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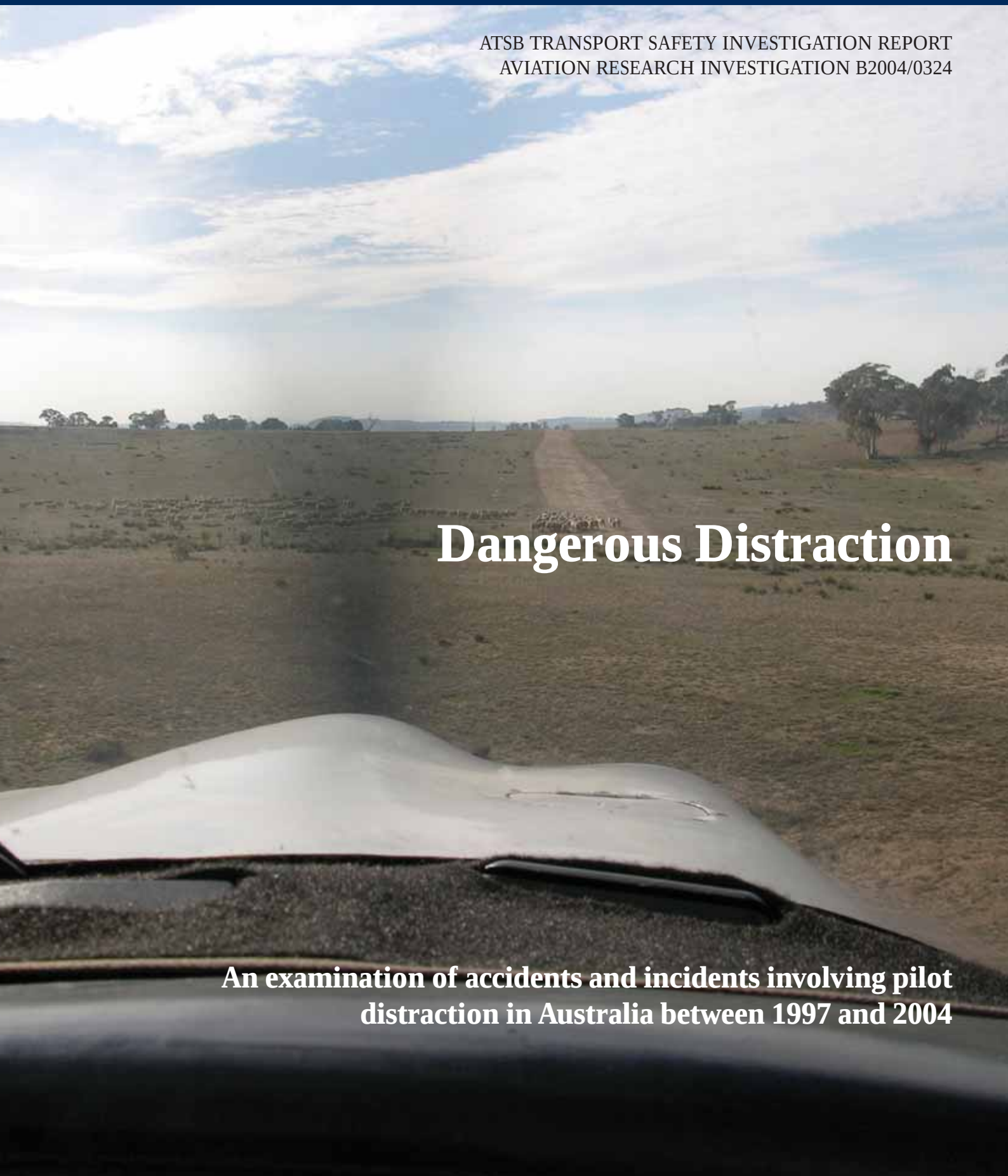
ATSB TRANSPORT SAFETY INVESTIGATION REPORT
AVIATION RESEARCH INVESTIGATION B2004/0324



Dangerous Distraction

An examination of accidents and incidents involving pilot distraction in Australia between 1997 and 2004

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Postal address: PO Box 967, Civic Square ACT 2608
Office location: 15 Mort Street, Canberra City, Australian Capital Territory
Telephone: 1800 621 372; from overseas + 61 2 6274 6590
Accident and serious incident notification: 1800 011 034 (24 hours)
Facsimile: 02 6274 6474; from overseas + 61 2 6274 6474
E-mail: atsbinfo@atsb.gov.au
Internet: www.atsb.gov.au

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ABBREVIATIONS

ALA	Aircraft Landing Area
ATC	Air Traffic Control
ATSB	Australian Transport Safety Bureau
ASRS	Aviation Safety Reporting System
CTA	Control Area
DME	Distance Measuring Equipment
FAA	Federal Aviation Administration
FL	Flight Level
FMC	Flight Management Computer
FMS	Flight Management System
GA	General Aviation
GPS	Global Positioning System
ILS	Instrument Landing System
MBZ	Mandatory Broadcast Zone
NDB	Non-Directional Beacon
NM	Nautical Miles
NHTSA	National Highway Transport Safety Administration
OCTA	Outside Controlled Airspace
PIC	Pilot in Command
RPT	Regular Public Transport
RWY	Runway
TCAS	Traffic Alert and Collision Avoidance system
VFR	Visual Flight Rules
VOR	Very High Frequency Omnidirectional Radio Range
VCA	Violation of Controlled Airspace

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Dangerous distraction: An examination of accidents and incidents involving pilot distraction in Australia between 1997 and 2004

Prepared by

Australian Transport Safety Bureau
PO Box 967, Civic Square ACT 2608 Australia
www.atsb.gov.au

Abstract

An examination of the Australian Transport Safety Bureau's aviation occurrence database indicates that distraction has contributed to a number of aviation safety accidents and incidents. The purpose of this study was to (i) examine the characteristics of pilot distraction (ii) explore the range of distraction sources that have contributed to aviation safety occurrences, and (iii) develop a taxonomy of pilot distraction. In total, 325 occurrences were identified using the database. 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 a pilot operating in any type of organisation, from small regional operations 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.

1 EXECUTIVE SUMMARY

An examination of the Australian Transport Safety Bureau's aviation occurrence database indicates that distraction has contributed to a number of aviation safety accidents and incidents. Initial figures show that over the period between 1997 and 2004 there have been over 500 occurrences attributed to distraction, with the majority involving pilot distraction. Without further analysis, the specific details on the types of situations in which distractions occur and the sources that trigger pilots to become distracted remain unclear. The purpose of this study was to (i) examine the characteristics of pilot distraction (ii) explore the range of distraction sources that have contributed to aviation safety occurrences, and (iii) develop a taxonomy of pilot distraction.

The analysis consisted of two phases. The first phase involved an examination of all distraction-related occurrences involving Australian registered civil aircraft between 1997 and 2004. In total, 325 occurrences were identified using the ATSB database. The results showed that the majority of occurrences were incidents rather than accidents or serious incidents. Furthermore, 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.

The second phase of the analysis involved an in-depth investigation into the sources of distraction. To do this, the narratives from the initial notification report and investigation file for each occurrence involving pilot distraction were individually analysed. For 237 occurrences, 247 sources were identified – indicative of multiple distractors. Each source was then entered into a separate dataset, coded and thematically grouped. The findings revealed that the majority of sources were associated with equipment malfunctions, problems communicating on the radio, passengers, and weather.

To provide a framework for categorising the range of distraction sources identified in the thematic analysis, a taxonomy was developed. This involved revising and re-grouping the 29 themes identified in the thematic analysis into several broad categories. Each category was then divided into sub-categories to capture the key sources of distraction identified in the analysis. The taxonomy was applied to the dataset and revised. The result was a two-tiered taxonomy that consisted of nine major categories and associated sub-categories. When re-applied to the dataset, the results indicated that the majority of distraction sources could be grouped into categories of 'flight management tasks', 'external objects', and 'people on board the aircraft'.

The findings of the study provide insights into the characteristics of pilot distraction. The study identifies the potential sources of pilot distraction and the situations in which distractions can arise. The study also demonstrates how distractions can negatively impact on pilot performance. In summary, the findings indicate that distractions can affect a pilot operating in any type of organisation, from small regional operations to large commercial airlines. Distractions can arise unexpectedly, during periods of high or low workload, or during any phase of the flight. In essence, no pilot is immune to distraction.

In recognition of the potential for distractions to reduce flight safety, the study proposes that airline operators and pilots would benefit from a system of distraction management. As a first step, the following suggestions for minimising the risk of distraction are proposed:

- Pilots should exercise discretion in engaging in conversation with other people on board the aircraft, particularly during pre-flight checks and critical phases of flight.
- If commercially viable, commercial general aviation pilots should consider leaving the right front seat vacant to minimise conversation with passengers.
- In the event of an equipment malfunction or abnormal situation, the pilot-in-command and co-pilot should be assigned specific responsibilities to ensure that at least one pilot continues to monitor and control the aircraft.
- Pilots may consider deferring ancillary tasks (e.g. paperwork) to low-workload phases of flight, but be aware that distractions can also occur when monitoring or conducting routine tasks.
- Flight attendants should be reminded during pre-flight briefings of the 'sterile cockpit rule' and to refrain from interrupting any flight deck activity until the crew indicates that they have completed their task.
- In accordance with previous research, operators may want to consider minimising the number of procedural items that can be performed at an undefined time during a phase of flight (Loukopoulos, Dismukes, & Barshi, 2003).
- Where possible, operating procedures that require tasks to be conducted concurrently should be replaced with procedures that require tasks to be conducted sequentially.
- If a checklist is interrupted, pilots should consider returning to the beginning of the checklist to reduce the potential for error.
- Simulator training should incorporate scenarios that require pilots to manage distractions, interruptions and concurrent tasks.

In conclusion, the study acknowledges that any development of a system to manage flight crew distraction will be limited by a lack of quantitative research in this area. It is therefore considered that further research on pilot distraction would be beneficial.

2 INTRODUCTION

2.1 Objectives of the study

The aim of the Australian Transport Safety Bureau (ATSB) is 'Safe Transport'. As part of its mission to improve transport safety, the ATSB investigates aircraft accidents and incidents in order to identify the factors that contributed to an occurrence. This process enables the ATSB to identify the factors that can reduce the likelihood of similar occurrences in the future. As part of its work, the ATSB maintains a database of aviation safety occurrences. This includes occurrences in Australia and overseas involving Australian-registered civil aircraft, and occurrences in Australia involving foreign-registered aircraft[1].

A preliminary examination of the ATSB's aviation occurrence database indicates that distraction has contributed to a substantial number of aviation safety occurrences. Between 1997 and 2004 there have been over 500 occurrences in which distraction has been identified as a contributing factor. The majority of these occurrences have involved pilot distraction. The purpose of this study was to undertake a comprehensive examination of the database to determine the types of situations in which distractions occur and the sources that trigger pilots to become distracted. Specifically, the objectives of the study were to:

- examine the characteristics of pilot distraction occurrences in Australia between 1997 – 2004;
- explore the range of distraction sources that have contributed to aviation safety occurrences; and
- develop a taxonomy of pilot distraction.

2.2 Background to the study

An ATSB study on distraction issues was suggested by Mr Graeme Johnstone, the State Coroner for Victoria, Australia. In February 2003, Mr Johnstone wrote to the ATSB to express his concern that aviation accidents may be broadly related to sightseeing and the use of videos or cameras. By way of example, Mr Johnstone referred to a fatal sky diving accident that occurred in the late 1980s, where the sky diver had been distracted by a video-camera (Case No. 3985/89).

Mr Johnstone also referred to an accident that occurred in Gisborne in 1999, where the pilot and all three passengers were fatally injured. According to the coronial findings, one of the factors contributing to the death of the pilot was "pilot attention either drawn away from or divided between flying the aircraft and looking at the ground" (Case No. 3649/99).

Mr Johnstone's initial concern about the role of distraction in aviation accidents has been substantiated by a more recent coronial finding into the death of a pilot conducting a private sightseeing flight in a Piper PA-28R-200 Arrow in 2004. The

[1] International Civil Aviation Organization Annex 13 chapter 8 recommends that accident and incident data be analysed. This study was conducted in accordance with this recommendation, under the Transport Safety Act 2003.

pilot was flying over Lake Eildon in Victoria with three passengers onboard when the aircraft struck a power cable about 133 feet over the lake. The impact forces of the wirestrike and the subsequent impact with the water destroyed the aircraft and killed all four occupants on board. There was no evidence to suggest that environmental, mechanical or operational factors may have contributed to the accident (ATSB, 2003b). However, film from a video-camera retrieved from the wreckage depicted the aircraft flying at a low level over the lake with the front seat passenger filming houseboats. According to the coronial finding, this may have accounted for pilot distraction and may explain why the pilot descended the aircraft to an unsafe height (Case No.517/04).

The dangers associated with distraction in the Australian transport industry have not gone unnoticed by the ATSB. In a recent publication on road safety in Australia (ATSB, 2004c), the ATSB discussed the safety risks associated with driver distraction. A number of distraction sources were identified, including smoking, conversing with passengers, adjusting the controls of audio equipment, and mobile phones. The publication also referred to an incident in which a 20-year old university student was distracted by attempting to swat a fly. She survived the crash, but her four friends who were travelling in the vehicle were killed.

The problem of distraction has also been identified in marine operations. In 2000 the ATSB released a marine safety investigation report into the grounding of a Malaysian flag container ship on Sudbury Reef, Great Barrier Reef (ATSB, 2000). The ship had sailed from Singapore and was bound for Sydney when it entered a restricted area and struck the reef. The ship's hull remained intact, but the grounding resulted in damage to the reef. The investigation found that the significant unsafe act that resulted in the grounding was the inattention of the mate on watch aboard the ship, who was distracted by his wife's telephone call to their family overseas.

Distraction has also been identified as a contributing factor to a rail accident which occurred in 2003 (ATSB, 2003a). The accident involved a freight train, which derailed close to the town of Chilton in Victoria. About four minutes later, a passenger train collided with the wreckage of the derailed train. Although no serious injuries were reported by either train crew or passengers, the derailed train and two carriages of the passenger train were significantly damaged. According to the investigation report, initial notification of the derailment was delayed at the train control station because the train controller was distracted by a non-essential incoming call.

Also in 2003, the ATSB was involved in the investigation of a major aviation accident involving pilot distraction. The accident occurred when an Ilyushin aircraft impacted the ground on approach to land at Bacau Airport in East Timor (ATSB, 2004b). The aircraft was destroyed by impact forces and a severe post-impact fire, leaving a trail of wreckage 400 meters long. All six occupants, including four Russian flight crew and two loadmasters, were fatally injured.

During the course of the investigation, it became evident that the flight engineer had misunderstood the pilot-in-command's use of the word 'increased'. The engineer had incorrectly interpreted the word to mean increased in relation to an instruction to increase engine thrust, rather than in relation to the pilot in command's previous action of increasing the rate of descent. The engineer subsequently responded by increasing engine thrust. The investigation found that this incorrect action would have been a significant distraction to the pilot-in-command, such that it probably diverted his attention from the primary task of flying the aircraft. It was therefore concluded that distraction was one of the contributing factors to the accident.

More recently, the ATSB conducted an investigation into an incident involving a Boeing 737-800, which was on a scheduled passenger flight from Perth to Canberra (ATSB, 2004a). Throughout the flight the crew were experiencing uncomfortably hot conditions in the cockpit due to a fault with the air conditioning system. On descent into Canberra, the crew received an alert from the aircraft's enhanced ground proximity warning system indicating that the aircraft was descending below the minimum sector altitude. It is possible that the excessive temperature and the crew's preoccupation with fixing the air conditioning system may have diverted their attention away from monitoring the position of the aircraft.

