analysis Reports

The ATSB Aviation Safety Research section conducts research to examine aviation safety issues and produce high quality research reports to promote safety within the aviation industry. The research programme aims to fulfil Australia's obligations, under International Civil Aviation Organization requirements, to analyse information held in the Bureau's aviation safety accident and incident database to determine if preventative safety measures are needed. The programme also covers topics that complement ATSB investigations and engages industry experts and stakeholders to ensure research is focused, timely and relevant.

Over the course of each financial year the ATSB aims to publish up to 10 research reports. In addition, the ATSB will continue to provide information and analysis about accident rates and trends, and will explore emerging issues and their influence on safety.

A synopsis of the reports completed and released in 2006 is contained below. To read any of the publications, visit the ATSB website (www.atsb.gov.au) and follow the links to Aviation Research Publications.

MBZ non-compliance remained low

Title: MBZ report: an examination of airspace-related occurrences in mandatory broadcast zones between 2001 and 2004

Report type: ATSB research paper

Author & performing organisation: ATSB

Release date: February 2006

Web link: www.atsb.gov.au/publications/2006/mbz_final.aspx

This report examines occurrences associated with mandatory broadcast zones (MBZ) in Australia. Specifically, the objectives of the report were to examine the number of occurrences involving General Aviation (GA) aircraft in addition to occurrences involving Regular Public Transport (RPT) aircraft that occurred in MBZ airspace from 2001 to 2004; and, examine the number of occurrences involving GA aircraft and RPT aircraft that were associated with intentional and unintentional non-compliance with MBZ procedures between 2001 and 2004.

The findings suggest that the number of MBZ airspace-related occurrences declined slightly over the four-year period. The findings contrast with those presented in the 2003 report which showed an increase in airspace-related occurrences between 1994 and 2001.

Overall, the findings suggest that the number of MBZ airspace-related occurrences in Australia, including those specifically relating to non-compliance with MBZ procedures, was relatively low and did not rise during this period. It may therefore be deduced that the risk due to MBZ-related occurrences did not increase. Importantly though, changes and potential inconsistencies in the reporting and recording of MBZ occurrences means these findings need to be interpreted cautiously.

Pilot Distraction: A common problem for aviators

Title: Dangerous distraction: an examination of accidents and incidents involving pilot distraction in Australia between 1997 and 2005

Report type: ATSB research paper

Author & performing organisation: ATSB

Release date: February 2006

Web link: www.atsb.gov.au/publications/2005/Distraction_report.aspx

Distraction has contributed to a number of aviation safety accidents and incidents. The purpose of this study was to examine the characteristics of pilot distraction, explore the range of distraction sources that have contributed to aviation safety occurrences, and develop a taxonomy of pilot distraction.

The results showed that the majority of occurrences were incidents rather than accidents or serious incidents. Distraction affected all operational groups and occurred during all phases of flight, including both ground and in-flight phases. Although most occurrences did not result in injuries, there were two accidents in which fatal injuries were sustained by the pilot-in-command. Many sources of pilot distraction were associated with equipment malfunctions, problems communicating on the radio, passengers, and weather. The sources of distraction provided the basis for the development of a taxonomy of pilot distraction. When applied to the dataset, the results indicated that the majority of distraction sources could be grouped into the categories of 'flight management tasks', 'external objects', and 'people on board the aircraft'.

In summary, the findings suggested that distractions can affect pilots operating in any type of operation, from general aviation to large commercial airlines. Distractions can arise unexpectedly, during periods of high or low workload, or during any phase of the flight. The report concludes with a number of tentative suggestions for minimising the risk of pilot distraction.

Australian Aviation: Fewer fatal accidents

Title: Analysis of fatality trends involving civil aviation aircraft in Australian airspace between 1990 and 2005

Report type: ATSB research paper

Author & performing organisation: ATSB

Release date: March 2006

Web link: www.atsb.gov.au/publications/2006/Research_Fatality_Tr.aspx

This research paper examined fatal accidents and fatalities involving civil aviation aircraft in Australian airspace between 1990 and 2005. The purpose of the paper was to provide accurate data to industry and the public by identifying key trends and characteristics. Specifically, the objectives of the paper were to identify trends for fatal accidents and fatalities from 1990 to 2005, examine the number of fatal accidents from 1990 to 2005 by pilot licence type, type of operation, level of proficiency, and aircraft weight, and, finally, examine the number of fatalities from 1990 to 2005 by pilot licence type, type of operation, level of proficiency and aircraft weight.

It was found that the number of reported fatal accidents and fatalities declined significantly between 1990 and 2005, with the highest number of fatal accidents and fatalities in 1990. The number of fatal accidents and fatalities reported in 2005 was below the annual average calculated for the 16-year period. Fatal accidents associated with both professional and non-professional pilots declined significantly between 1990 and 2005.

In relation to type of operation, the findings show that both commercial and non-commercial operations experienced a significant decrease in the number of fatal accidents between 1990 and 2005. For commercial operations, 2004 was the lowest for the 16-year period for both fatal accidents and fatalities. An elevated fatality rate for 2005 was primarily because of a fatal accident at Lockhart River in Queensland, which involved 15 fatalities. Overall, the fatal accident and fatality rates for commercial and non-commercial operations in Australian airspace have been very low.

Wire Strike: A Danger for low-level operations

Title: Wire-strike accidents in general aviation: data analysis 1994 to 2004

Report type: ATSB research paper

Author & performing organisation: ATSB

Release date: June 2006

Web link: www.atsb.gov.au/publications/2006/wirestrikes_20050055.aspx

Wire strikes are a significant safety concern for the aviation industry, in particular, the general aviation sector. Wire strikes may result in fatalities and/or the destruction of an aircraft. The report analyses the characteristics of wire-strike occurrences in the general aviation sector using accident and incident data collected by the ATSB. The data showed a downward trend beginning in 1998, with a return to previous accident rates in 2004.

Reported wire-strike accidents were primarily in three of the statistical groups used by the ATSB for investigative purposes — aerial agriculture, other aerial work, and private/business. The majority of wire-strike accidents were associated with aerial agriculture operations. The findings reinforce the clear danger to pilots flying at low level in the vicinity of powerlines and the need to be proactive in reducing the risks associated with such, including the implementation of risk management plans, thorough pre-flight planning and preparation, ongoing training, the use of power-line markers, and due diligence and care.