There have been other occurrences in which aviation investigators have suspected that distraction has contributed to an accident. The causal relationship, however, has often been difficult to establish during the investigation process. Particularly in circumstances when the pilot has been fatally injured, it has been impossible for investigators to accurately determine the relationship between the unsafe act which led to the accident and the pilot's state of distraction. Due to this limitation, it is likely that the number of fatal accidents involving pilot distraction is higher than the number identified by the ATSB. It is also due to this limitation that the most accurate source of information on pilot distraction is drawn from accidents and incidents where the pilot has survived to tell the story.

2.3 Definition of distraction

'Distraction' is defined in the Macquarie dictionary as the act of distracting, drawing away or diverting, an action that divides attention (Macquarie, 2003). In accordance with this, pilot distraction may be broadly defined as a process, condition or activity that takes a pilot's attention away from the task of flying. It may therefore be surmised that an effect of pilot distraction is the interruption of pilot control. Importantly though, this definition should also be conceptualised within the context of attention.

Attention is conceived as a focusing response to a stimulus or task that reflects a state of arousal or concentration (Berlyne, 1993). Studies indicate that attention paid to a particular stimulus or task generally occurs in the context of competition among multiple stimuli or tasks for limited processing capacity (Broadbent, 1953; Kahneman, 1973). Multiple stimuli or tasks that make simultaneous demands on an individual's central processing mechanism will tend to interfere with each other. Should one or more of these competing stimuli or tasks be of sufficient magnitude to interfere with or divert attention from the original focus of attention, then the individual becomes distracted (Nelson, Duncan, & Kiecker, 1993).

It is within the context of attention that the process of distraction occurs. According to Nelson et al. (1993) this involves (i) a primary task (ii) a secondary or distracting stimulus or task (i.e. distractor) and (iii) the diversion of attention in response to the secondary task. Secondary tasks may be initiated either by physiological or psychological phenomena internal to the individual or by an external task or stimulus. Within the aviation environment, there are many secondary tasks that can divert the pilot's attention from a primary task. Some may be events or issues that must be attended to, whereas others may only be simple stimuli that require no immediate action. Even a momentary deflection from ongoing activities can have the potential to interrupt the primary task and adversely affect future performance (Latorella, 1999).

Distraction should also be conceived in relation to sensory modalities. Studies have shown that vision, hearing and touch sensors are unable to ignore sudden and unexpected changes in stimulus, irrespective of their significance to the original task. In one study, air traffic controllers could not resist looking at radar images of aircraft that formed gestalts on the screen (Landry, Sheridan, & Yufik, 2001). This is despite the aircraft being irrelevant to the task, as indicated by their location on the screen. Conversely, other studies have shown that expected and relevant stimuli can be ignored (Sheridan, 2004). Together, these findings suggest that humans do not have total control over their sensory system, despite virtue of intent.

2.4 Driver distraction

A substantial amount of scientific research on distraction stems from research on automobile driver distraction. A review of the Australian National Coroners Information System (NCIS) has highlighted the relationship between distraction and road accidents (NCIS, 2005). Between July 2000 and May 2005, there were 51 accidents where the driver was confirmed or suspected to have been distracted. In the identified accidents, a total of 61 individuals lost their lives.

The review of the NCIS identified a range of sources that distracted drivers. The most common source was talking on the phone (n = 14), sending/receiving SMS (n = 8), and passengers (n = 5). Other sources included weather (e.g. sun in eyes, lightening, heat, and fog), other vehicles, and eating/drinking.

Of particular relevance to this study are the different types of distractions that have been identified in driver research. Among the main types referred to by the National Highway Transport Safety Administration (NHTSA) are:

- **Visual distraction** – e.g. looking away from the road.
- **Auditory distraction** – e.g. responding to a mobile phone.
- **Biomechanical (physical) distraction** – e.g. visually searching for a control to manipulate.
- **Cognitive distraction** – e.g. being 'lost in thought'.

It is proposed that these four distraction types may provide a useful framework for examining pilot distraction. When applying this framework, however, it is important to note that each type is not mutually exclusive. During flight, for example, answering a call on the cockpit-cabin interphone system may involve all forms of distraction, including:

- visual distraction caused by looking at the indicator light;
- auditory distraction caused by the sound of the chime;
- biomechanical distraction caused by picking up the handset; and
- cognitive distraction caused by focusing on the topic of conversation.

2.5 Previous studies on pilot distraction

Dealing with distractions is a normal part of everyday flying. Pilots generally respond to distractions quickly and efficiently, interspersing novel events with habitual, well-practiced sequences of actions. As a result, the impact of distraction on performance and aviation safety generally goes unnoticed. However, a review of

related empirical and scientific literature clearly indicates that pilots are vulnerable to distraction-related errors. Moreover, the literature reveals that the types of situations in which these errors arise are often complex and very diverse.

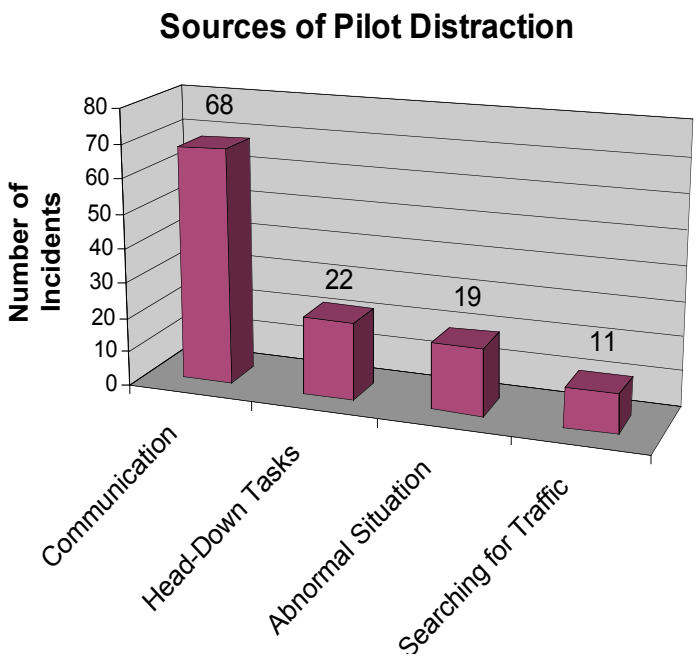
In 1978, the NASA-Ames Research Centre examined more than 2000 Aviation Safety Reporting System (ASRS) reports involving incidents of distraction in air carrier operations. The findings indicated that even simple events and activities can result in pilot distraction (Monan, 1978). In addition, the findings showed that pilots were interrupted by distractions associated with (i) non-operational activities, such as public address announcements, paperwork, and social conversation, and (ii) operational tasks, such as completing checklists, air traffic control (ATC) communications, and radar monitoring. From these findings, it is evident that distractions can occur indiscriminately in regard to hands-on flying activities and non-operational activities that occur during the course of flying.

In a subsequent study, Monan (1992) examined 140 Aviation Safety Reporting System (ASRS) reports to determine the causes of runway incursions. The examination revealed that 23 incidents involved a breakdown of attention management by the pilot due to distraction. Often the distraction was caused by a flight attendant entering the cockpit or a head-down task associated with programming the Flight Management System (FMS). The sources of distraction were ranked in order of most to least distracting as follows:

1. Checklists
2. Passenger announcements
3. Company radio calls
4. Miscellaneous (system malfunction, putting away manuals, etc)
5. Flight attendant entering the cockpit
6. Conversation
7. FMS programming

More recently, Dismukes, Young, and Sumwalt (1998) examined 107 ASRS reports in which flight crew paid inadequate attention to one task while performing another task. The examination revealed a wide range of activities that distracted or preoccupied the pilots. Ninety per cent of these activities were categorised into four different groups: (i) communication, including discussion among crew or radio communication; (ii) head-down tasks, such as programming the FMS or reviewing approach charts; (iii) responding to abnormal situations; and (iv) searching or responding to visual traffic (see Figure 1). Of these, the most common types of error were associated with communicating with other crew or communicating over the radio.

Figure 1. The main sources of pilot distraction. The sources were identified from an analysis of ASRS reports involving concurrent tasks. Source: Dismukes et al. (1998).



Further examination of the ASRS database revealed that distraction had a significant impact on performance. The results showed that there were 21 different types of routine tasks that flight crew neglected at a critical moment while attending to another task. Of these, 69 per cent involved the failure to monitor the current status of the aircraft, the position of the aircraft, or the actions of the pilot. According to Dismukes et al. (2003), the large percentage of lapses in monitoring may be indicative of the high amount of monitoring required in cockpit operations. The authors postulated that monitoring may be particularly vulnerable to distraction because it involves vigilance, from which attention is readily diverted when more salient and engaging task demands arise.

More recently, distractions were identified by the Federal Aviation Administration (FAA) as a significant contributing factor to checklist errors (FAA, 1995). During a review of 300 randomly selected ASRS incident reports, the FAA identified 61 occurrences of failure to monitor and cross check flight deck activity, misuse or failure to use checklists, and missed or overlooked items on the checklist following distraction or interruption. Analysis of the reports revealed that a high number of occurrences occurred when the crew were nearing the end of the work day or were rushing to meet a scheduled departure time.

In summary, a review of the literature found that there are only a few studies on pilot distraction. However, there were a number of key points that emerged from the literature:

- pilots are vulnerable to distraction;
- the sources of pilot distraction are diverse;
- distractions stem from a range of operational and non-operational tasks; and
- distractions can result in performance errors during both critical and non-critical phases of flight.

These findings are derived solely from studies conducted in the United States. There has been no extensive examination of aviation occurrences involving pilot distraction in Australia. Consequently, the extent of the problem in the Australian aviation industry has not been well understood. This exploratory investigation of pilot distraction aims to provide a better understanding of the issues in the Australian context.

3 METHODOLOGY

3.1 Analysis of the occurrence database

The study focussed on pilot distraction in regular public transport (RPT) operations and general aviation (GA) operations involving Australian-registered civil aviation aircraft between January 1997 and September 2004. GA operations involved registered powered aircraft such as aeroplanes and helicopters conducting private, charter operations or aerial work (e.g. aerial surveying, aerial photography or fire spotting) (see Appendix A). Operations involving military aircraft or gliders were excluded from the dataset.

Accidents or incidents associated with pilot distraction were identified using the ATSB aviation occurrence database. To do this, a search query was conducted for the field that contained the words 'distracting event/interruptions'. This resulted in a sample size of 325, which was examined according to the following factors:

- **Type of occurrence** – whether the occurrence was classified as an accident, serious incident or incident by the ATSB (see Appendix A).
- **Level of injury** – the level of personal injury (i.e. fatal, serious, minor, none) sustained by the crew members and/or passengers of the aircraft (see Appendix A).
- **Type of operation** – the type of operation that the pilot was conducting at the time of the distraction (i.e. flying training, charter, RPT etc) (see Appendix A).
- **Outcome** – the first real or potentially unsafe event that occurred as a result of the distraction.
- **Phase of flight** – the phase of flight when the outcome of the distraction occurred. It encompasses both ground and in-flight phases.

For 237 occurrences in the sample, it was possible to extract further information about the sources of the distraction. This information was derived from an individual examination of the narratives from the initial notification report informing the ATSB of the occurrence and the subsequent investigation report. The distraction sources were then individually coded and classified according to various themes that emerged during the process of data acquisition. For each thematic group, the contexts in which the distractions occurred were explored and any further trends in the data were identified. The thematic analysis provided the basis on which the taxonomy of pilot distraction was subsequently developed (see Section 6).

3.2 Methodological limitations

A number of methodological limitations should be considered when interpreting the results of the study. This includes the problem of subjectivity in regard to the factors that constituted pilot distraction. Without an objective definition, these factors were susceptible to interpretation by those reporting the accident/incident to the ATSB and those entering the details of the subsequent investigation into the aviation database. As a result, it was difficult to achieve a high level of reliability when coding the data.

In addition, it was not possible to conduct an exhaustive examination of all occurrences involving pilot distraction using the aviation database. Often the status

of the pilot's attention was unknown, particularly in accidents where the pilot sustained fatal injuries. The majority of occurrences in the database were therefore based on the recollections of surviving pilots. Due to this bias, the majority of occurrences examined in this study were incidents rather than accidents. This bias is likely to be reflected in the low number of fatal accidents identified in the analysis (see Section 4.2).

4 OCCURRENCES INVOLVING PILOT DISTRACTION

4.1 Type of occurrence

The study found that pilot distraction contributed to 325 occurrences involving Australian-registered aircraft between 1997 and 2004. As shown in Table 1, the majority of occurrences were incidents (n = 258) rather than serious incidents (n = 2) or accidents (n = 65). The highest number of incidents reported to the ATSB was in 2001.

Table 1. Number of occurrences involving pilot distraction between 1997 and 2004.

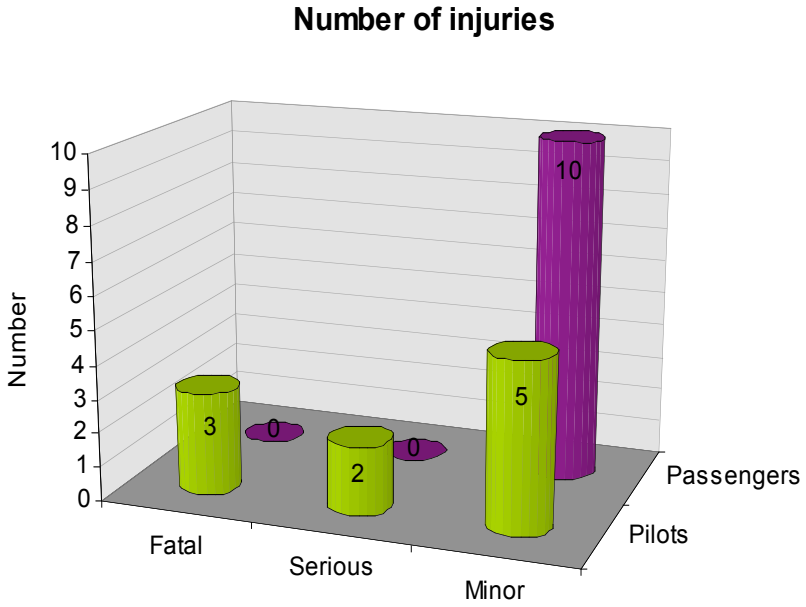
Occurrence Type	1997	1998	1999	2000	2001	2002	2003	2004	Total
Accident	10	9	8	3	16	10	7	2	65
Serious Incident	0	0	0	1	0	0	1	0	2
Incident	1	12	41	61	58	49	25	11	258
Total	**11**	**21**	**49**	**65**	**74**	**59**	**33**	**13**	**325**

The number of fatal accidents associated with distraction is relatively low (n = 2). This may be due to the difficulties encountered by investigators in determining whether distraction contributed to an accident in which the pilot was fatally injured. It is therefore likely that the number of fatal accidents involving distraction is higher than shown.

4.2 Level of injury

A total of 316 occurrences resulted in nil fatalities to the pilot, other crew members, or passengers. Of the remaining occurrences, two involved fatal injuries, two involved serious injuries, and five involved minor injuries (see Appendix A). As shown in Figure 2, all fatal injuries were sustained by pilots (n = 3).

Figure 2. The number of injuries sustained by pilots and passengers.