Drugs and alcohol in aviation

Title: Accidents and incidents involving alcohol and drugs in Australian civil aviation: 1 January 1975 to 31 March 2006

Report type: ATSB research paper

Author & performing organisation: David G Newman. Flight Medicine Systems Pty Ltd

Release date: June 2006

Web link: www.atsb.gov.au/publications/2006/B20060169_001.aspx

Drug and alcohol use in pilots can have a detrimental impact on aviation safety. Important cognitive and psychomotor functions necessary for safe operation of an aircraft can be significantly impaired by drugs and alcohol. The purpose of the study was to determine the prevalence and nature of drug and alcohol-related accidents and incidents in Australian civil aviation.

A search of the ATSB's accident and incident database was conducted for all occurrences in which drugs or alcohol were recorded between 1 January 1975 and 31 March 2006. The majority of these occurrences were related to alcohol. The drugs identified included prescription drugs, over-the-counter medications and illegal drugs (including heroin and cannabis).

The results of this study show that the prevalence of drug- and alcohol-related accidents and incidents in Australian civil aviation is very low, but that the related accident and fatality rates are high. The planned introduction of a mandatory drug and alcohol testing programme into the Australian civil aviation industry will provide a more prescriptive approach to the issue of drug and alcohol use in pilots. Education and training remain important elements of an overall approach to reducing the significant impact of drug and alcohol use on flight safety.

Depressuriation: Vigilence is the key

Title: Depressurisation accidents and incidents involving Australian civil aircraft: 1 January 1975 to 31 March 2006

Report type: ATSB research paper

Author & performing organisation: David G Newman. Flight Medicine Systems Pty Ltd

Release date: June 2006

Web link: www.atsb.gov.au/publications/2006/B20060142.aspx

Commercial aircraft involved in high altitude operations are generally pressurised to protect the occupants from the adverse effects of hypoxia, decompression illness and hypothermia. Failure of the pressurisation system is a potential threat to flight safety.

The purpose of this study was to determine the prevalence and consequences of aircraft decompression events in Australian civil aviation. The aim was to document the prevalence, nature, type, degree and extent of decompression events in Australian civil aviation, as well as the consequences of such events, especially hypoxia and pressure-related medical effects.

In general, the results of this study show that there is a high chance of surviving a pressurisation system failure, provided that the failure is recognised and the corresponding emergency procedures are carried out expeditiously. Aircrew should maintain a high level of vigilence with respect to the potential hazards of cabin pressurisation system failure.

Human Factors in Aviation safety investigation

Title: A layman's introduction to human factors in aircraft accident and incident investigation

Report type: ATSB research paper

Author & performing organisation: David Adams. David Adams Consulting

Release date: June 2006

Web link: www.atsb.gov.au/publications/2006/B20060094.aspx

This information paper seeks to provide people without an in-depth knowledge of the practice of 'human factors' a general plain English explanation of what human factors is, how it has evolved, and how it is applied to aircraft accident and incident safety investigations. The paper also gives a brief explanation of international agreements and Australian law as they apply to aircraft accident and incident investigations.

The purpose of applied human factors is to build better and safer products and systems. In aircraft accident and incident investigation, the specific purpose of human factors is to understand in detail how and why people make errors (including slips and lapses) or commit violations that lead to accidents.

In the development of aviation, the scope of human factors has evolved from focusing predominantly on the interface between the

pilot and the aircraft to a broader consideration of all the human activities of the system that are involved in placing and supporting the pilot in the operation of the aircraft. This broader focus considers not only the actions of the pilot, but also the cabin crew, the maintenance crews, air traffic controllers, and the management of the organisation that controls the activities of the aircraft.

The ATSB must, with as much certainty as possible, be able to determine not only what happened in any given accidents, but more importantly, why it happened. This information is critical in making safety recommendations aimed at improving transport safety.

Communication analysis

Title: Communication in context: a conversation analysis tool for examining recorded voice data in investigations of aviation occurrences

Report type: ATSB research paper

Author & performing organisation: Maurice Nevile. University of Canberra

Release date: June 2006

Web link: www.atsb.gov.au/publications/2006/B20050118.aspx

The report presents a tool for representing and analysing recorded voice data in investigations of aviation occurrences, or other transport occurrences. The aim of the project was to explore the potential value of an established sociological academic research methodology, called conversation analysis, for representing and analysing recorded voice data for investigations of aviation or other transport occurrences.

The methodology can expand the level of understanding that investigators can obtain from a voice recording as part of an investigation. Conversation analysis may be especially valuable for investigating transport occurrences because it focuses on examining the details of communication in context, as it actually occurs in real time.

The report is a tool for using conversation analysis to inform and guide analysis of recorded voice data in investigations.

Weather assurance and flight safety

Title: Destination weather assurance risks associated with the Australian operational rules for weather alternate minima

Report type: ATSB research paper

Author & performing organisation: A Langford & M Watson. ATSB

Release date: June 2006

Web link: www.atsb.gov.au/publications/2006/B20040246.aspx

A number of issues are relevant in making an assessment that a flight can be completed safely, including confidence that the weather at the destination will enable a safe landing. This study has examined weather data to measure the level of confidence that can be obtained in predicting a destination's weather by the use of weather forecasts and comparing these results with the actual weather that prevailed. The reliability of weather forecasting as a safety-critical aspect of air transport operations was selected in part because of the availability of extensive meteorological records for major Australian airports.

The use of en-route weather reports for updating operational decisions was examined to assess their capacity to provide a timely en-route warning that the destination weather would prevent a safe landing from being assured, thereby enabling an early diversion to an alternate airport.

Benchmarking australian aviation safety

Title: International fatality rates: a comparison of Australian civil aviation fatality rates with international data

Report type: ATSB research paper

Author & performing organisation: ATSB

Release date: August 2006

Web link: www.atsb.gov.au/publications/2006/B20060002.aspx

Fatal accident and fatality rates for Australia were compared with similar rates for the United States, Canada, the United Kingdom, and New Zealand, between 1995 and 2004.