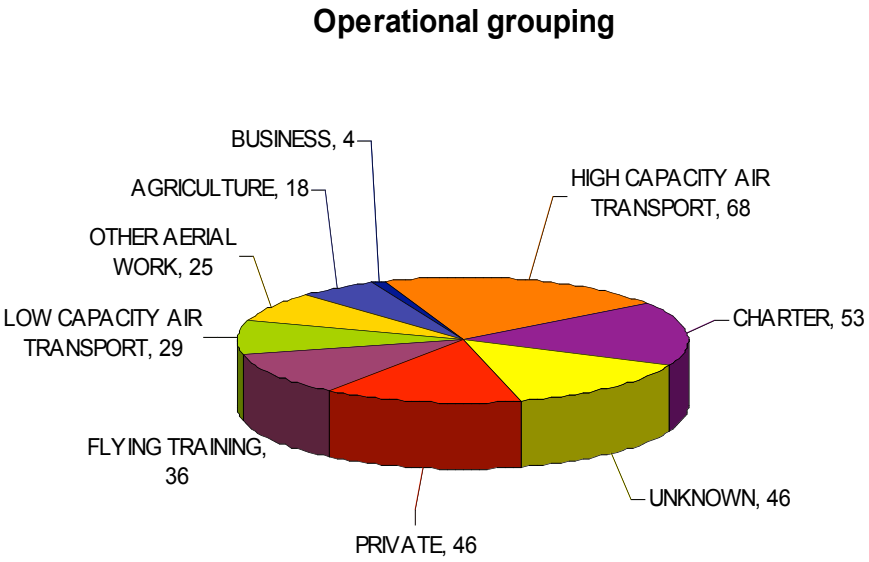


Among the fatal injuries was an accident involving a Piper Aztec which impacted with the ground. According to the investigation report, it was likely that the aircraft descended to the ground after the pilot became distracted shortly after takeoff. Due to the absence of surviving witnesses, it was not possible to determine the distraction source (ATSB Occurrence No. 199702473).

4.3 Type of operation

Figure 3 shows the number of occurrences involving pilot distraction grouped by type of operation. The largest category of occurrences was associated with pilots operating high capacity air transport aircraft (n = 68). The remaining 257 occurrences involved a range of different operational groups, including those undertaking charter, private, and flying training operations.

Figure 3. The number of distraction occurrences by type of operation



Examination of the investigation narratives for the flying training group revealed that flying instructors often became distracted by their students. One incident involved two light aircraft – a Robin, in which an instructor and his student were conducting dual circuits in a light aircraft, and a Partenavia that was about to take off. Although the instructor was conscious that the Partenavia would be flying in the same circuit area, his attention was focussed on guiding the control movements of his student. It was not until he saw the Partenavia approximately 50 metres away that his focus returned to the and he immediately took evasive action (ATSB Occurrence No. 200401490).

4.4 Outcome of the distraction

There was a wide range of outcomes (i.e. first real or potentially unsafe event) that were directly attributed to the distracting event. As shown in Table 2, the majority of outcomes were classified as potential outcomes (n = 184) rather than actual outcomes (n = 141).

Table 2. Actual and potential outcomes attributed to pilot distraction.

	OUTCOME	FREQUENCY	PERCENTAGE
ACTUAL	Altitude bust	3	0.9
	Collision with foliage/tree	10	3.1
	Collision with ground	21	6.4
	Collision with miscellaneous man-made feature	41	12.6
	Collision with powerline	17	5.2
	Collision with stationary aircraft	4	1.2
	Collision with water	4	1.2
	Door or window problem	5	1.5
	Engine malfunction	1	0.3
	Fire, explosion or fumes	2	0.6
	Flight control/surface problem	3	0.9
	Fuel system failure	2	0.6
	Hard landing	2	0.6
	Instrument failure	4	1.2
	Landing gear problem	12	3.7
	Propeller/rotor malfunction	1	0.3
	Runway incursion	1	0.3
	VCA	8	2.5
	Total	**141**	**43.3**[a]
POTENTIAL	Potential collision with aircraft in controlled airspace	127	39.0
	Potential collision with aircraft moving on the ground	27	8.3
	Potential collision with aircraft OCTA	7	2.2
	Potential collision with ground	10	3.1
	Potential collision with stationary aircraft	1	0.3
	Potential collision with vehicle/movable equipment	2	0.6
	Potential engine malfunction	4	1.2
	Potential flight/surface problem	4	1.2
	Potential fuel system failure	2	0.6

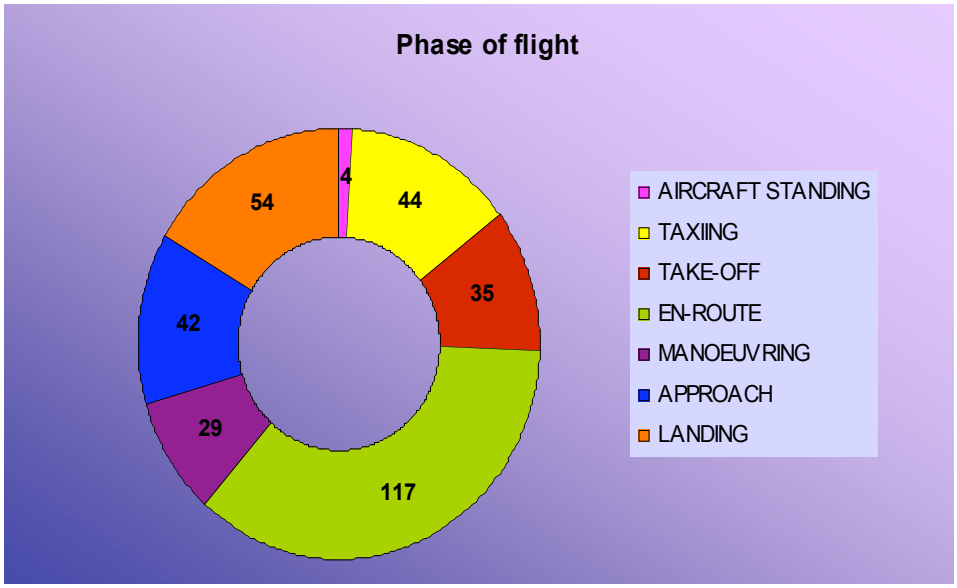
Further examination of the actual outcomes indicated that 41 pilots had collided with a miscellaneous man-made feature. These included a variety of objects, such as a localiser antenna, taxiway marker, fuel drums, fence posts, poles and pylons. In one incident, a float plane collided with a pylon while water taxiing at slow speed. The collision was attributed to the pilot being distracted by a foggy windscreen and his preoccupation with wiping it clear.

4.5 Phase of flight

From the aviation database it was not possible to determine the exact time of flight when the actual distraction occurred. However, some indication of timing may be determined from when the distraction-related outcome took place, since all distractions occurred prior to the outcome.

Figure 4 shows the number of occurrences that took place during a particular phase of flight. The majority of outcomes occurred en route (n = 117) or during the landing (n = 54) phase. The outcomes that occurred during taxiing (n = 44) were equally distributed between taxing prior to take off and taxiing after landing.

Figure 4. The phase of flight when the distraction-related outcome occurred.



Further examination of the data indicated that a high proportion of outcomes that occurred en route (n = 28) or during approach (n = 20) were associated with high capacity air transport operations (Table 3). In addition, a high proportion of outcomes that occurred during the manoeuvring phase were associated predominantly with agricultural operations (n = 17).

Table 3. The number of distraction-related outcomes for phase of flight by operational group.

	AIRCRAFT STANDING	TAXIING	TAKE-OFF	EN ROUTE	MANOEUV-RING	APPROACH	LANDING
High Capacity	0	7	9	28	0	20	4
Low Capacity	0	5	4	13	1	5	1
Private	1	8	6	6	0	4	21
Business	0	1	0	2	1	0	0
Charter	1	10	9	15	0	2	16
Flying Training	1	4	4	12	2	6	7
Agriculture	0	0	0	0	17	0	1
Other Aerial Work	1	2	2	9	7	2	2
Private	1	8	6	6	0	4	21
Unknown	0	7	1	32	1	3	2

Among the high capacity air transport occurrences that occurred en route was the following incident that involved a visual distraction.

> The co-pilot was manually flying the departure and the aircraft was to maintain 5,000 ft. The requirement to maintain an airspeed in the climb was cancelled. The pilot in command placed his hand on the speed control knob when the aircraft was approaching 5,000 ft, with the intention of increasing the commanded speed as soon as the altitude was captured by the flight director. This action distracted the co-pilot and the aircraft climbed to 5,200 ft before returning to the cleared altitude.
>
> ATSB Occurrence No: 199900480

Although the increase in altitude did not result in a breakdown in separation, the investigator concluded that there was potential for a worse outcome. Importantly, this incident demonstrates how a momentary distraction during a normal climb to cruise can jeopardise flight safety.

5 PILOT DISTRACTION

5.1 Sources of distraction

Individual examination of the investigation narratives and reports between 1997 and 2004 provided further information on the source of pilot distraction for 234 occurrences in the database. Most occurrences in this sub-sample involved a single distractor. There were, however, some occurrences that involved two or more distraction sources. Therefore the number of distractions identified in the original dataset was slightly higher (n = 247) than the number of actual occurrences. A complete list of distraction sources is presented in Appendix B.

5.2 Sources grouped by themes

The pilot distractions were grouped into 29 different themes that were identified during the process of data acquisition. As shown in Table 4, the majority of pilot distractions were grouped under the theme of 'equipment problems' (n = 33). This was followed by distractions associated with 'radio communication problems' (n = 19), 'passengers' (n = 18), and 'weather' (n = 18).

The following section undertakes a more detailed examination of the types of distractions that were grouped under each theme. The aviation database provided additional information in terms of the operational groups that could be identified from the database, the number and type of injuries sustained, and the outcome of the distraction (see 3.1). Where appropriate, extracts from the investigation reports are provided throughout the analyses to demonstrate the types of situations in which distractions have occurred.

Table 4. Frequency and percentage of distractions grouped by themes.

	DISTRACTION THEMES	FREQUENCY	PERCENT
1	AGRICULTURAL TASKS	6	2.4
2	AIR TRAFFIC CONTROL	12	4.9
3	ANIMALS ON RUNWAY	6	2.4
4	APPROACH	4	1.6
5	CHECKLISTS	4	1.6
6	COMPANY RADIO	5	2.0
7	EQUIPMENT PROBLEMS	33	13.4
8	FLIGHT ATTENDANT	4	1.6
9	FLIGHT CREW	7	2.8
10	GROUND PERSONNEL	2	0.8
11	HEALTH CONCERNS	1	0.4
12	MOBILE PHONE	4	1.6
13	MONITORING INSTRUMENTS/DISPLAYS	6	2.4
14	OBJECT/PERSON ON GROUND	11	4.5
15	PAPERWORK	6	2.4
16	PASSENGER	18	7.3
17	PERFORMANCE CONCERNS	4	1.6
18	PERSONAL ISSUES	1	0.4
19	PILOT TRAINING	10	4.0
20	POOR VISIBILITY	7	2.8
21	RADIO COMMUNICATION PROBLEMS	19	7.7
22	SAFETY CONCERN	6	2.4
23	SYSTEM PROGRAMMING	10	4.0
24	TAXIING/PARKING	10	4.0
25	TIME PRESSURES	6	2.4
26	TRACKING	2	0.8
27	TRAFFIC	13	5.3
28	WEATHER	18	7.3

5.2.1 Agricultural tasks

The theme ‘agricultural tasks’ referred to any type of operation in which the pilot was distracted by performing an agricultural task. There were six distractions associated with agricultural tasks. Of these, five occurred during manoeuvring operations and one when the aircraft was standing. All occurrences involved a collision, either with the ground (n = 3), a powerline (n = 2), or water (n = 1). Minor injuries were sustained in two of the occurrences.

The types of agricultural tasks that distracted pilots included adjusting a broken water pump ground unit, checking chemical levels for a swath run, adjusting spray pressure, and moving stranded stock to dry ground. As demonstrated by the following extract, the pilot does not always have to be inside the aircraft for an accident to happen.

> After landing the helicopter and with the engine and rotors still running, the pilot alighted to close a gate after yarding cattle.

> While still absent from the controls he heard the engine RPM begin to rise and the helicopter became airborne, rolled to the right and crashed into the ground sustaining substantial damage. The pilot later reported that he may not have applied the collective friction nut firmly enough or that it may have vibrated loose. He also advised that he had become pre-occupied with closing the gate to prevent the cattle from escaping.
>
> ATSB Occurrence No: 200101172

5.2.2 Air traffic control

'Air traffic control' (ATC) distractions involved the loss of pilot attention due to interaction with air traffic control. There were 12 distractions identified under this theme. Of these, half were associated with high capacity air transport operations. Almost all resulted in a potential collision with another aircraft (n = 10), either on the ground or in controlled airspace. Other outcomes of the distraction included a landing gear problem and a flight control/surface problem. Nil injuries were reported.

The majority of distractions were associated with communicating with air traffic controllers (n = 10). The remaining two distractions included a change in ATC frequency and confusion over an ATC clearance. The extract below demonstrates how a charter pilot was disrupted by ATC communications during approach to land.

> At 5 NM on final approach to runway 23, the pilot commenced the pre-landing checks but without extending the landing gear as he intended to do this further in. However, he was distracted due to radio communications for separation purposes with an incoming BAe-146 aircraft and failed to lower the landing gear. This resulted in the aircraft making a wheels-up landing. The aircraft sustained substantial damage to the lower fuselage, propeller and engine but the pilot was unharmed.
>
> ASB Occurrence No: 200105192

5.2.3 Animals on runway

There were six distractions associated with the theme 'animals on runway'. All distractions resulted in a collision. This included collisions with miscellaneous man-made features (including a fence and runway marker cone), the ground, and foliage and trees. Nil injuries were identified in the sample.

Pilots were predominantly distracted by wallabies or kangaroos crossing the runway. Other distractions included livestock crossing the air strip and, as demonstrated in the following example, a dead rabbit on the runway. Importantly, this example also demonstrates how a single visual distraction can result in severe structural damage to a single engine light aircraft.

> The aircraft departed Alice Springs for Ti Tree on a night VFR training flight. Circuits were conducted at the Ti Tree ALA.

> During the take-off roll on the last circuit, at the point of transferring to instruments on lift-off, the pilot under supervision was momentarily distracted by a dead rabbit on the runway. The aircraft deviated to the left slightly and the left wheel touched a runway marker cone at the lift-off point. A very soft bump was heard. During a pre-flight inspection the following afternoon a dent in the leading edge of the left stabilator was noticed. The damage was most likely caused by the runway cone, dislodged by the port wheel, being picked up by the slipstream of the aircraft and contacting the stabilator. No damage was sustained by the landing gear.
>
> ATSB Occurrence No: 199801708

5.2.4 Approach

'Approach' distractions referred to distractions in which the pilot became preoccupied with conducting the approach. Four distractions were grouped under this theme. Of these, two were associated with high capacity air transport operations, one with private operations, and one with flying training operations. Two of the distractions contributed to a wheels-up landing. There were no injuries reported.

All of the distractions involved thoughts about the approach, and were therefore indicative of a cognitive distraction (see Section 2.4). For two occurrences, the distractions stemmed from thoughts concerning a particular aspect that may affect the approach. This included notification from ATC of a change of approach and the requirement to conduct a 'non-normal' approach at 10 000 feet. The extract below is another example, where the pilot became so preoccupied with a practice glide approach that he forgot to conduct his down-wind checks. The result was a wheels-up landing.

> At 3500' above the circuit area I cut the throttle and trimmed for a glide. The radio broadcasts and a visual scan indicated that the circuit would be empty by the time I came down. I had difficulty establishing a steady glide possibly due to unstable air, and made numerous trim adjustments while trying to judge the descent to my selected 1000' area. Being somewhat 'rusty' on glide approaches, this began to occupy me more and more. Descending into the down-wind near a close-in base position, I broadcast a 'base' call and continued the glide - concerned that it now appeared that I would under-shoot. The wind was not steady. On mid-final I decided to abort the glide and power in - unaware that I'd completely forgotten about the down-wind checks.
>
> ATSB Occurrence No: 200300021

5.2.5 Checklists

There were four distractions associated with checklists. The sample included both pre-takeoff checks (n = 3) and landing checks (n = 1). All known operational groups were identified as charter (n = 3). The outcome of the distractions included two landing gear problems, a collision with a stationary aircraft, and a potential collision with an aircraft moving on the ground. No injuries were identified in the sample.

Examination of the narratives suggests that checklist distractions generally resulted in a failure to maintain an adequate lookout. In one occurrence, preoccupation with landing checks resulted in the aircraft drifting off the runway and suffering a landing gear collapse. In another instance, preoccupation with before take-off checks resulted in an aircraft's right wingtip colliding with the rudder of a stationary aircraft. Evidence of inadequate lookout suggests that the checklists represented a visual distraction. This may have been compounded by biomechanical distraction in response to check list items that required a physical response.

5.2.6 Company radio

'Company radio' distractions were associated with conversations with company personnel, such as agricultural pilots working in the same vicinity and company maintenance personnel. There were five distractions grouped under this theme. These were experienced by pilots from a range of operational groups, including high capacity air transport, low capacity air transport, agriculture and other aerial work.

Most 'company radio' distractions resulted in a potential collision, either with another aircraft or the ground (n = 4). There was one accident, however, that resulted in serious injury to the pilot and major damage to the aircraft. As indicated below, this accident occurred during an agricultural swath run.

> During agricultural spraying operations, as the pilot was descending to commence another swath run, the aircraft's main landing gear struck a powerline and it dived vertically into the cotton crop. The impact destroyed the entire forward section of the fuselage, spilling the complete load of chemical. The pilot was seriously injured and remained trapped in the wreckage for a considerable time while emergency personnel established the toxic risk. During this time the pilot was attended to by the property owner and ambulance officers. The operator later reported that the support pole for the wire was hidden by a shed and that the pilot had been distracted by a radio call from another spraying aircraft operating nearby.
>
> ATSB Occurrence No: 200100476

5.2.7 Equipment problems

'Equipment problems' referred to distractions where the pilot became preoccupied with aircraft equipment that was not functioning normally. There were 31 distractions grouped under this theme. Most occurrences involved a charter aircraft (n = 9) or a high capacity air transport aircraft (n = 7).

As shown in Table 5, one-third of the distractions resulted in actual outcomes. The most frequent outcome (n = 16) was a potential collision with an aircraft in controlled airspace. One minor injury was identified in the sample.

Table 5. Distractions associated with equipment problems grouped by type of outcome.

	OUTCOME	FREQUENCY	PERCENT
ACTUAL	Collision with foliage/tree	1	3
	Collision with ground	1	3
	Collision with miscellaneous man-made feature	3	9.1
	Collision with powerline	1	3
	Flight control/surface problem	1	3
	Instrument failure	2	6.1
	Landing gear problem	2	6.1
	Propeller / rotor malfunction	1	3
	Total	**12**	**36.3[a]**
POTENTIAL	Potential collision with aircraft in controlled airspace	16	48.5
	Potential collision with aircraft moving on the ground	2	6.1
	Potential collision with aircraft OCTA	1	3
	Potential collision with ground	1	3
	Potential fuel system failure	1	3
	Total	**21**	**63.6[a]**

The types of equipment problems that resulted in pilot distraction generally fell into two distinct categories, depending on whether the equipment was inside or outside the cockpit. Internal equipment problems often involved computer malfunctions, such as those associated with the flight management system, the navigational aid system, headsets and the cockpit seat. External equipment problems were associated with the engine malfunctions, exterior doors and windows, and the landing gear.

Examination of the narratives indicated that equipment problems tended to divert the pilots' attention away from the primary task of controlling the aircraft. In a number of cases, the pilots became so focussed on identifying the source of the problem or implementing measures to fix it that they lost situational awareness. This is demonstrated in the following extract, in which the pilot of a B747 became distracted by a fuel problem at flight level (FL) 330. The investigation concluded that the distraction was a contributing factor to an infringement of separation standards. According to the report:

> The crew (then) became involved in troubleshooting a problem with balancing the main fuel tanks. The PIC stated that they had been distracted and forgot about the requirement to descend to FL310 by 31 NM southeast of TASHA. The PIC reported that he was aware of the B737 on the crossing track as he had heard the controller request the B737 crew to contact them (the B747 crew).… It is probable that the crew's efforts to regain time during the flight became their primary focus. Thus, when the fuel transfer problem arose they concentrated on that item to ensure that the flight could continue to make up time. That action caused

them to be distracted from managing the flight in accordance with air traffic control instructions.

ATSB Occurrence No: 200103079

5.2.8 Flight attendant

There were four distractions associated with flight attendants. All distractions were experienced by pilots operating high capacity air transport aircraft. Furthermore, all distractions resulted in potential outcomes, of which three involved a potential collision with another aircraft. There were no injuries identified in the sample.

Each distraction involved a flight attendant entering the cockpit. In one incident, the pilot became distracted by the senior flight attendant who was advising him of passenger wheel chair requirements. While noting these on a landing card, the aircraft violated the maximum speed restriction.

In two accounts the flight attendant entered the cockpit when the 'sterile cockpit' procedure was in force. This procedure requires that no communication except that related to an urgent safety-related matter occurs during the critical phases of flight (CASA, 2003). In one incident, adherence to the sterile cockpit policy would have prevented the flight attendant from distracting the pilot during descent. As described below, this action contributed to an altitude bust, whereby the pilot descended below the assigned altitude of 7,000 ft.

An investigation by the operator established that the pilot in command (PIC) had selected 5,000 ft in error, and that a cross-check of the altitude setting by the co-pilot had been obscured by sun reflections on the instrument panel. The PIC believed that he may have overheard the assignment of 5,000 ft to the crew of another aircraft at the time he was resetting the altitude indicator. At the same time, the purser entered the cockpit and this action may have distracted the PIC so that he only remembered the last altitude transmitted, and not that actually assigned to his aircraft.

ATSB Occurrence No: 199902511

As a result of the investigation, the operator issued a safety notice to flight crew emphasising the need for sterile flight deck requirements during critical phases of flight.

5.2.9 Flight crew

Seven distractions were attributed to pilots' becoming distracted by other flight crew. The distractions were associated primarily with high capacity (n = 4) and low capacity (n = 2) air transport operations. Most occurrences involved pilots becoming distracted by other operating flight crew, such as the pilot-in-command or co-pilot. There was one incident when the pilot became distracted by an 'intimidating check captain'. Nil injuries were identified in the sample.

Further examination of the data revealed that flight crew distractions fell into two separate categories, depending on their significance to flight operations. Distractions that were operationally relevant involved discussions concerning the safety of the flight, such as potential windshear on departure and thoughts about a First Officer's cross wind limit. Distractions that were not imperative to flight operations included auditory distractions caused by general conversations and visual distractions caused by the extraneous actions of another pilot (e.g. vacating the seat, hand on speed control knob).

In most cases, the outcome of the distraction was a potential collision with an aircraft in controlled airspace (n = 5). There was one incident, however, where the distraction contributed to a collision with a miscellaneous man-made feature. The incident occurred when the pilot of a DC3 charter operation became distracted by the co-pilot vacating the right hand seat. While being left to taxi solo, the pilot failed to negotiate a turn. The aircraft subsequently clipped a runway sign, effectively damaging the propeller blades.

5.2.10 Ground personnel

There were two distractions associated with ground personnel, one experienced by an agricultural pilot and the other by a private pilot. In both cases, the pilots became distracted by ground personnel that were working on the aircraft during the pre-flight planning and preparation stage of the flight. There were no injuries reported.

In the first incident, an agricultural pilot collided with a powerline during a spray run. The pilot reported that he had become distracted by the poor performance of the engineers to complete the aircraft's maintenance on time. In the second incident, a private pilot was interrupted during his pre-flight inspection by the refuelling agent. This distracted him from completing the inspection and ensuring that the fuel tank caps were on. The missing fuel caps subsequently resulted in a fuel system failure.

5.2.11 Health concerns

There was one incident involving a distraction due to health concerns. The incident occurred when the pilot of a light aircraft was distracted by severe stomach cramps during the approach to land. According to the investigation, the distraction caused the pilot to misjudge the height and speed of the approach. The result was a heavy landing. Importantly, this incident reveals how an unexpected medical condition can have a debilitating effect on performance.

5.2.12 Mobile phone

Four distractions were grouped under the theme of 'mobile phone'. The operational groups identified in the sample included charter (n = 2), private (n = 1) and business (n = 1). The outcomes associated with the mobile phone included an engine

malfunction, collision with a stationary aircraft, collision with the ground, and a door/window problem. There were no injuries identified in the sample.

Mobile phone distractions occurred on the ground during passenger boarding, during taxiing prior to take-off, during final approach, and during the pre-flight inspection. As demonstrated in the extract below, the outcome of the distraction was not always immediate.

> During the daily inspection of the helicopter, the pilot was interrupted by a phone call. After attending to the call and some early arriving passengers, the daily was completed and the flight from Cooma to Khancoban carried out. While disembarking passengers at Khancoban, the ground crew indicated to the pilot that something was not normal. The pilot shut down and inspected the helicopter. The inspection revealed a missing right main engine access cowling and damage to the underside of the main rotor blades. Several days later, after removal and repair of one main rotor blade and the replacement of the missing engine access cowling, the helicopter was returned to service.
>
> ATSB Occurrence No: 199704324

Although the specific impact that mobile phone distractions have on the cognitive and physiological performance of pilots remains unclear, research on driver distraction has identified a number of adverse effects. According to driver simulator studies, mobile phones can significantly impair a driver's visual search patterns, reaction times, decision-making processes and the ability to maintain speed, throttle control and lateral position on the road (Young, Regan, & Hammer, 2003). Similarly, it is possible that pilots may also be vulnerable to a decrease in cognitive functioning, slower reaction times, and limited biomechanical performance due to one or no hands on the controls.

5.2.13 Monitoring instruments/displays

There were six distractions associated with monitoring instruments or displays in the cockpit. Three distractions were experienced by pilots operating high capacity air transport aircraft. The distractions contributed to a collision with a powerline, a collision with the ground, and four potential collisions. One occurrence resulted in minor injury to the pilot.

All monitoring distractions involved a visual distractor. The source of the distractor varied, and included the airspeed indicator, the global positioning system (GPS), and the traffic alert and collision avoidance system (TCAS). In the following example, the pilot of a B717 became distracted by a moving map display:

> As the aircraft descended on the outbound leg, the crew noticed that the predicted track for the inbound turn on the map display screen showed a break between the inbound turn and the inbound track. During the inbound turn, the pilot in command became concerned that the aircraft was not going to intercept the inbound radial by the final approach fix (5 DME), and both he

> and the co-pilot directed their attention to the aircraft's tracking profile…. FINDING. A break (or discontinuity) in the predicted track on the map display screen (a normal feature in the operation of the system) distracted the crew during the inbound turn, during which time the aircraft descended below the step altitude (2,200 ft).
>
> ATSB Occurrence No: 200302433

5.2.14 Object/person on ground

Eleven distractions were attributed to the pilot becoming distracted by an object or person on the ground. The majority of pilots that experienced ground distractions were operating charter flights (n = 4), conducting agricultural operations (n = 3), or performing other aerial work (n = 3). Seven distractions resulted in actual outcomes involving a collision. This included collisions with powerlines (n = 3), foliage and trees (n = 2), water (n = 1), and a fence (n = 1). Nil injuries were reported.

There were seven distractions associated with ground objects. The sources of these distractions included vehicles in close proximity, yachts and boats near the landing area, and a steel decking plate near the helicopter landing pad. In all of these cases, the pilot was concerned about the potential risk that the object posed to the safety of the flight. Also included in this group were geographical 'objects', such as a river and unfamiliar terrain.

In addition, there were four distractions attributed to people on the ground. This finding suggests that people in close proximity to the operating aircraft pose a significant safety hazard, not only to themselves but also to the aircraft. This is demonstrated by an incident involving an aerial spray run, where the pilot became distracted by the movement of a person near the crop. When the person was clear, he commenced the spray run but forgot that there was a two-phase power line that ran across the crop. The helicopter subsequently collided with the power line and sustained minor damage. The pilot escaped unharmed.

5.2.15 Paperwork

There were six distractions attributed to paperwork. Four were attributed to pilots operating either private aircraft or low capacity air transport aircraft. The operational group for two occurrences was unknown. The majority of distractions resulted in a potential collision with an aircraft in controlled airspace. A more serious outcome was a collision with a hangar door. The collision occurred when the aircraft was standing and passengers were disembarking. There were no injuries reported for either passengers or crew.

In two incidents the pilot was distracted by papers (including maps) that had dropped on the cockpit floor. The findings from one investigation report indicate that the incident occurred while the pilot was physically bending over to retrieve the papers (i.e. a biomechanical distraction). The remaining distractions were associated with pilots completing flight-related paperwork, such as filling in the flight-log or preparing for a flight navigation exercise.

5.2.16 Passenger

In total, 18 distractions were due to passengers. The operational groups associated with passenger distractions varied and included private (n = 6), charter (n = 4), low-capacity air transport operations (n = 2), and other aerial work (n = 3). There were no high-capacity air transport operations identified in the sample. The distractions contributed to a number of potential and actual outcomes. Among the actual outcomes was a rejected take-off resulting in fire, a landing gear failure, and an unlocked door. There were also a number of collisions, including collisions with powerlines, foliage and trees, and the runway.

In most cases, the distractions were caused by passenger commentary (e.g. about the sighting of a crocodile) and interactive conversations between the passenger and the pilot. Other distracting events included the dislodgement of a passenger's boot behind the rudder pedal and nervous or ill passengers. In addition, one pilot became distracted by a passenger alerting him to what he thought was an engine fire, which turned out to be a glowing exhaust system.

More threatening types of distractions in terms of both pilot and aircraft safety were caused by unruly, argumentative or demanding passengers. In two occurrences, the distractions were due to camera crew who were instructing the pilot on where to manoeuvre the aircraft. In the accident described below, the camera crew required that the aircraft fly close to a powerline. Even though the pilot was aware of the risks involved, he was unable to accurately judge its position due to the onboard distractions.

> The Bell 206B was engaged in filming motor vehicles in a remote area. The pilot was requested to relocate to an area he had not previously reconnoitred. There were numerous communication problems due to language difficulties with the predominantly foreign film crew. The pilot had spotted a powerline running along the edge of the road that was being used to film the vehicle, and deemed the area not suitable. The film crew persisted in requesting low level filming, eventually the pilot agreed and became airborne. After several delays due to further communications problems, the final run of the day was commenced. During this sequence, the helicopter struck the powerline and impacted the ground heavily. One occupant received minor injuries and the other two occupants escaped injury. The helicopter sustained substantial damage.
>
> ATSB Occurrence No: 200101515

5.2.17 Performance concerns

The theme 'Performance Concerns' referred to distraction in which the pilot's attention was focussed on his performance. There were four distractions grouped under this theme. The pilots were employed in a variety of operations, including high-capacity air transport, charter, and private operations. Three of the distractions resulted in a potential collision with another aircraft and one resulted in a collision with the ground. Nil injuries were reported.