The key findings indicated that the fatal accident rate for Australian air carrier operations, which includes all regular public transport and commercial charter operations, was slightly higher than the rate for the United States for most years. The fatal accident rates for the non-general aviation sector for

both countries are largely influenced by the commercial charter (Australia) and on-demand (United States) operational categories, which each have a much higher fatal accident rate than scheduled airline services. If Australia's activity profile mirrored that of the United States, Australia's overall fatal accident rate would fall below that of the United States. Both Australia and the United States recorded a significant downward trend in the general aviation fatal accident rate.

For most years, the rate of fatal accidents for all operations in Australia was slightly lower than that for Canada. Australia also recorded a significant decline in the rate of non-public transport fatal accidents during this period compared with the United Kingdom. The general aviation fatal accident rate for Australia was lower than the rate recorded for New Zealand, and showed a downward trend.

Overall, the findings showed that Australia's fatal accident and fatality rates were mostly similar to the corresponding rates of the other countries examined. Using North America and the United Kingdom to represent world's best practice and as a benchmark of aviation safety, the findings demonstrate that Australia has a good safety record.

Low risk of passenger medical problems in-flight

Title: An analysis of in-flight passenger injuries and medical conditions: 1 January 1975 to 31 March 2006

Report type: ATSB research paper

Author & performing organisation: David G Newman. Flight Medicine Systems Pty Ltd

Release date: October 2006

Web link: www.atsb.gov.au/publications/2006/B20060171.aspx

Approximately 1.5 to 2 billion passengers fly on the world's civil aircraft each year. As the population ages and the number of air travellers increases, with longer routes flown by bigger aircraft, the number of medical events involving passengers is anticipated to increase.

The purpose of this study was to determine the prevalence, nature, type and extent of medical problems and injuries occurring for passengers on board civil registered aircraft. The aim, in particular, was to determine the most common in-flight medical problems for passengers, and what proportion of these events result in an aircraft diversion.

The most common cause of in-flight death was heart attack. Serious injuries accounted for slightly more than a third of reported occurrences. Minor injuries accounted for the majority of cases. The most common medical event in passengers was minor musculoskeletal injury. Of the known medical conditions, heart attack was the most common reason for an aircraft diversion.

The results of this study are consistent with other published international experience. There is a low risk of passengers sustaining either an injury or a medical event as a consequence of travel on a civil aircraft.

Aircraft accidents: Far North Queensland in context

Title: ATSB transport safety research report fatal aircraft accidents: far north Queensland in context

Report type: ATSB research paper

Author & performing organisation: ATSB

Release date: November 2006

Web link: www.atsb.gov.au/publications/2006/b20060034.aspx

The paper examined the number and rate of fatal accidents in Australia, Queensland and Far North Queensland involving aircraft with a maximum take-off weight of 11,000 kg or less between 1990 and 2005.

The comparison of fatal accidents, fatalities and associated rates presented in the report provides a broad overview of the distribution of fatal aircraft accidents and associated fatalities across the states, territories and regions of Australia. There are a number of factors that may contribute to a fatal aircraft accident such as aircraft type and operation, aircraft maintenance, pilot training and experience, pilot health, organisational and regulatory factors, and environmental conditions. However, many of these contributory factors are independent of the accident location. Even though an accident occurred at a particular location; there is often no reason to suggest that the same accident could not have occurred in another state, territory or region. As a result, the analyses undertaken in this report reflects what occurred in a particular state, territory or region and does not necessarily indicate the level of safety in a region.

The distribution of fatalities in Queensland was not the same as the distribution of fatal accidents. The difference is probably due to the different kinds of aviation activity in different regions. That is, there is a higher proportion of private aviation activity in the South, but less in the northern regions where commercial

activity contributes a larger proportion of total activity. Accordingly, South Queensland records more fatalities in private operations, but Far North Queensland has more of its fatalities in the commercial categories. Because charter aircraft might be expected to carry more passengers than private operations, the number of fatalities in Far North Queensland is relatively high compared with the number of fatal accidents.

This report shows that there is some apparent variation in the fatal accident rates across different parts of Australia. But with low fatal accident numbers, an assessment of statistically significant differences is not possible. One accident can alter the statistics considerably, and taken out of context, might imply some underlying problem even if none exists.

Assessing the safety of sattelite navigation landing systems

Title: Perceived pilot workload and perceived safety of RNAV (GNSS) approaches

Report type: ATSB transport safety discussion paper

Author & performing organisation: Stuart T Godley. ATSB

Release date: December 2006

Web link: www.atsb.gov.au.publications/2006/20050342_RNAV.aspx

Area navigation global navigation satellite system (RNAV (GNSS)) approaches have been used in Australia since 1998 and have now become a common non-precision approach. Since their inception, however, there has been minimal research of pilot performance during normal operations outside of the high capacity airline environment.

For pilots operating Category A and Category B aircraft (predominantly single and twin-engine propeller aircraft), the RNAV (GNSS) approach resulted in the highest perceived pilot workload (mental and perceptual workload, physical workload, and time pressure), more common losses of situational awareness, and the lowest perceived safety compared with all other approaches evaluated, apart from the non-directional beacon (NDB) approach.

For pilots operating Category C aircraft (predominantly high capacity jet airliners), the RNAV (GNSS) approach only presented higher perceived pilot workload and less perceived safety than the precision ILS approach and visual day approach, but lower workload and higher safety than the other approaches evaluated. The different aircraft category responses were likely to have been due to high capacity aircraft having advanced automation capabilities and operating mostly in controlled airspace.

The concern most respondents had regarding the design of RNAV (GNSS) approaches was that they did not use references for distance to the missed approach point on the approach chart and cockpit displays. Other problems raised were short and irregular segment distances and multiple minimum segment altitude steps, that the RNAV (GNSS) approach chart was the most difficult chart to interpret, and that five letter long waypoint names differing only by the last letter can easily be misread.

ATSB Aviation Safety Grant Reports

The Aviation Safety Research Grants Programme funded a number of one-off research projects suggested by the community or industry participants. The programme complemented the ATSB's targeted research programme by promoting innovative worthwhile research into aviation safety; expanding and consolidating the aviation safety knowledge base; and increasing the pool of effective aviation safety researchers.

The Aviation Safety Research Grants Programme was a three year initiative introduced for the first time in 2003-04. The current grants scheme concluded in 2005–06. The work reported and the views expressed are those of the author(s) and do not necessarily represent those of the Commonwealth. However, the Commonwealth publishes and disseminates these reports in the interests of information exchange.

Infant passenger safety in commercial air travel

Title: Child restraint in aircraft

Report type: Research grant

Author & performing organisation: Gibson, T, Thai, K and Lumley, M. Human Impact Engineering.

Release date: March 2006

Web link: www.atsb.gov.au/publications/2006/crs_final.aspx

Commercial air travel remains the safest mode of transport available in OECD countries. Commercial airlines in Australia do not require infants under the age of 24 months to

occupy their own seats during flight. However, the children carried in the arms of adult passengers must be restrained during taxi, take-off, landing and turbulence.

This project reviewed the developments in safe transport of children in aircraft and conducted a test programme based on current Australian child restraint systems (CRS). This initial programme was later extended to include the assessment of infant carrier systems (commonly referred to as baby slings) for use as infant restraints in aircraft.

The travelling public is likely to expect that the level of safety offered to child passengers in commercial aircraft is equivalent to that of adult passengers restrained by lap belts. The use of an appropriate child restraint system can offer the highest level of safety for young children travelling in aircraft, both in turbulence and in crash situations. However, the compatibility of current Australian automotive CRS with aircraft seating has not been investigated and their performance in aircraft emergency situations is unknown.

There are very few preventable child deaths in aircraft crashes. Making infant air-seats compulsory would raise air travel costs which could result in a net increase in deaths and injuries as families opt for automobile travel — a higher-risk mode of transport per kilometre of travel.

Managing organisational flight safety

Title: Organising for flight safety

Report type: Research grant

Author & performing organisation: Dannatt R, Marshall V & Wood M. AVISE & Curtin Graduate School of Business

Release date: March 2006

Web link: www.atsb.gov.au/publications/2006/grant_200402401.aspx

Many factors contribute to an airline's safety record, some external to the organisation and others internal. An important internal contribution comes from the manner in which the company's flight operations are managed. This study addresses the organisational factors impinging on an airline's safety outcome that are subject to influence by managers in their flight operations divisions. Particular attention is given to evidence of the concept known as 'institutional resilience'.

Twelve major airlines in Australasia and South East Asia participated in the study. The study used a mixed method approach, incorporating both qualitative data (interviews) and quantitative data (audit). The framework of analysis has six-parts: human factors, culture, safety management systems, benchmarking, and theory of high reliability and institutional resilience.

The results show both significant similarities and important differences between the airlines. Attention is given to differences between domestic and overseas airlines. The similar outcomes are useful as a normative guideline on the way airlines should address their management of safety. The differences provide a guide to further development by both airlines and researchers.

The study identifies three areas suitable for further research. The first relates to further development of reactive and proactive measures that can indicate the state of an airline's 'safety health'. When used in an appropriate combination, such measures should indicate changes in intrinsic safety levels and facilitate the prioritisation of remedial action. The next area builds on the first by investigating the development of a checklist. The third area is development of a process to improve the reporting rate of flight crew error.

Fatigue inadequately managed

Title: Fatigue management in the New Zealand aviation industry

Report type: Research grant

Author & performing organisation: Leigh Signal, Denise Ratieta, & Phillippa Gander. Sleep/Wake Research Centre, Research School of Public Health, Massey University

Release date: April 2006

Web link: www.atsb.gov.au/publications/2006/grant_20040048.aspx

This study aimed to gather information on how New Zealand aviation organisations are managing fatigue, the different strategies being used, the advantages and disadvantages of different approaches, the barriers companies are facing in managing fatigue, and the resources used or required to help organisations better manage fatigue.

The findings strongly suggest that there is a need to raise industry awareness of the causes and consequences of fatigue, and processes for its management. It is suggested that the regulatory authority, industry bodies, and Occupational Safety and Health representatives consider who is responsible for doing this,

and what educational material and supporting resources need to be developed and made available to operators.

It is also suggested that the regulator carefully considers what supporting information it provides to operators and the fatigue management processes it requires operators to have in place. This is considered of particular importance for those organisations which have approval to operate under company-specific or accredited flight and duty time schemes where greater flexibility is possible.

Managing passengers in an emergency

Title: Evacuation commands for optimal passenger management

Report type: Research grant

Author & performing organisation: Lauren J Thomas, Sophie O'Ferrall & Antoinette Caird-Daley. Human Factors Group, School of Engineering, Cranfield University & Virgin Blue Airlines

Release date: May 2006

Web link: www.atsb.gov.au/publications/2006/grant_20040239.aspx

This report describes a two-phase research programme undertaken by Cranfield University in collaboration with Virgin Blue Airlines. Phase I involved a best practice forum to investigate current practice in managing passengers in emergency situations. The results showed that operators used a variety of commands to manage passengers in emergency situations, and that while some operators provided stringent procedures, others accepted that cabin crew may need to adapt commands and procedures to deal with the situation at hand.

The results from Phase I were used to design an experiment conducted as Phase II of the research. The results provided an insight into passenger expectations of commands and emergency instructions.

The evacuation trials showed that an active safety briefing had significant advantages over a passive safety briefing, and that the visibility of the cabin crew influenced passenger perceptions of evacuation effectiveness. Implications for operators are discussed.

Fire resistance of composite materials

Title: Fire safety of advanced composites for aircraft

Report type: Research grant

Author & performing organisation: A.P. Mouritz. School of Aerospace, Mechanical & Manufacturing Engineering, RMIT University

Release date: May 2006

Web link: www.atsb.gov.au/publications/2006/grant_20040046.aspx

Fire contributes to aircraft accidents and many fatalities. The growing use of polymer composite materials in aircraft has the potential to increase the fire hazard due to the flammable nature of the organic matrix. This report assesses the fire hazard of current and next-generation polymer composites for aircraft, and identifies those materials with improved flammability resistance.

For both aircraft cabin materials and aircraft structural materials the following fire properties were considered in the determination of fire safety: time-to-ignition, limiting oxygen index, peak heat release rate, average heat release rate, total heat release, flame spread rate, smoke, and combustion gases. The data are presented as performance tables which rank the composite materials in order from best to worst.