All of the distractions grouped under 'performance concerns' involved a cognitive distraction (i.e. being lost in thought). In one incident, cognitive distraction contributed to a runway incursion at Sydney airport. According to the investigation report:

> During discussions with the crew of the Metro, it became apparent that, after landing, the pilot under training had been concerned with his performance during the practice ILS approach, and had initiated a brief discussion with the training captain at about the time the aircraft had been taxiing along taxiway Juliet.
>
> ATSB Occurrence No: 199802817

The investigation concluded that 'the attention of the pilot under training was partially diverted from safely taxiing the aircraft due to his pre-occupation with a previous event' was a significant factor that contributed to the occurrence. This incident demonstrates the adverse impact that internal distractors can have on pilot attention and concentration.

5.2.18 Personal issues

There was one incident involving a distraction due to personal issues. The incident involved a Cessna aircraft that was operating a charter flight from Goulburn Island to Darwin. On late final to land, the pilot was alerted by radio that the landing gear had not extended. The pilot commenced an overshoot but was unable to prevent the aircraft from making contact with the ground. The investigation concluded that:

> It was likely that the pilot's personal and other problems, and the resulting interrupted sleeping and eating patterns diminished the pilot's ability to manage the tasks necessary to prepare the aircraft for landing. That degradation in performance was compounded by the in-flight distractions that coincided with when the pilot would have normally conducted his sequence of pre-landing actions and checks. The result was that the pilot unwittingly omitted to lower the aircraft's landing gear.
>
> ATSB Occurrence No: 200402714

This incident highlights the negative impact that personal issues can have on performance. Although there was only one incident identified in the ATSB database, previous studies have also identified a relationship between personal issues and aviation safety occurrences. An examination of ASRS reports found, for example, that personal issues represented a significant human factor contributing to emergency and abnormal situations during flight (Burian & Barshi, 2003).

5.2.19 Pilot training

Distractions grouped under the theme of 'pilot training' referred to situations where the pilot became preoccupied by some aspect of flight training. There were 10 distractions caused by pilot training. Of these, seven involved flying training flights

and three involved high capacity air transport operations. The majority of distractions (n = 9) resulted in a potential collision, either during flight or on the ground. One distraction resulted in a flight control problem due to the incorrect adjustment of the flaps.

The majority of pilots identified in the dataset were flight instructors conducting dual student training flights. Instructors often became preoccupied with explaining aeronautical concepts (e.g. on geographical points) or monitoring or guiding the performance of their students. For instance, there was one occurrence where a B767 pilot became distracted whilst training the officer in hand flying.

Further examination of the reports indicated that the instructor's distraction was often in response to the student's poor performance. For example, one instructor became distracted when trying to correct a steep final approach path. Another instructor became physically distracted by assisting the movements of his student. In the following example, the instructor became distracted when his student crossed the holding point without clearance. According to the investigation report:

> CT4 aircraft, Roller 44, was on a dual check for solo circuits waiting at the holding point of runway 30. The instructor was distracted as a result of the student crossing the holding point line as the first of 3 CT4 aircraft already in the circuit area had commenced their base turn. The instructor immediately instructed the student to hold position and await the first of 2 aircraft to complete their landing. When the instructor had judged the spacing between the second aircraft on final as being adequate, he instructed the student to line up for takeoff. On hearing the line up call from Roller 44, Roller 41 requested that the aircraft hold position. The instructor on board Roller 44 advised that the aircraft had already entered the flight strip for RWY 30. Roller 41, now established on final, commenced a go around.
>
> ATSB Occurrence No: 200105370

5.2.20 Poor visibility

The theme 'poor visibility' involved situations in which the pilot's vision was impaired. The operational groups identified in the dataset included high capacity air transport (n = 2), low capacity air transport (n = 1), charter (n = 2), agriculture (n = 1), and other aerial work (n = 1). Four of the distractions resulted in a collision, either with a miscellaneous man-made feature (i.e. pylons and drums), the ground, or water. Nil injuries were identified in the sample.

The most common factor contributing to poor visibility was sun glare (n = 3). Incidents involving sun glare impaired vision in two different ways:

1. reducing visibility through the windscreen; and
2. decreasing the ability to read the cockpit instruments.

In one incident, the pilot of a B747-300 reported that he was unable to detect the 'green-band lights' on the trim setting due to glare from the sun. The reduced illumination resulted in the pilot incorrectly selecting the green band select switch when setting the take-off thrust. The take-off warning horn subsequently sounded and the takeoff was rejected.

Other factors identified in the sample included fog, dust and a tree. Each of these resulted in a visual distraction, such that the ability to see the flight path was impaired. However, in the two incidents involving fog, both pilots reported being distracted by wiping the window clear. This combination of visual and biomechanical distractions resulted in a helicopter colliding with water. According to the investigation report:

> When the windscreen fogged, the pilot's vision was reduced and when he attempted to wipe the windscreen, he was sufficiently distracted to not notice the helicopter descending towards the water.
>
> ATSB Occurrence No: 200000622

5.2.21 Radio communication problems

There were 18 distractions attributed to problems with communicating on the radio. A variety of operational groups were identified in the sample, including private (n = 4), charter (n = 3), flying training (n = 3), and high capacity air transport (n = 2). As shown in Table 6, the majority of distractions resulted in a potential collision with an aircraft in controlled airspace.

Table 6. Distractions associated with radio communication problems grouped by type of outcome.

	OUTCOME	FREQUENCY	PERCENT[a]
ACTUAL	Collision with ground	1	5.3
	Collision with miscellaneous man-made feature	2	10.5
	Communications system failure	1	5.3
POTENTIAL	Potential collision with aircraft in controlled airspace	11	57.9
	Potential collision with aircraft moving on the ground	2	10.5
	Potential collision with ground	1	5.3
	Potential flight control / surface problem	1	5.3
	Total	**19**	**100**

[a] Figures do not add to 100 due to rounding.

From the information available, it was possible to identify three main sources of distraction that resulted in radio communication problems. These were (i) radio congestion (ii) poor radio frequency, and (iii) transmission interference. It was evident from the investigation reports that these problems often made contact with ATC difficult, and in some cases, not possible:

> While en route, the pilot was instructed to contact ATC on 125.8 MHz for clearance. Due to a radio problem, the pilot did not call as instructed. By the time communication was established, the aircraft had entered CTA without clearance.
>
> ATSB Occurrence No: 200205494

Often the radio communication problems caused the pilot to misunderstand the clearance altitude assigned by the air traffic controller. This sometimes led to an altitude bust, whereby the pilot deviated from an assigned flight level. More common, however, were violations of controlled airspace (VCA), as demonstrated below:

> After departing Bankstown on a northerly heading, VH-BXI was cleared to transit the Richmond MBZ at 4,000 ft and the pilot was instructed to leave the transponder on. The aircraft was later observed to the north of Richmond climbing through 4,500 ft into CTA. Initial attempts to contact the aircraft were unsuccessful and another southbound aircraft at 5,000 ft was vectored clear. The pilot of BXI finally contacted and instructed to descend back to 4,000 ft. The pilot of BXI reported that after was departing from Bankstown he experienced communication difficulties and could not identify the Mount McQuoid NDB. Whilst rectifying the problem, he misjudged his dead reckoning distance and climbed too early. The aircraft subsequently climbed into CTA without a clearance.
>
> ATSB Occurrence No: 199903679

5.2.22 Safety concerns

The theme 'safety concerns' referred to distractions where the pilot became preoccupied with thoughts about flight safety. There were six distractions grouped this theme. The distractions were not unique to any particular operation, but encompassed charter (n = 2), agriculture (n = 2), high capacity air transport (n = 1) and charter operations (n = 1). All occurrences resulted in an actual outcome, with the majority resulting in a collision, either with the ground, runway or powerlines. Nil injuries were reported.

The subject of the safety concerns identified in the sample varied. Examples included concerns about a burning smell in the cockpit, an unusual radio call from a Hercules indicating the pilot's intent to land, and a hump in the middle of the landing airstrip.

The distractions grouped under 'safety concerns' were all cognitive distractions. In all cases, the pilot became preoccupied with thoughts about how to most effectively manage a potentially unsafe or unusual situation. A review of the narratives revealed that a pilot's attention could become so absorbed by safety concerns to the exclusion of external events, resulting in an impairment of situational awareness:

> During agricultural spraying operations, the aircraft's right wing tip struck a powerline that was partially obscured by trees. The pilot felt no unusual flight characteristics and elected to return to the company base to have the aircraft inspected. This revealed only minor cosmetic damage to the wingtip. The pilot later reported that he had been distracted by thinking ahead on how he would deal with a second wire and had forgotten about the first one.
>
> ATSB Occurrence No: 200105191

5.2.23 System programming

The theme 'system programming' referred to distractions that involved the programming or setting of an aircraft system. In total, 10 distractions were grouped under this theme. Among the operational groups identified in the dataset were four high capacity air transport operations and two charter operations. Five distractions resulted in potential outcomes, with the majority involving a potential collision with an aircraft in controlled airspace. Two distractions contributed to actual collisions, including a collision with the runway and a collision with runway edge lights.

The majority of system programming distractions were associated with setting the FMS, and particularly the flight management computer (FMC). Other computerised systems identified in the dataset included the GPS and the altitude display. Distractions were also caused by setting the transponder code and testing the very high frequency omnidirectional radio range (VOR) navigation system.

System programming distractions involved a combination of visual and biochemical forms of distraction. This is demonstrated in the extract below, which describes the sequence of events that resulted in a B747 deviating off the runway during the takeoff roll:

> When SWT was issued with a transponder code and cleared for an immediate departure, the aircraft was at the holding point at A7. The pilot read back an incorrect code and was again given the correct code. To enter the code into the transponder, he had to lean across the cockpit to the right side of the instrument panel. He did this as the aircraft entered the runway. When he looked forward again, he saw a line of white lights directly ahead and commenced the takeoff roll. Almost immediately, he heard a noise from the left side of the aircraft and rejected the takeoff.
>
> ATSB Occurrence No: 199802197

5.2.24 Taxiing/parking

'Taxiing/parking' distractions were associated with safety occurrences that happened while manoeuvring the aircraft on the aerodrome. A total of 11 taxiing/parking distractions were identified under this theme. The types of operations that could be identified in the sample included private (n = 2), high capacity air transport (n = 1), low-capacity air transport (n = 1), private (n = 1), business (n = 1), flying training (n = 1), agriculture (n = 1) and other aerial work (n = 1).

The majority (n = 9) of distractions resulted in a collision with bushes and trees or a miscellaneous man-made feature. The man-made features included light poles, fence posts, and a taxi light. There were no injuries reported.

The distractions were generally caused by a pilot's preoccupation with manoeuvring around a parked aircraft or object (i.e. fences, cones and tyres) on the runway. It is likely that the objects represented a visual distractor, thereby causing the pilot to lose awareness of his position on the runway. The result was typically a collision, as demonstrated below:

> While taxiing from the aircraft's parked position, the pilot was negotiating a path between an aircraft parked on the right side and failed to observe a light pole on the aircraft's left side. The left wing tip cover struck the light pole and sustained minor damage.
>
> ATSB Occurrence No: 200105969

5.2.25 Time pressures

The theme 'time pressures' referred to situations in which the pilot's attention was focussed on maintaining an on-time flight schedule. There were six distractions grouped under this theme. Of these, three involved a charter flight, two involved a low capacity air transport aircraft, and one involved a private flight. There were three actual outcomes directly attributed to the distraction, including a landing gear failure, a collision with the ground, and a problem with the door.

The findings indicated that pilots allowed themselves to be rushed or pressured by company scheduling in an effort to achieve on-time performance. On three occasions the pre-flight inspection was not completed. In one incident, the incomplete

inspection resulted in the pilot leaving the wheel chocks on the right horizontal stabiliser to allow for the loading of bags. The aircraft subsequently departed with the chocks still on. When en route, the chocks became tangled in the high frequency aerial, subsequently causing significant damage to the fin of the aircraft.

Time pressures were identified in a study on errors related to checklist design (FAA, 1995). The findings indicated that the omission of checklist items due to pilot distraction tended to occur when crew were rushing to make a scheduled departure time. The findings also showed that pilots tended to complete the checklist from memory, give it only cursory effort, or initiate the checklist but not complete it in an effort to make up time,

5.2.26 Tracking

'Tracking' distractions involved situations where the pilot's attention was focussed on tracking the status of the aircraft. There were two occurrences involving tracking distractions. Both occurrences resulted in an altitude bust.

In one incident involving a tracking distraction, the pilot of a B747 became distracted by his doubts about the accuracy of tracking. In the second incident, it appears that the pilot may have been preoccupied with overcoming tracking problems. According to the investigation report:

> The aircraft was assigned a climb to FL200 and then cleared to FL290. However the controller then noted that the aircraft was drifting to the right of track. To avoid a conflict with opposite direction traffic at FL200, the controller instructed the aircraft to maintain FL190. The pilot read back the instruction correctly. Shortly afterwards, the controller noted the aircraft appeared to be at FL204. The pilot confirmed that the aircraft was above the assigned level, and was then instructed to continue climbing to FL290. ATS reported that the pilot may have been distracted by problems with tracking. There was no infringement of separation standards.
>
> ATSB Occurrence No: 200003174

5.2.27 Traffic

'Traffic' distractions referred to situations in which the pilot's attention was focussed on nearby traffic. Together, there were 13 distractions grouped under this theme. The operational groups that could be identified in the sample included private (n = 4), flying training (n = 3), and charter (n = 2) operations. The actual and potential outcomes related to the distraction are presented in Table 7. Nil injuries were reported.

Table 7. Distractions associated with traffic concerns grouped by type of outcome.

	OUTCOME	FREQUENCY	PERCENT
ACTUAL	Collision with ground	4	31
	Collision with miscellaneous man-made feature	2	15
	Landing gear problem	2	15
POTENTIAL	Potential collision with aircraft in controlled airspace	2	15
	Potential collision with aircraft OCTA	1	8
	Potential collision with stationary aircraft	1	8
	Potential collision with vehicle/moving equipment	1	8
	Total	**13**	**100**

The majority of distractions associated with traffic concerns were visual distractions, such as nearby aircraft. Typically, the aircraft were flying in the same circuit area or about to take off. It was not always aircraft, however, that represented visual distractions. As demonstrated in the following extract, parachutists also attracted attention:

> Prior to landing the N22 Nomad aircraft, the pilot under instruction had not selected the landing gear down and the aircraft contacted the ground with the landing gear still retracted. The pilot under instruction reported that during the asymmetric circuit training when he went to select the landing gear down, the instructing pilot advised him to wait until they were sure the aircraft would make it to the field, preferably on final approach. The instructing pilot reported that during the final approach his attention became focused on parachutists in the vicinity and he forgot about selecting the landing gear down.
>
> ATSB Occurrence No: 200103262

In addition to visual distractors, there was one case when the pilot's concern about traffic was triggered by an auditory distractor. This occurred when the pilot of a charter aircraft became distracted by the 'unusual nature and content of a radio transmission from the pilot of a following C-130 Hercules aircraft.' According to the investigation report, consideration of the radio call coincided with the time that the pilot normally carried out his last check of the aircraft configuration in preparation for landing. As a result, the pilot omitted to lower the aircraft's landing gear and the aircraft subsequently collided with the ground.

5.2.28 Weather

There were18 distractions grouped under the theme 'weather'. The operational groups identified in the sample included high capacity air transport (n = 6), charter (n = 3), private (n = 2), and low capacity air transport (n = 1). As shown in Table 8, the most frequent outcome was a potential collision with an aircraft in controlled airspace. Nil injuries were reported.

Table 8. Distractions associated with weather grouped by type of outcome.