The composite most often used in pressurised aircraft cabins is glass/phenolic, and the database shows that this material has excellent fire reaction performance and that very few next-generation composites display superior properties. The most used structural composite is carbon/epoxy, and this material has poor fire resistance and can pose a serious fire hazard. A number of advanced structural composites with superior fire properties are identified, including materials with high temperature thermoset polymer, thermoplastic or inorganic polymer matrices.

Final leg poses greatest difficulty

Title: An assessment of general aviation pilot performance during simulated flight

Report type: Research grant

Author & performing organisation: Mark Wiggins. MARCS Auditory Laboratories, University of Western Sydney

Release date: May 2006

Web link: www.atsb.gov.au/publications/2006/grant_20040242.aspx

This study was designed to create a dataset that captured the performance of general aviation pilots during a simulated flight. Each pilot was provided with a meteorological briefing, maps, and all the equipment necessary to conduct the flight as it would occur within the operational environment.

The performance of pilots was assessed at three levels of analysis, the broadest of which involved pilots' self-reports of their performance in general, and their performance during the flight. At a more detailed level, the performance was rated by an observer across each of the legs of the flight. Assessments included the accuracy with which the aircraft was controlled, the accuracy of track-keeping, the accuracy in maintaining the prescribed altitude, and the level of fatigue management. The final level of analysis involved objective data that were recorded throughout the flight by the flight simulator.

Although the primary aim of the study was the collection of a dataset that captured performance, some comparative analyses were conducted, primarily to establish the basis for the differences in performance that were evident amongst pilots. Overall, the data indicated that performance during the flight was due less to pilots' qualifications and recent experience and more to the stage of flight during which the assessment took place. Specifically, the final leg of the flight was associated with the greatest variability in performance and was associated with relatively poorer performance than the preceding stages of the flight. The results are discussed in terms of the impact of the nature of the task, and the impact of fatigue.

Visual cues in the landing flare

Title: Investigation of visual flight cues for timing the initiation of the landing flare

Report type: Research grant

Author & performing organisation: Stephen Palmisano, Simone Favelle, Gavin Prowse, Richard Wadwell, & Ben Sachtler. School of Psychology, University of Wollongong

Release date: June 2006

Web link: www.atsb.gov.au/publications/2006/grant_20050119.aspx

While improper execution of the flare manoeuvre has been implicated in many landing incidents, very few human factors studies appear to have examined this problem. This flight simulation study examined three different visual strategies that pilots could use to time the flare. On each trial, non-pilots, student pilots or private pilots were required to judge either their time-to-contact with the ground, or an idealised time to initiate the flare.

The data provided some support for the hypothesis that pilots initiate the flare when their perceived time-to-contact with the ground reaches a critical value. Pilot performance was generally superior to non-pilot performance. However, both pilots and non-pilots were found to demonstrate flare timing biases during impoverished visual conditions (i.e. reduced depth cues), indicating that strategies based on perceptions of environmental distance and/or critical runway angle must also have played a role.

Importantly, very accurate timing judgments were possible with richer visual displays (i.e. additional depth cues) that provided performance feedback. Thus, it was concluded that entry-level flight simulators can be used for flare timing training if certain minimum visual display conditions have been met.

Safety culture: No room for complacency

Title: Assessing institutional resilience: a useful guide for airline safety managers?

Report type: Research grant

Author & performing organisation: Margot Wood, Robert Dannatt, & Verena Marshall. Curtin University of Technology, and AVISE

Release date: July 2006

Web link: www.atsb.gov.au/publications/2006/AVISE_20040240.aspx

Significant attention has been given in the literature to aviation safety, with emphasis on the importance of developing and maintaining resilience to accidents. To date, this attention has remained at the conceptual level, with comparatively little empirical research undertaken to test the validity of concepts put forward in the literature. This report presents the findings of a qualitative study, investigating the factors perceived to facilitate safety culture and institutional resilience within airlines. Data was obtained through semi-structured interviews with participants, based on questions relating to terms contained in James Reason's Checklist for Assessing Institutional Resilience.

Themes emerging from the findings include the importance of leadership roles undertaken by the board, senior management, chief pilots and safety departments, and the influence of both formal and informal performance

management systems. Analysis of the findings addresses the implications for Reason's checklist, and identifies those factors that are not on the checklist but perhaps ought to be. The emergence of a model which may be empirically tested through quantitative design is considered, along with other recommendations for future research.

In conclusion, strategies are presented, drawn from the data, which support the presence or absence of safety cultures within the airline industry and impact on ability to assess institutional resilience.

Cabin safety messages go unheard

Title: Public attitudes, perceptions and behaviours towards cabin safety communications

Report type: Research grant

Author & performing organisation: Andrew Parker. Synovate Pty Ltd

Release date: July 2006

Web link: www.atsb.gov.au/publications/2006/B20040238.aspx

The study provides an overview of aircraft cabin safety communications in Australia, in terms of effectiveness, passenger attitudes to such communications and opportunities that exist for improvement.

Most passengers agreed that paying attention to cabin safety communications is important. However, results revealed that behaviours do not always match this perception. Passenger attention levels to safety communications were found to be generally low. Of all communication types tested, the safety briefing was most prone to perceptions of reduced relevance through repeated exposure, while very low attention levels and perceptions of content establish safety cards as being generally ineffective.

A framework for cognitive processing of cabin safety communications is presented. The framework identifies that passenger behaviours may be negatively influenced by perceptions that it is socially undesirable to pay attention to safety information. Changing normative and attitudinal beliefs represents the greatest opportunity to improve communication effectiveness.

Key opportunities are identified to improve cabin safety through enhancement of communications. These recommendations include tailoring communications to the needs of specific passenger profiles, providing additional information to passengers, improved design guidelines, regular content variation and use of communications specialists in safety media design.

What bird was that?

Title: Forensic identification of aviation bird strikes in Australia

Report type: Research grant

Author & performing organisation: Leslie Christidis, Janette A. Norman, Rebecca N. Johnson, & Sue Lindsay. Australian Museum, & Museum Victoria

Release date: June 2006

Web link: www.atsb.gov.au/publications/2006/grant_20050117.aspx

The aim of this study was to investigate the feasibility of forensic DNA-based techniques in identifying species involved in Australian aviation bird strikes. Experimental bird tissues were subjected to severely damaging conditions to determine if DNA could be extracted from these samples. In addition, DNA and feather microscopy databanks were created from the species classified as being the highest risk for strikes to provide reference data to compare against unknown samples.

DNA was successfully extracted from all strike samples collected with sampling kits then returned to the laboratory and positive identifications were able to be made to species level in the majority of cases. Interestingly, it was found that attempts at visual species identification were often incorrect and that the putative high risk species were only responsible for 27 per cent of the unidentified strikes.

In general, the study found DNA identification of strike species to be a reliable method for identifying the species involved in collisions, and that it would be a useful addition to the methods already employed to identify wildlife strikes at civilian aerodromes.

Improvements for cockpit warning signals

Title: Design and evaluation of auditory icons as informative warning signals

Report type: Research grant

Author & performing organisation: Catherine Stevens, Nathan Perry, Mark Wiggins, & Clare Howell. MARCS Auditory Laboratories, University of Western Sydney

Release date: August 2006

Web link: www.atsb.gov.au/publications/2006/grant_B20050120_001.aspx

Auditory icon caricatures of everyday sounds have the potential to convey information by non-verbal means quickly and accurately. Two experiments investigated the application of auditory icons as warning signals to the civil aviation cockpit environment. Warning signals that are iconic and that stand in a direct relation to the event being signalled, such as the sound of coughing to signal the presence of carbon monoxide, should convey information about the nature of the critical event as well as alerting the operator that there is a problem.

By contrast, signals that are arbitrarily associated with an event, such as a beep to signal the presence of carbon monoxide, provide little information about the nature of the event. Speed and accuracy of recognition in response to these different types of warnings may also be influenced by modality (visual, auditory, auditory + visual) and by task demand (low, high).

As hypothesised, fewer training trials were required to learn iconic warnings compared with abstract warnings. During the test phase, the effect of iconicity, as hypothesised, was influenced by modality and task demand. Bimodal (auditory + visual) warnings were recognised with the greatest consistency and accuracy. Auditory abstract warnings elicited slow reaction times and poor accuracy. Auditory iconic warnings, under conditions of high demand, evoked levels of accuracy comparable with bimodal warnings.

Again as hypothesised, accuracy was greater in response to auditory iconic than in response to abstract warnings, and recognition accuracy and reaction time were unaffected by level of flying experience. These initial experiments suggest that there is potential for the use of auditory iconic warnings and bimodal warnings as the means, not only to alert, but also inform pilots about the nature of a critical incident.

ATSB Road Safety Research and Analysis Reports

The ATSB's road safety research programme generates objective information to support the development and evaluation of road safety strategies, policies and regulations. Research projects are undertaken in-house, drawing on the ATSB's national data collections, or are contracted out to private sector consultants or academic researchers. Bureau officers establish the research objectives, manage the projects and exercise quality control over the resulting reports.

How safe are Australia's roads?

Title: International road safety comparisons: the 2004 report

Report type: ATSB research paper

Author & performing organisation: ATSB

Release date: May 2006

Web link: www.atsb.gov.au/publications/2006/Int_Comp_03.aspx

The report presents detailed tables of road death rates for OECD nations and Australian states and territories. These rates allow Australia's road safety performance to be compared with other OECD nations, while taking account of the differing levels of population, motorisation and distances travelled annually.

The 2004 report found that Australia's road deaths per 100,000 population and road deaths per 10,000 registered vehicles were again below the corresponding OECD median rates. The Australian road death rate per 100 million kilometres travelled corresponded to the OECD median rate.

Among the OECD nations for which 2004 data were available, Australia had:

- 11th lowest rate (out of 24) in terms of road deaths per 100,000 population (7.9 deaths);
- 9th lowest rate (out of 22) in terms of road deaths per 10,000 registered vehicles (1.2 deaths)
- 4th lowest rate (out of 11) in terms of road deaths per 100 million vehicle kilometres travelled (0.8 deaths).

Overall, of the OECD nations for which 2004 data were available:

- Netherlands recorded the lowest rate of road deaths per 100,000 population (4.9 deaths)
- Norway recorded the lowest rate of road deaths per 10,000 registered vehicles (0.9 deaths)
- Sweden recorded the lowest rate of road deaths per 100 million vehicle kilometres travelled (0.6 deaths).

The Australian Capital Territory performed better than any other Australian state/territory or OECD nation in terms of all reported road death rates (2.8 deaths per 100,000 population, 0.4 deaths per 10,000 registered vehicles, and 0.3 deaths per 100 million

vehicle kilometres travelled). The Northern Territory recorded the highest death rates of all Australian states/territories (17.5 deaths per 100,000 population, 3.3 deaths per 10,000 registered vehicles, and 2.2 deaths per 100 million vehicle kilometres travelled).

Road surface and braking performance

Title: A pilot study of the effects of macrotexture on stopping distance

Report type: Consultant report : CR 226

Author & performing organisation: Peter Cairney & Anthony Germanchev. ARRB Consulting

Release date: April 2006

Web link: www.atsb.gov.au/publications/2006/CR226_Macro.aspx

This pilot study was undertaken to investigate whether presently available methods were capable of generating useful information on the relative contribution of road surface properties to stopping distance at different speeds. Testing was carried out at four sites with different combinations of macrotexture and skid resistance.

Braking performance appeared to show little variability in relation to the main effects of speed, site and conditions being manipulated in the study. Speed had a much greater impact on stopping distance than the other variables. Site and condition both had a significant effect. Apart from the effect of speed, the only effect that was large enough to have practical significance was the interaction of site, speed and condition. In wet conditions at higher speeds, stopping distances were noticeably greater at the site which had low skid resistance.

The report concluded that further investigation of the relation between crash occurrence and road surface, taking into account geometric characteristics and travel speed, would seem to be the most productive direction for the immediate future.