	OUTCOME	FREQUENCY	PERCENT
ACTUAL	Collision with miscellaneous man-made feature	1	5.6
	Collision with powerline	1	5.6
	Landing gear problem	1	5.6
POTENTIAL	Potential collision with aircraft in controlled airspace	13	72.2
	Potential engine malfunction	1	5.6
	Potential flight control/surface problem	1	5.6
	Total	**18**	**100**

Weather distractions were essentially a form of visual distraction. The majority of incidents were caused by pilot attentiveness to weather outside the aircraft. These included incidents where the pilot became preoccupied with diverting around bad weather, looking for a gap in the clouds, and searching for thunderstorms. Often the source of distraction was an unexpected change in weather conditions, such as unforecast fog or an active thunderstorm:

> The aircraft had been diverted around numerous isolated thunderstorms throughout the flight, when the company advised of a large active thunderstorm cell approaching the destination aerodrome. In their haste to descend so as to sight the approaching thunderstorm, the flight crew commenced descent without requesting clearance from ATC. Traffic in the vicinity was a SAAB travelling in the same direction. The flight crew used TCAS to avoid conflict with the SAAB, however a technical infringement of separation standards occurred. The pilot in command later stated that recent airspace changes, and distraction created by the thunderstorm approaching the destination aerodrome contributed to the incident.
>
> ATSB Occurrence No: 200006052

In addition to visual distractors external to the aircraft, pilots were also distracted visually by the weather radar inside the aircraft. In one incident involving a B737, the diversion of attention towards the weather radar contributed to a loss of separation.

> The investigation determined that the separation standard would not have been infringed if the crew of the B737 had complied with the 5,000 ft altitude requirement. At the time of the infringement the B737 was being manually flown by the pilot in command who was distracted from his primary task of controlling the aircraft's flight path. The distraction occurred as the pilot in command monitored the weather radar and assessed the meteorological conditions that the aircraft was encountering during the climb.
>
> ATSB Occurrence No: 200006052

5.2.29 Workload

There were 12 distractions associated with 'workload'. Among the operational groups included in the dataset were high capacity air transport (n = 3), low-capacity air transport (n = 3), (n = 1), charter (n = 1), business (n = 1), flying training (n = 1), and private (n = 1) operations. The majority of outcomes were classified as a potential collision with an aircraft in controlled airspace (n = 8). There was one actual outcome, which involved a collision with the runway due to a 'wheels-up' landing. Nil injuries were reported.

Workload distractions generally involved a pilot's preoccupation with prioritising and managing a number of simultaneous cockpit duties. Sometimes the cockpit duties were described by the pilots as ancillary in nature and secondary to the primary task of managing the flight (e.g. radio work with other aircraft). Such tasks were often performed during a busy stage of flight (i.e. during transition changes, take-off and landing).

In several incidents, the distraction resulted in the pilot failing to contact ATC to obtain the required clearance. As such, a number of workload distractions contributed to an altitude bust, a VCA, or a runway incursion. The following incident, involving a pilot operating a Piper aircraft, is an example of a workload distraction that contributed to an altitude bust:

> The en route controller had cleared the aircraft to descend to 7,000 ft and instructed the pilot to contact the tower controller at 30 NM Albury. The aircraft was 21 NM from Albury and descending through 5,000 ft before the pilot contacted the tower controller. There was no infringement of separation standards.
>
> ATSB Occurrence No: 199900404

6 TAXONOMY OF PILOT DISTRACTION

6.1 Development of the taxonomy

A primary goal of this study was to develop a taxonomy of the sources of pilot distraction. The 29 themes examined in the previous section provided the foundation for the taxonomy. The themes were revised and re-grouped in an effort to remove any conflicts of overlap. In addition, new categories were created that enabled the sources to be more accurately defined and classified into a structured format.

In an attempt to capture the key sources of pilot distraction, each major category was divided into sub-categories. Together, these categories encompassed the main themes of pilot distraction identified in the thematic analysis. The preliminary framework for the taxonomy and examples of the types of distractions associated with each sub-category are presented in Table 9.

Table 9. Preliminary framework for the taxonomy of pilot distraction.

DISTRACTION SOURCE	SUB-CATEGORY	EXAMPLES
Flight management tasks	Cockpit instruments	Monitoring the airspeed indicator
	Equipment problem	Analysing and troubleshooting an engine problem
	Flight management systems	Programming the FMS
Radio communications	Air traffic control	Obtaining a runway clearance
	Company personnel	Taking instructions from company engineer
	Other aircraft	Receiving call from another aircraft
	Transmission problem	Transmission congestion or interference
Ancillary tasks	Checklists	Conducting pre-landing checks
	Paperwork	Completing load sheets or log books
Operational concerns	Approach	Thinking about a change of approach
	Safety hazards	Concerned about burning smell in cockpit
	Tracking	Fault analysing tracking problem
External events	Birds	Avoiding birds in flight path
	Objects / people on ground	Looking at vehicles near spraying area
	Other aircraft	Watching aircraft in same circuit area
	Parachutists	Watching the movements of parachutists
	Terrain	Sightseeing or searching for familiar landmarks
	Weather conditions	Looking at thunderstorms or clouds
Aerodrome events	Animals on the runway	Avoiding kangaroos crossing the runway
	Focussed on parking	Looking for vacant parking area
	Focussed on taxiiing	Looking for taxiway markings
	Ground staff	Monitoring work of refuellers
	Obstacles on runway	Manouevring around foreign objects on runway
	Other aircraft	Manouevring around aircraft on runway
Non-operational events	Dropped items	Picking up charts or documents from cockpit floor
	Mobile phone	Conversing on mobile phone
	Other tasks	Preparing aerial work or navigational exercise
Other people	Flight attendants	Recording information from flight attendants
	Flight crew	Communicating with other flight crew
	Passenger	Film crew or tourists
	Students	Instructing or monitoring student performance
Human Factors	Poor health	Stomach cramps
	Personal concerns	Thinking about family
	Reduced vision	Sun glare or fog
	Time pressures	Tight scheduling
	High workload	Performing multiple tasks

6.2 Testing the taxonomy categories

Once the preliminary categories were formulated, the taxonomy was applied to the 247 pilot distractions identified in the thematic analysis. During this process, it became evident that some categories needed to be further refined. This resulted in the following main changes:

- The primary category of ‘other people’ was changed to ‘people on board’ to eliminate the ambiguity regarding air traffic controllers. Prior to the change, there was a concern that air traffic controllers may pose an overlap between ‘radio communication distractions’ and ‘other people’.
- A number of sub-category headings were renamed or restructured to correspond more accurately within the nine broad categories. For example, ‘objects/people

on the ground' was split into two categories to delineate between objects and people. Furthermore, 'monitoring equipment/instruments' was divided into those involving flight management systems and cockpit instruments.

6.3 Results of the revised taxonomy

Following refinement of the taxonomy categories and sub-categories, the revised taxonomy was re-applied to the 247 occurrences involving pilot distraction. The results of the final taxonomy are presented in Table 10.

The final taxonomy of pilot distraction consists of nine major categories of pilot distractions. The categories may be broadly defined as:

- **Flight management tasks** – includes distractions associated with controlling the aircraft, including the management of aircraft systems and the monitoring of cockpit instruments.
- **Radio communications** – includes distractions caused by the pilot's interaction with the aircraft radio, including distractions associated with obtaining traffic information (i.e. from ATC or other aircraft).
- **Ancillary tasks** – distractions associated with flying-related duties but not critical to the management of the aircraft, such as paperwork and liaising with flight attendants to record passenger requirements.
- **Non-operational tasks** – distractions not associated with the work of the pilot or the general operation of the aircraft.
- **Operational concerns** – distractions associated with concerns relating to the operation or safety of the aircraft.
- **External events** – distractions that are viewed outside of the cockpit window (i.e. involving a distractor external to the aircraft).
- **Aerodrome events** – distractions that are associated with an object, person or animal on the aerodrome (i.e. involving a distractor on the ground).
- **People on board** – distractions arising from the pilot's interaction with another person on board the aircraft, and may involve active or passive behaviour (i.e. listening, talking etc).
- **Human factors** – distractions associated with psychological and physiological variables that affect the pilot's performance, such as illness, stress and workload.

Table 10. Frequency and percentage of distraction sources classified according to the taxonomy of pilot distraction.

THE TAXONOMY OF PILOT DISTRACTION		
DISTRACTION SOURCE	**FREQUENCY**	**PERCENTAGE[a]**
Flight management tasks	**49**	**19.8**
Equipment problem	33	13.4
Flight management systems	13	5.3
Cockpit instruments	3	1.2
External events	**42**	**17.0**
Weather	18	7.3
Nearby aircraft	12	4.9
Object on ground	6	2.4
Person on ground	3	1.2
Terrain	2	0.8
Birds	1	0.4
People on board	**39**	**15.8**
Passenger (e.g. film crew, tourists)	18	7.3
Student	10	4
Flight crew	7	2.8
Flight attendant	4	1.6
Radio communications	**37**	**15.0**
Radio communication problem	19	7.7
Air traffic control	12	4.9
Company radio	5	2
Other aircraft	1	1.6
Human Factors	**27**	**10.9**
High workload	12	4.9
Poor visibility	7	2.8
Time pressures	6	2.4
Poor health	1	0.4
Personal concerns	1	0.4
Aerodrome events	**18**	**7.3**
Animals on runway	6	2.4
Focussed on taxiing	4	1.6
Other aircraft	3	1.6
Obstacles on runway	2	0.8
Ground personnel	2	0.8
Focussed on parking	1	0.4
Operational concerns	**15**	**6.1**
Safety concern	5	2.4
Approach	4	1.6
Performance concerns	4	1.6
Tracking issues	2	0.8
Non-operational tasks	**10**	**4.0**
Agricultural task	6	2.4
Mobile phone	4	1.6
Dropped items	3	1.2
Ancillary tasks	**10**	**4.0**
Checklists	4	1.6
Paperwork	3	1.2

[a] Figures do not add to 100 due to rounding.

The taxonomy indicated that approximately 20 per cent of aviation occurrences in which the source of distraction could be determined were associated with flight management. Of these, the majority were attributed to equipment problems. Visual allocation outside of the aircraft accounted for approximately 17 per cent of occurrences and people on board the aircraft accounted for approximately 16 per cent. The results also indicated that ancillary distractions and non-operational distractions did not contribute substantially to accidents and incidents involving pilot distraction.

6.4 Discussion of the taxonomy

The results of the taxonomy are specific to the ATSB aviation safety database. As such, the taxonomy differs from previous frameworks used in driver and aviation research. Notably, it does not adopt the four-distraction type model used by the NHTSA (i.e. visual, auditory, biomechanical or cognitive). Although this approach provided a useful framework for examining certain examples of pilot distraction occurrences during the thematic analysis, its ability to provide an appropriate framework within the context of aviation was considered unsuitable. Without any real measure of the physical or cognitive processes involved at the moment when the pilot's attention was diverted, this approach may have led to over-interpretation or misinterpretation of the information.

In addition, the taxonomy differs from the framework used by Monan (1971). As indicated earlier (see Section 2.3), Monan (1971) classified distractions according to two groups: (i) operational activities such as checklists and malfunctions, and (ii) non-operational activities, such as conversation and paperwork. In the present study, initial attempts to classify the occurrences according to this system frequently resulted in overlap. For example, occurrences involving conversation with another crew member fell into either group, depending on the context and operational significance of the conversation. In an effort to minimise overlap, the current taxonomy was designed to be more detailed and contains more categories to accommodate the numerous types of distractions experienced by pilots.

It is important to note that the taxonomy is limited to the sources of distraction. In part, this limitation reflects the methodological constraints associated with using occurrence databases and aviation safety and investigation reports for data. More so, because the majority of distraction occurrences were classified as minor (i.e. they did not involve a serious safety deficiency), they did not require an on-site investigation or an investigation report to be written. Consequently, the only method for determining information about the distraction was from the initial notification report. For most minor incidents, this was limited in detail.

Despite the limitations of the taxonomy, it provides an unprecedented insight into the range of sources that have contributed to aviation occurrences in Australia between 1997 and 2004. A more complete taxonomy of distracting events could be developed and applied to future occurrence data.

7 GENERAL DISCUSSION

In general, the findings of the study revealed that distractions experienced by pilots operating Australian-registered civil aviation aircraft between 1997 and 2004 can have a significant impact on flight safety. Although the majority of occurrences were classified as incidents, the results clearly indicated that distractions can contribute to pilot injury and cause substantial damage to aircraft. Depending on the location and phase of flight, damage can also extend to objects, trees and other aircraft in close proximity to the aircraft under the control of the distracted pilot.

An important finding arising from the study is that the sources of most pilot distractions are not unique to any one type of operation. For example, distractions associated with radio communication problems (e.g. poor transmission, malfunction, congestion) were common to high capacity air transport, charter, private and flying training operations. Similarly, distractions associated with weather (e.g. diverting around cloud, unforecast fog, adverse wind) and workload (e.g. ancillary tasks, high workload) were experienced by pilots from a range of operational groups.

A major source of distraction was people on-board the aircraft. This included other flight crew, flight attendants and passengers. The majority of the incidents were associated with conversations that occurred within the cockpit. This included conversations associated with flight operations and passenger commentary. There were also instances where pilots became distracted by the demands of film crew and an intimidating check captain. People-related distractions also occurred in relation to people on the ground, including maintenance personnel and people that could be observed from the cockpit.

The findings also indicated that particular sources of distraction were more commonly associated with some operational groups than others. Not surprisingly, distractions caused by flight attendants entering the cockpit were only identified in occurrences involving high capacity air transport operations and distractions associated with agricultural tasks were only experienced by pilots conducting agricultural operations and other aerial work. These findings suggest that pilots operating in particular sections of the aviation industry are more at risk of becoming distracted or preoccupied by distractors unique to their operating environment.

In line with a previous study on pilot distraction by Monan (1971), the findings revealed that checklists were a source of distraction. Checklist distractions, associated with both pre-take off and landing checks, generally resulted in a failure to maintain an adequate lookout. According to Monan's (1971) examination of ASRS reports, checklist activity was almost always being conducted while other cockpit tasks were being performed (i.e. radar monitoring, minor malfunctions, systems operation, traffic watch). From these findings, Monan (1971) concluded that checklist accomplishment became a cause for distraction not by itself but as part of cockpit workload.

Due to inherent limitations of the database, it was not always possible to determine the exact time when the distraction occurred. However, based on data indicating the phase of flight when the outcome occurred, in addition to information derived from the investigation reports, it is evident that distractions occurred throughout all phases. The results also showed a tendency for certain distractions to occur more frequently during particular phases of flight. For instance, distractions caused by animals on the

runway predominantly occurred on landing, and distractions caused by checklists typically occurred during taxiing.

Although it was not possible to determine the time of day when the distraction occurred, previous research has shown that time of day is a contributing factor. According to a study on checklist design by the FAA (1995), omitting checklist items due to distraction was common when crew members were nearing the end of the work day. This suggests that fatigue may be a contributing factor to air safety occurrences involving pilot distraction.

Further examination of the results revealed that distractions often happened when pilots were faced with an abnormal or unexpected situation. In fact, the most serious source of pilot distraction occurred as a result of an unexpected equipment malfunction. When such situations arose, the pilots became focussed on carrying out non-routine or emergency operating procedures. This had the effect of drawing the pilots' attention away from the primary tasks of monitoring and controlling the aircraft.