Toddler deaths in driveways

Title: Driveway deaths of child pedestrians

Report type: ATSB Monograph 18

Author & performing organisation: ATSB

Release date: May 2006

Web link: www.atsb.gov.au/publications/2006/monograph_18.aspx

Every year, a number of young children in Australia are killed as a result of low-speed impact with a motor vehicle, often as a consequence of a parent or family friend unwittingly driving a motor vehicle over a child in their yard or driveway. This monograph presents a summary of driveway deaths of child pedestrians (under seven years old) during the period 1996–2001. During 1996–2001, there were 66 reported cases of driveway deaths of children.

Toddlers under three years of age were most at risk, especially boys, and more than a third of the cases occurred when the motor vehicle was travelling forwards. The majority of these deaths occurred in regional, rural or remote areas, and the majority occurred at or near the child's home. In most cases (83 per cent), the driver was a parent or relative of the child, or a family friend.

Speed seen as biggest killer

Title: Community attitudes to road safety: community attitudes survey wave 18, 2005

Report type: Consultant report : CR 227

Author & performing organisation: Darren Pennay. Social Research Centre

Release date: May 2006

Web link: www.atsb.gov.au/publications/2006/CR227.aspx

This report documents the findings from the ATSB's 2005 survey of community attitudes to road safety. The survey was the 18th in the long running programme, the main purpose of which is to monitor attitudes to a variety of road safety issues, evaluate specific road safety countermeasures, suggest new areas for intervention and identify significant differences among jurisdictions.

The issues examined include: perceived causes of road crashes, exposure and attitudes to random breath testing, attitudes to speed, perceptions of police enforcement, mobile phone use while driving, reported usage of seat belts, involvement in road crashes, and experience of fatigue while driving.

The Australian community continued to identify speed as the factor which most often leads to road crashes. Other factors mentioned were: inattention/lack of concentration, drink driving and driver fatigue.

Considering community perceptions of these factors over the longer term, there were indications that the community increasingly

sees inattention/lack of concentration as a factor contributing to road crashes. There was also evidence of a longer term upward trend in perceptions of speed as a factor. By contrast, mention of drink driving as a factor in road crashes appeared to be declining.

Indigenous Australians over-represented in road deaths

Title: Australian Indigenous road safety

Report type: Consultant report : CR 225

Author & performing organisation: Tanya Styles & Colin Edmonston. ARRB Group

Release date: June 2006

Web link: www.atsb.gov.au/publications/2006/CR225_noap.aspx

Although precise quantification of the road safety problem has been difficult, due to poor reporting of crashes and complexities with the identification of Indigenous people, it has been estimated that Indigenous Australians are over-represented in road fatalities by about a factor of three.

Indigenous road crash data were sought from all jurisdictions, although only databases for Western Australia, Queensland and the Northern Territory identify Indigenous involvement in road crashes.

Current and ongoing initiatives undertaken to address Indigenous road safety issues were identified during the consultation process. Initiatives addressing general road safety, community development, licensing, alcohol, restraint wearing, and vehicle purchasing were all identified. Notwithstanding the focus on licensing programmes, there does seem to be a wide variety of road safety programmes being delivered, aimed at several different aspects of road safety and a range of population groups.

Despite the lack of formal evaluation, the consultation appeared to reveal that 'best practice' examples of road safety programmes for Indigenous Australians often involve group work and interactive learning, which may be most effective if led by a community-based road safety educator.

Positive changes in motor vehicle advertising

Title: A content analysis of Australian motor vehicle advertising

Report type: Consultant report : CR 228

Author & performing organisation: Mary Sheehan, Dale Steinhardt & Cynthia Schonfeld. Centre for Accident Research & Road Safety - Queensland

Release date: June 2006

Web link: www.atsb.gov.au/publications/2006/CR228.aspx

The 'Advertising for Motor Vehicles Voluntary Code of Practice' provides guidance to advertisers on themes and driving practices appropriate to depict in motor vehicle advertising. This project aimed to evaluate the effectiveness of the Australian Code and its subsequent revision in regulating the content of motor vehicle advertising. The study examined and compared advertisements, prior to the Code's introduction, after the Code's introduction, and after the 2004 revision.

The most encouraging result was that the occurrence of the primary themes of 'performance' and 'exciting/fun to drive', both of which have sub-themes which could be interpreted as encouraging unsafe driving, have diminished significantly since the Code was introduced. Themes relating to general driving safety were represented in a very low proportion of advertisements.

The researchers also compared the messages identified in the content analysis of a selection of advertisements with those perceived by males aged 18 to 25 by asking groups of young people to report on messages they perceived. This was assessed through showing groups of young people a sample of the advertisements that had been used in the main project, and asking them to report what messages they perceived in the advertisements

Visibility of cyclists is key safety issue

Title: Deaths of cyclists due to road crashes

Report type: ATSB research paper

Author & performing organisation: ATSB

Release date: July 2006

Web link: www.atsb.gov.au/publications/2006/death_cyclists_road.aspx

This report gives an overview of the circumstances of road crashes in which cyclists died in the period 1991 to 2005 and provides

more detail for 1996 to 2004, the latest period for which detailed data were available. It examines the incidence of helmet wearing among cyclist deaths, the major factors in fatal crashes involving cyclists and the main crash types. Age and gender distributions, day of week, time of day and speed limit at the crash site are also examined.

From 1996 to 2000, nearly one-third of all male cyclists and nearly half of male cyclists in the 10 to 19 age group killed in road crashes were not wearing a helmet. Similarly, nearly one-third of all female cyclists killed in road crashes in the period were not wearing a helmet.

The most frequently assigned major factor in fatal road crashes involving cyclists was the failure of cyclists and other road users to observe each other on the road. For cyclists, their visibility remains a key safety issue.

The most common type of crash in which cyclists were fatally injured was the cyclist being hit from behind by a motor vehicle travelling in the same lane in the same direction. Cyclists riding on rural roads are particularly at risk of being run over from behind. The next most common crash type was the cyclist riding from the footway into an intersection or onto a road and being hit by an oncoming motor vehicle.

Holiday road deaths similar to rest of year

Title: Characteristics of fatal road crashes during national holiday periods

Report type: ATSB research paper

Author & performing organisation: ATSB

Release date: July 2006

Web link: www.atsb.gov.au/publications/2006/Holiday_fatalities.aspx

The study examines annual trends in road fatality numbers for Christmas and Easter holiday periods, and undertakes a comparative analysis of crash factors between holiday periods and the remainder of the year.