According to theories on attention, interruptions associated with unexpected events introduce new tasks on top of the on-going activity. This situation often results in conflict, whereby the need to concentrate on one event in order to give it full processing capacity conflicts with external events (Miyata & Norman, 1986). For example, a pilot experiencing a problem with the radio may suspend work on the current activity of controlling the aircraft to attend to the demands of the new task (i.e. fixing the radio). In doing so, the pilot may lose track of the initial activity of controlling the aircraft. This example demonstrates the conflicting properties of the information processing system: continual concentration and continual distraction. This conflict is indicative of the limitations of the human information processing system and memory capacity.

Importantly though, the pilot distractions observed in this study did not always occur in response to non-normal tasks. In fact, the findings indicated that pilots became distracted when conducting normal routine activities. These included activities of either an operational (e.g. paperwork, monitoring the weather, FMS programming) or non-operational (e.g. conversation) nature. Research suggests that prolonged use of attention directed to specific tasks can lead to attention fatigue (R. Kaplan & Kaplan, 1989; S. Kaplan, 1995). One of the manifestations of this type of fatigue is the declining ability to concentrate (R. Kaplan & Kaplan, 1989). It is possible that the monotony of normal tasks and associated attention fatigue may have contributed to pilot distraction. It is also possible that the susceptibility of pilots to become distracted during normal operations is associated with the high level of automatic processes involved. This relationship may be explained by the conflict between automatic and cognitive processes.

The behaviour of humans is controlled by two primary systems. One system, known as conscious control, requires attention and effort. Its resources are limited, such that it will only enable one task to be performed at a time (Miyata & Norman, 1986). The second system, referred to as subconscious control, involves automated cognitive processes. These processes involve specialised procedures for tasks that are relatively independent of one another. Subconsciously performed tasks are therefore regarded as unlimited (Miyata & Norman, 1986).

As automated tasks become routine and a person becomes more skilled at task performance, less effort and attention are required. Automatic processes are often exhibited by experienced pilots when they subconsciously perform well-learned and

routine tasks. When performing multiple tasks, however, there is an interaction between automatic and controlled processes. For example, an experienced pilot's ability to manually fly a familiar aircraft involves automated processing. With the introduction of a secondary flying task, however, conscious attention will also be required. Thus, if ATC requests the pilot to intercept a radial, the pilot will be required to consciously monitor the VOR and then adjust the heading to intercept that radial.

If the automatic system is allowed to operate without any conscious control, it is vulnerable to distraction and error. One particular type of error associated with automatic processes is habit capture. This error occurs when an action originally intended for a particular goal is 'captured' by a habit or another well-rehearsed pattern (Norman, 1986; Reason & Mycielska, 1982). Research shows that habit capture errors occur frequently during checklists that are executed by memory (Cummings, 2003). Specifically, when a checklist is commenced and a particular item is reached, a habit capture error can occur when the pilot inadvertently switches to a different memorised checklist, in effect transposing the two items.

In addition to high workload situations, pilots also became distracted during periods of low workload. Research on driver distraction has confirmed that events that require low mental workload (e.g. single tasks requiring one to look or hear) or no workload with respect to the driving task can be distracting (Lee, McGehee, Brown, & Reyes, 2002). Such events may involve a sudden recollection or mental image or an unexpected thought irrelevant to the task being performed. This theory may help to explain why some pilots became distracted by their concerns about previous performance, whereby a transient mental recall may have diverted the pilot's attention away from controlling the aircraft.

It is clear that cognitive processes are central to the problem of pilot distraction. However, further research is needed to understand how these processes contribute to performance decrements and aviation safety deficiencies. In particular, it would be useful to determine the effect that different types of distractions have on simple and complex task performance. Furthermore, it would be useful to determine how distraction varies across individual (e.g. age, experience) and operational (e.g. aircraft type, operational group) differences. Simulator studies may provide a well-controlled and safe approach for obtaining these data.

8 STRATEGIES FOR REDUCING PILOT DISTRACTION

It is likely that pilots have a general awareness of the inherent risks associated with distractions in the flying environment. Like all humans, however, pilots are susceptible to becoming preoccupied and distracted with one task to the detriment of another task. As indicated by the findings, distractions can affect a pilot operating in any type of organisation, from small regional operations to large commercial airlines. Furthermore, distractions can arise unexpectedly, during periods of high or low workload, or during any phase of flight. In essence, no pilot is immune to distraction.

To counter a pilot's vulnerability to distraction, airline operators and pilots may benefit from a system for managing distraction. Such a system should include training modules to increase pilot awareness of the ubiquitous nature of distraction and its ability to impair performance. In addition, the system should provide pilots with strategies for managing distractions in the flying environment. Although it is acknowledged that further research is necessary to validate the effectiveness of particular strategies, the findings of this study provide the basis for the following tentative suggestions:

- Pilots should exercise discretion in engaging in conversation with other people on board the aircraft, particularly during pre-flight checks and critical phases of flight.
- If commercially viable, commercial general aviation pilots should consider leaving the right front seat vacant to minimise conversation with passengers.
- In the event of an equipment malfunction or abnormal situation, the pilot-in-command and co-pilot should be assigned specific responsibilities to ensure that at least one pilot continues to monitor and control the aircraft.
- Pilots may consider deferring ancillary tasks (e.g. paperwork) to low-workload phases of flight, but be aware that distractions can also occur when monitoring or conducting routine tasks.
- Flight attendants should be reminded during pre-flight briefings of the 'sterile cockpit rule' and to refrain from interrupting any flight deck activity until the crew indicates that they have completed their task.
- In accordance with previous research, operators may want to consider minimising the number of procedural items that can be performed at an undefined time during a phase of flight. According to Loukopoulos et al. (2003), 'floating' procedural items should be linked to fixed reference points, such as at the end of a particular checklist.

- Where possible, operating procedures that require tasks to be conducted concurrently should be replaced with procedures that require tasks to be conducted sequentially.
- If a checklist is interrupted, pilots should consider returning to the beginning of the checklist (if possible) to reduce the potential for error.
- Simulator training should incorporate scenarios that require pilots to manage distractions, interruptions and concurrent tasks. For example, scenarios could include realistic radio communications (i.e. ATC, company representatives, other aircraft) and unexpected interruptions from flight attendants.

To enhance the successful implementation of distraction management strategies, a number of broader issues should also be considered. In particular, consideration should be given to the demands of the flying environment and the effects that the type of operation and scheduling requirements will have on pilot workload. Attention should also be given to the impact that automation may have on task demands and how this may vary across airlines, aircraft types, and particular routes. Addressing these issues will assist in facilitating the development of strategies most appropriate and suitable to the particular operations being undertaken.

9 CONCLUSION

To date, the ATSB's database is the largest and most comprehensive dataset available for studying pilot distraction across all cross-sections of the Australian aviation industry. Despite this, it was limited in its ability to generate sufficient information for analysing all occurrences involving distraction. In fact, the source of distraction was unknown for almost one-third of occurrences in which distraction was identified as a contributing factor. The lack of detail was not due to the database being inefficient, but because the majority of occurrences that involved pilot distraction were classified as minor. Subsequently, the occurrences did not require an on-site investigation or an investigation report to be written. The only method for determining the source of distraction for these occurrences was from the initial notification report.

Despite the methodological limitations, it was possible to provide an in-depth qualitative analysis of distraction in the Australian aviation industry. This analysis involved identifying many of the key sources of pilot distraction, exposing the many types of situations in which distractions have occurred, and revealing how distractions have contributed to safety deficiencies. Together, the findings have shown that distractions have the potential to significantly threaten flight safety across all sections of the industry and during all phases of flight. Clearly, strategies to minimise pilot distraction need to be developed and designed with particular attention to the operations being undertaken.

On a final note, it is acknowledged that any development of a system to manage flight crew distraction will be limited by a lack of quantitative research in this area. Further research is necessary to determine a pilot's susceptibility to distractors, the factors that influence this susceptibility, and the conditions under which pilots engage in distracting tasks. In order to conduct this research, objective and standardised measures of distraction need to be developed. It is hoped that this study has provided an insight into further areas for research and, in doing so, established the basis for future directions in better understanding and minimising pilot distraction.

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11 APPENDIX A: GLOSSARY

Accident

An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, in which:

a) a person is fatally or seriously injured as a result of:
   - being in an aircraft, or
   - direct control with any part of the aircraft, including parts which have become detached from the aircraft, or
   - direct exposure to jet blast,

   except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or
b) the aircraft sustains damage or structural failure; or
c) the aircraft is missing or is completely inaccessible.

Agricultural Operations

Operations involving the carriage and/or spreading of chemicals, seed, fertiliser or other substances for agricultural purposes, including operation for the purpose of pest and disease control.

Business Operations

Includes operations by the aircraft owner, the operator's employees, or the hirer of the aircraft for business or professional reasons. Excluded from this category are operations directly involved in trade or commerce.

Charter Operations

Carriage of cargo or passengers on non-scheduled operations by the aircraft operator or his/her employees for hire or reward, but excluding Regular Public Transport operations (scheduled services).

Fatal Accident

An aircraft accident in which at least one person is fatally injured.

Flying Training

Flying under instruction for the issue or renewal of a licence or rating, aircraft type endorsement or conversion training. Includes solo navigation exercises conducted as part of a course of applied flying training.

General Aviation

General aviation refers to all non-scheduled flying activity in aircraft that have been allocated an Australian VH-registration by CASA. Excluded from this category are VH-registered sailplanes, ultra-light aircraft, hang gliders, balloons and autogyros.

High Capacity Regular Public Transport

A high capacity RPT aircraft is an aircraft that is certified as having a maximum seating capacity exceeding 38 seats or a maximum payload exceeding 4,200 kg.

Incident

An occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of operation.

Low Capacity Regular Public Transport

A low capacity RPT aircraft is an aircraft that is certified as having a maximum seating capacity less than or equal to 38 seats or maximum pay load less than or equal to 4,200 kg.

Minor Injury

An injury sustained by a person in an accident that was not a fatal or serious injury.

Other Aerial Work

Includes operations conducted for the purposes of aerial work other than 'agricultural operations'. Operations classified as other aerial work include aerial surveying and photography, spotting, aerial stock mustering, search and rescue, ambulance, towing (including glider, target and banner towing), advertising, cloud seeding, fire fighting, parachute dropping, and coastal surveillance.

Private

Includes operations by the aircraft owner, the operator's employees, or the hirer of the aircraft for private pleasure, sport or recreation, or personal transport not associated with a business or profession.

Regular Public Transport (RPT)

All air service operations in which aircraft are available for the transport of members of the public, or for use by members of the public for the transport of cargo (freight and/or mail), for trade or commerce and which are conducted in accordance with fixed schedules to and from fixed terminals over specific routes with or without intermediate stopping places between terminals. Excluded from this category are charter and non-scheduled operations.

Serious Incident

An incident involving circumstances indicating that an accident nearly occurred.

Serious Injury

An injury which is sustained by a person in an accident which:

a) requires hospitalisation for more than 48 hours, commencing within seven days from the date the injury was received; or
b) results in a fracture of any bone (except simple fractures of fingers, toes, or nose) or;
c) involves lacerations which cause severe haemorrhage, nerve, muscle or tendon damage; or
d) involves injury to any internal organ; or
e) Involves second or third degree burns, or any burns affecting more than five per cent of the body surface; or

f) Involves verified exposure to infectious substances or injurious radiation.

VH-registered aircraft

Any aircraft certified by CASA to appear on the civil aviation register.

12 APPENDIX B: PILOT DISTRACTION

The following table provides a description of the sources of distraction identified from the ATSB investigation reports for occurrences involving Australian-registered civil aviation aircraft between 1997 and 2004. It also includes information on the year of the occurrence, the type of occurrence, operational group, and the level of injury sustained. Occurrences involving more than one distraction can be identified by the same ATSB occurrence number.

ATSB OCCURRENCE NUMBER	YEAR	TYPE	OPERATIONAL GROUP	INJURY	DISTRACTION
200402714	2004	Incident	CHARTER	NONE	Fault analysing problem with instrument landing system
200402714	2004	Incident	CHARTER	NONE	Unusual radio transmission from a Hercules
200402714	2004	Incident	CHARTER	NONE	Personal thoughts
200402714	2004	Incident	CHARTER	NONE	Jet thrust turbulence problem
200402047	2004	Incident	HIGH CAPACITY	NONE	Checking FMS and MCP settings
200401785	2004	Incident	CHARTER	NONE	Engine overheat condition
200401683	2004	Incident	LOW CAPACITY	NONE	Navigational aid problem
200401676	2004	Incident	PRIVATE	NONE	Attention on passenger
200401490	2004	Incident	FLYING TRAINING	NONE	Assisting and directing student movements
200400914	2004	Accident	CHARTER	NONE	Passenger commentary
200400732	2004	Incident	PRIVATE	NONE	Looking at a sprinkler in landing area
200400727	2004	Incident	UNKNOWN	NONE	Radio communication problem
200400102	2004	Incident	HIGH CAPACITY	NONE	Problem with the FMS
200305371	2003	Accident	AGRICULTURE	MINOR	Checking chemical levels for swath run
200305171	2003	Incident	CHARTER	NONE	Passenger boarding aircraft
200304891	2003	Incident	CHARTER	NONE	Mobile phone call
200304536	2003	Incident	AGRICULTURE	NONE	Poor and untimely performance of engineers
200304406	2003	Incident	HIGH CAPACITY	NONE	High workload at transition level

ATSB OCCURRENCE NUMBER	YEAR	TYPE	OPERATIONAL GROUP	INJURY	SOURCE OF DISTRACTION
200304396	2003	Incident	HIGH CAPACITY	NONE	Communicating with company maintenance
200304263	2003	Incident	LOW CAPACITY	NONE	Problem with the autopilot
200304065	2003	Incident	PRIVATE	NONE	Bending over to retrieve documents
200303896	2003	Incident	CHARTER	NONE	Conducting pre-landing checks
200303858	2003	Incident	LOW CAPACITY	NONE	Completing paperwork
200303826	2003	Incident	LOW CAPACITY	NONE	Confusion over ATC clearance
200303575	2003	Incident	PRIVATE	NONE	Mobile phone call
200302433	2003	Serious Incid.	HIGH CAPACITY	NONE	Break in the tracking profile on map display screen
200302252	2003	Incident	HIGH CAPACITY	NONE	Carrying out FMC route modification
200302245	2003	Incident	UNKNOWN	NONE	Communicating with ATC
200302172	2003	Accident	OTHER AERIAL WORK	NONE	Failure of landing gear and flaps to retract
200302102	2003	Accident	OTHER AERIAL WORK	NONE	Focussed on nearby traffic
200301990	2003	Incident	HIGH CAPACITY	NONE	Interphone call from flight attendant
200301799	2003	Incident	HIGH CAPACITY	NONE	Radio congestion
200301671	2003	Incident	CHARTER	NONE	Alternator indicating a problem
200300871	2003	Incident	HIGH CAPACITY	NONE	Conversing on company radio
200300848	2003	Incident	FLYING TRAINING	NONE	Radio difficulties
200300838	2003	Incident	HIGH CAPACITY	NONE	Change of approach
200300220	2003	Accident	CHARTER	NONE	Propeller synchronisation problem
200300193	2003	Incident	UNKNOWN	NONE	Radio difficulties
200300021	2003	Accident	FLYING TRAINING	NONE	Preoccupation with practice glide approach
200206320	2002	Incident	HIGH CAPACITY	NONE	Avoiding thunderstorms
200206290	2002	Incident	CHARTER	NONE	Busy
200206210	2002	Incident	HIGH CAPACITY	NONE	Glare from the sun
200206210	2002	Incident	HIGH CAPACITY	NONE	Watching departing aircraft
200205999	2002	Incident	HIGH CAPACITY	NONE	Failure of a radio communication control panel
200205821	2002	Accident	LOW CAPACITY	NONE	Manoeuvring around a stationary aircraft
200205752	2002	Accident	PRIVATE	NONE	Reassuring nervous passenger