Pronounced year to year fluctuations in the data suggest that the number of people killed in any given holiday period is significantly influenced by random events. An analysis of the average number of deaths per day found that fatality rates during holiday periods were not systematically higher or lower than fatality rates at other times of the year.

The study also found no evidence of any change in the involvement of primary causal factors (speeding, alcohol or fatigue). The findings are broadly consistent with the results of a similar study undertaken in 2003.

Australians see speed, drink driving, inattention and fatigue as main causes of crashes

Title: Community attitudes to road safety - community attitudes survey wave 19, 2006

Report type: Consultant report: CR 229

Author & performing organisation: Darren Pennay. Social Research Centre

Release date: December 2006

Web link: www.atsb.gov.au/publications/2006/CR229_Commuity_Attit.aspx

This report documents the findings from the ATSB's 2006 survey of community attitudes to road safety. This 19th survey in a series of national surveys on community attitudes to road safety was conducted in March and April 2006. The issues examined include: perceived causes of road crashes, exposure and attitudes to random breath testing, attitudes to speed, perceptions of police enforcement, mobile phone use while driving, reported usage of seat belts, involvement in road crashes, and experience of fatigue while driving.

The Australian community continued to nominate speed as the factor which most often leads to road crashes. The other factors most frequently mentioned were drink driving, inattention/lack of concentration, and driver fatigue. The report notes that community recognition of fatigue and inattention as important causal factors has increased markedly over the years.

The survey also identified a self-reported propensity for risk-taking behaviour among a substantial proportion of Australian motorists. For example, more than a quarter of drivers considered it acceptable to speed in certain situations, and about half admitted to using a mobile phone while driving.

ATSB Road Safety Research Grant Reports

The ATSB administers an annual road safety research grants scheme. This is a competitive scheme that provides funding for worthwhile projects initiated by external researchers. All applications are assessed against published selection criteria and grants are awarded strictly on merit. The resulting reports are published by the ATSB in the interest of disseminating road safety information.

Attitudes about speeding

Title: Beliefs and attitudes about speeding and its countermeasures

Report type: Research grant

Author & performing organisation: Julie Hatfield & R.F. Soames Job. School of Psychology, University of Sydney

Release date: May 2006

Web link: www.atsb.gov.au/publications/2006/grant_20010342.aspx

Speeding substantially reduces road safety, and despite efforts to reduce speeding it remains the norm. This research surveyed licensed drivers in metropolitan Sydney, regional NSW, and rural NSW on their attitudes, experience and behaviour in relation to speeding. A significant group of respondents reported being likely to speed 'under typical conditions in the middle of the day'.

Self-reported speeding was less likely under poor conditions and near schools, and more likely in situations where it has clear benefits and is perceived as unlikely to result in crashing or being booked. Respondents recognised that speeding poses a threat to safety, and acceptance of current speed limits and penalties for speeding was relatively high.

The research recommends that campaigns aim to identify that speeding is likely to result in crashing or being penalised, and encourage social disapproval of speeding. In particular, campaigns should address the perception that speeding can be safe under any circumstances.

Estimating performance impacts of driver fatigue

Title: Managing driver fatigue: quantifying real world performance impairment

Report type: Research grant

Author & performing organisation: Stuart D Baulk, Sarah Biggs, Cameron van den Heuvel, Kathryn Reid & Drew Dawson. Centre for Sleep Research, University of South Australia

Release date: November 2006

Web link: www.atsb.gov.au/publications/2006/grant_200601.aspx

Driver fatigue remains a major cause of road crashes worldwide. Research has demonstrated that fatigue is comparable to alcohol in terms of performance impairment and risks to road safety.

It has been well established that increased wakefulness causes driving impairment, both in simulated and on-road driving. Fatigue management systems have used simple performance tests in an attempt to quantify the risk of impairment to performance in the real world. Little is known however, about the relationship between such measures.

The primary objectives of this study were: (1) To measure the decrements in performance caused by increasing levels of fatigue using a simple test of visual reaction time (PVT) and an interactive driving simulation task; and (2) To provide a link between simple and complex measures of performance. Secondary aims were to examine the effects of fatigue on perception of performance, and to examine the effects of gender on fatigue, driving performance and perception.

Extended wakefulness caused significant decrements in PVT and driving performance, as well as subjective sleepiness and perceptions of performance. While subjective measures normalised following recovery sleep, objective performance measures did not. Results suggest that although objective measures of both simple and complex performance are clearly linked, driving simulation cannot be replaced by a simple reaction time test. Gender differences were found in PVT performance and perceptions of driving ability, with females responding more slowly, and rating their driving as worse than males.

Full frontal protection reduces injuries

Title: Crash-based evaluation of Australian Design Rule 69 (Full Frontal Impact Occupant Protection)

Report type: Research grant

Author & performing organisation: Michael Fitzharris, Brian Fildes, Stuart Newstead & David Logan. Monash University Accident Research Centre

Release date: December 2006

Web link: www.atsb.gov.au/publications/2006/Grant_Report200603.aspx

In-depth crash and injury data were used to evaluate Australian Design Rule 69 (ADR 69), Full Frontal Impact Occupant Protection, with respect to both injury risk and cost of injury for drivers of passenger cars. The effectiveness of frontal airbag deployment was also examined.

The results of this evaluation indicate reductions of 80 per cent and higher in the likelihood of sustaining Abbreviated Injury Scale (AIS) 2+ head and face injuries, with even greater gains associated with frontal driver airbag deployment. The frontal driver airbag was particularly important in reducing the probability of chest injuries. The average injury cost savings for drivers of post-ADR 69 manufactured passenger cars was found to be as high as A$19,000 depending on the body region, while the combined injury cost saving associated with head, face, neck and chest injuries combined was A$27,000 on average per driver.

The findings point the way forward for improvements in vehicle safety design for the further protection of the spine and the lower extremity in particular, where the regulation has had little impact among this sample of belted drivers. The report discusses limitations of the research and implications of the findings and provides recommendations to build on the success of ADR 69.

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