ATSB OCCURRENCE NUMBER	YEAR	TYPE	OPERATIONAL GROUP	INJURY	SOURCE OF DISTRACTION
200205359	2002	Incident	HIGH CAPACITY	NONE	Change in ATC frequency
200205359	2002	Incident	HIGH CAPACITY	NONE	High workload
200204936	2002	Incident	HIGH CAPACITY	NONE	Glare from the sun
200204936	2002	Incident	HIGH CAPACITY	NONE	Poor reception on load CTL frequency
200204842	2002	Accident	PRIVATE	NONE	Kangaroos on runway
200204808	2002	Accident	PRIVATE	NONE	Events in circuit area
200204712	2002	Incident	UNKNOWN	NONE	Correcting wrong transponder code
200204205	2002	Incident	PRIVATE	NONE	Passenger's conversation
200204070	2002	Incident	PRIVATE	NONE	Taxiing around tyre on runway
200203941	2002	Incident	LOW CAPACITY	NONE	Problem with landing gear
200203893	2002	Accident	OTHER AERIAL WORK	NONE	Manoeuvring for camera crew
200203878	2002	Incident	UNKNOWN	NONE	Approaching cloud
200203757	2002	Incident	HIGH CAPACITY	NONE	Non-normal approach at 10 000 ft
200203675	2002	Incident	UNKNOWN	NONE	Bad weather
200203597	2002	Accident	PRIVATE	NONE	Attention on passenger
200203573	2002	Incident	FLYING TRAINING	NONE	Coaching and assessing student
200203493	2002	Incident	HIGH CAPACITY	NONE	Extensive deviations due to bad weather
200203414	2002	Accident	OTHER AERIAL WORK	NONE	Dusty conditions during lift-off
200203200	2002	Incident	HIGH CAPACITY	NONE	Burning smell in cockpit
200203197	2002	Incident	HIGH CAPACITY	NONE	Intimidating check captain
200203111	2002	Incident	PRIVATE	NONE	Wallaby on runway
200203064	2002	Incident	PRIVATE	NONE	Communication problems during a frequency transfer
200202843	2002	Incident	CHARTER	NONE	Mechanical problem with co-pilot's seat
200202812	2002	Incident	FLYING TRAINING	NONE	Manoeuvring around a cone on runway
200202680	2002	Incident	HIGH CAPACITY	NONE	Concentrating on new taxiway
200202622	2002	Accident	PRIVATE	NONE	Attempting to site another aircraft on a crossing runway
200202560	2002	Accident	PRIVATE	NONE	Kangaroos on runway

ATSB OCCURRENCE NUMBER	YEAR	TYPE	OPERATIONAL GROUP	INJURY	SOURCE OF DISTRACTION
200202179	2002	Incident	CHARTER	NONE	Co-pilot vacating seat
200202138	2002	Incident	CHARTER	NONE	Concerned with departing prior to inbound company aircraft
200202125	2002	Incident	LOW CAPACITY	NONE	Conversing with another company pilot
200201992	2002	Incident	CHARTER	NONE	Running late for next flight
200201737	2002	Incident	LOW CAPACITY	NONE	Unruly passenger
200201681	2002	Incident	FLYING TRAINING	NONE	Go-around of another aircraft
200201412	2002	Incident	LOW CAPACITY	NONE	Filling out flight log
200201283	2002	Incident	HIGH CAPACITY	NONE	Communicating with ATC
200200463	2002	Incident	HIGH CAPACITY	NONE	Monitoring the weather
200200245	2002	Incident	AGRICULTURE	NONE	Motor vehicle near spraying area
200200109	2002	Incident	UNKNOWN	NONE	Looking for a parking area
200106119	2001	Incident	HIGH CAPACITY	NONE	Diverting around bad weather
200106058	2001	Incident	PRIVATE	NONE	Increasing engine temperature
200105969	2001	Incident	OTHER AERIAL WORK	NONE	Manoeuvring around a parked aircraft
200105942	2001	Incident	UNKNOWN	NONE	Identifying engine problem
200105932	2001	Accident	CHARTER	NONE	Concerned with time pressure
200105744	2001	Accident	AGRICULTURE	MINOR	Setting up spray run equipment
200105733	2001	Incident	HIGH CAPACITY	NONE	Training student
200105733	2001	Incident	HIGH CAPACITY	NONE	High workload situation
200105685	2001	Incident	UNKNOWN	NONE	Diverting around bad weather
200105468	2001	Incident	PRIVATE	NONE	In a rush due to bad weather
200105409	2001	Incident	HIGH CAPACITY	NONE	Conscious of First Officer's cross-wind limit
200105409	2001	Incident	HIGH CAPACITY	NONE	Setting missed approach altitude
200105398	2001	Incident	UNKNOWN	NONE	Door that opened during flight
200105370	2001	Incident	FLYING TRAINING	NONE	Student crossing the holding point line
200105246	2001	Incident	FLYING TRAINING	NONE	Being off-track
200105195	2001	Incident	AGRICULTURE	NONE	Adjusting and resetting a broken water pump ground unit

ATSB OCCURRENCE NUMBER	YEAR	TYPE	OPERATIONAL GROUP	INJURY	SOURCE OF DISTRACTION
200105183	2001	Accident	OTHER AERIAL WORK	NONE	Unusual steel decking plate on a concrete pad
200105170	2001	Incident	UNKNOWN	NONE	Concentrating on RPT traffic
200105048	2001	Incident	FLYING TRAINING	NONE	Busy traffic period
200104968	2001	Incident	FLYING TRAINING	NONE	Closing a window during flight
200104796	2001	Incident	HIGH CAPACITY	NONE	Lockout lever in "lockout" position
200104715	2001	Incident	CHARTER	NONE	Passenger visiting cockpit
200104582	2001	Incident	UNKNOWN	NONE	Transmission interference
200104564	2001	Incident	UNKNOWN	NONE	Looking for a break in the cloud
200104460	2001	Incident	PRIVATE	NONE	Avoiding a parked aircraft
200104375	2001	Incident	UNKNOWN	NONE	Adverse wind effect
200104353	2001	Accident	PRIVATE	NONE	Report about a hump in the middle of runway
200104333	2001	Incident	CHARTER	NONE	Diverting around cloud
200104281	2001	Incident	LOW CAPACITY	NONE	Premature boarding of passenger
200104192	2001	Incident	CHARTER	NONE	Testing new PAL equipment
200104145	2001	Incident	PRIVATE	NONE	Positioning the aircraft
200104145	2001	Incident	PRIVATE	NONE	Radio work with 3 other aircraft
200104027	2001	Incident	UNKNOWN	NONE	Operating first passenger flight
200103649	2001	Incident	PRIVATE	NONE	Kangaroos on runway
200103348	2001	Incident	UNKNOWN	NONE	Pre-takeoff checks
200103262	2001	Incident	FLYING TRAINING	NONE	Parachutists in the vicinity
200103193	2001	Incident	HIGH CAPACITY	NONE	Looking for taxiway
200103193	2001	Incident	HIGH CAPACITY	NONE	High workload
200103079	2001	Incident	HIGH CAPACITY	NONE	Problem with the main fuel tank
200103034	2001	Incident	FLYING TRAINING	NONE	Prioritising workload
200102724	2001	Incident	LOW CAPACITY	NONE	Attempting to make scheduled departure time
200102398	2001	Accident	CHARTER	NONE	Bad weather
200101834	2001	Incident	FLYING TRAINING	NONE	Stomach cramps

ATSB OCCURRENCE NUMBER	YEAR	TYPE	OPERATIONAL GROUP	INJURY	DISTRACTION
200101515	2001	Accident	OTHER AERIAL WORK	MINOR	Film crew instructing pilot w here to fly
200101465	2001	Incident	UNKNOWN	NONE	Tracking problems
200101265	2001	Accident	CHARTER	NONE	Yachts and other boats in vicinity of touchdow n area
200101218	2001	Accident	CHARTER	NONE	Mobile phone call
200101172	2001	Accident	OTHER AERIAL WORK	NONE	Closing the cattle gate
200101103	2001	Incident	AGRICULTURE	NONE	Approaching vehicle on highw ay
200101001	2001	Incident	PRIVATE	NONE	Radio transmissions
200100910	2001	Incident	PRIVATE	NONE	Conversing w ith refueller prior to take-off
200100874	2001	Incident	HIGH CAPACITY	NONE	Communicating w ith ATC
200100649	2001	Incident	UNKNOWN	NONE	An ill passenger
200100476	2001	Accident	AGRICULTURE	SERIOUS	Conversing on company radio
200006364	2000	Incident	UNKNOWN	NONE	Problems w ith the ADF
200006283	2000	Incident	PRIVATE	NONE	Emergency training exercise on the ground
200006225	2000	Incident	LOW CAPACITY	NONE	Cockpit duties
200006052	2000	Incident	LOW CAPACITY	NONE	Avoiding thunderstorms
200005892	2000	Incident	LOW CAPACITY	NONE	Communicating w ith ATC
200005522	2000	Incident	UNKNOWN	NONE	Communicating w ith ATC
200005030	2000	Serious Incid.	HIGH CAPACITY	NONE	Unexpected loss of directional control
200004909	2000	Incident	UNKNOWN	NONE	Completing paperw ork
200004471	2000	Incident	OTHER AERIAL WORK	NONE	Searching for a river
200004414	2000	Incident	PRIVATE	NONE	Diverting around bad w eather
200004190	2000	Incident	HIGH CAPACITY	NONE	Flightcrew training and cockpit duties
200003863	2000	Incident	CHARTER	NONE	Unfamiliar terrain
200003836	2000	Incident	LOW CAPACITY	NONE	Cockpit duties
200003690	2000	Accident	OTHER AERIAL WORK	NONE	Passenger's sighting of a crocodile
200003665	2000	Incident	UNKNOWN	NONE	Communication difficulties
200003181	2000	Incident	CHARTER	NONE	Photographer standing by the fence

ATSB OCCURRENCE NUMBER	YEAR	TYPE	OPERATIONAL GROUP	INJURY	SOURCE OF DISTRACTION
200003099	2000	Incident	HIGH CAPACITY	NONE	Simultaneous engagement of autopilot and cancellation of speed restriction
200002968	2000	Incident	UNKNOWN	NONE	Obtaining ATC radar response
200002861	2000	Incident	HIGH CAPACITY	NONE	Training second officer
200002610	2000	Incident	PRIVATE	NONE	Speed indicator
200002531	2000	Incident	UNKNOWN	NONE	Problem with headset
200002243	2000	Incident	HIGH CAPACITY	NONE	Passing messages to the Cabin Services Manager
200002147	2000	Incident	CHARTER	NONE	Communication temporarily lost
200002031	2000	Incident	LOW CAPACITY	NONE	Conversing with co-pilot
200002027	2000	Incident	HIGH CAPACITY	NONE	Dealing with busy ATC
200001885	2000	Incident	LOW CAPACITY	NONE	TCAS equipment
200001764	2000	Incident	LOW CAPACITY	NONE	Time pressure to regain schedule
200001720	2000	Incident	PRIVATE	NONE	Arguing with passenger
200001710	2000	Incident	UNKNOWN	NONE	Looking for a break in the cloud
200001690	2000	Incident	HIGH CAPACITY	NONE	Communicating with ATC
200001105	2000	Incident	HIGH CAPACITY	NONE	Communicating with ATC
200001057	2000	Incident	CHARTER	NONE	Conducting cockpit checks
200000863	2000	Incident	LOW CAPACITY	NONE	Attention on passenger
200000849	2000	Incident	FLYING TRAINING	NONE	Radio problems
200000843	2000	Incident	CHARTER	NONE	Conversing with co-pilot
200000622	2000	Accident	CHARTER	NONE	Foggy windscreen
200000582	2000	Incident	FLYING TRAINING	NONE	Student performance
200000484	2000	Incident	LOW CAPACITY	NONE	Possible problem with engine
200000397	2000	Incident	FLYING TRAINING	NONE	Training student
200000337	2000	Incident	CHARTER	NONE	Passenger boot lodged behind rudder pedal
200000266	2000	Incident	OTHER AERIAL WORK	NONE	Conversing on company radio
200000036	2000	Incident	PRIVATE	NONE	Incorrect radio frequency
199906070	1999	Incident	UNKNOWN	NONE	Problem with generator

ATSB OCCURRENCE NUMBER	YEAR	TYPE	OPERATIONAL GROUP	INJURY	DISTRACTION
199905522	1999	Incident	FLYING TRAINING	NONE	Student performance
199905518	1999	Accident	FLYING TRAINING	NONE	Livestock on runway
199905329	1999	Incident	UNKNOWN	NONE	Radio communication problem
199905238	1999	Incident	HIGH CAPACITY	NONE	Flight crew discussion on windshear conditions
199905234	1999	Incident	AGRICULTURE	NONE	Person near the crop
199905214	1999	Incident	HIGH CAPACITY	NONE	Intercepting the localiser
199905183	1999	Incident	CHARTER	NONE	Problem with door
199905066	1999	Incident	UNKNOWN	NONE	Picking up dropped map
199905011	1999	Incident	OTHER AERIAL WORK	NONE	Testing aircraft systems
199904935	1999	Incident	HIGH CAPACITY	NONE	Programming the FMC
199904794	1999	Incident	AGRICULTURE	NONE	Blocked view due to tree
199904402	1999	Incident	CHARTER	NONE	Busy doing ancillary duties
199904351	1999	Incident	HIGH CAPACITY	NONE	Listening to wheelchair requirements from Cabin Service Manager
199904284	1999	Incident	LOW CAPACITY	NONE	Watching approaching aircraft
199904103	1999	Incident	FLYING TRAINING	NONE	Conversing with student
199904072	1999	Incident	HIGH CAPACITY	NONE	Unforecast fog
199903679	1999	Incident	PRIVATE	NONE	Communication difficulties
199903501	1999	Incident	CHARTER	NONE	Erroneous airspeed and altitude readings
199903445	1999	Accident	OTHER AERIAL WORK	NONE	Detecting rotor vibration
199903117	1999	Accident	CHARTER	NONE	Pre-takeoff checks
199902863	1999	Incident	LOW CAPACITY	NONE	Glare from the sun
199902511	1999	Incident	HIGH CAPACITY	NONE	Flight attendant entering cockpit
199902232	1999	Incident	CHARTER	NONE	Avoiding soft runway edges
199901888	1999	Incident	CHARTER	NONE	Avoiding traffic in circuit area
199901643	1999	Incident	PRIVATE	NONE	Preparing for a navigational exercise
199901643	1999	Incident	PRIVATE	NONE	Two passenger's on aircraft
199900846	1999	Incident	HIGH CAPACITY	NONE	Weather conditions

ATSB OCCURRENCE NUMBER	YEAR	TYPE	OPERATIONAL GROUP	INJURY	SOURCE OF DISTRACTION
199900404	1999	Incident	LOW CAPACITY	NONE	High workload phase of flight
199900383	1999	Incident	BUSINESS	NONE	Ancillary duties during a period of high workload
199804967	1998	Incident	CHARTER	NONE	Programming the GPS receiver
199804896	1998	Incident	UNKNOWN	NONE	Radio problems
199804628	1998	Accident	CHARTER	NONE	Congestion on radio
199804132	1998	Incident	FLYING TRAINING	NONE	Passenger mistaking a glowing exhaust system for an engine fire
199804012	1998	Incident	HIGH CAPACITY	NONE	Problem with position of engine air door
199803897	1998	Accident	CHARTER	NONE	Vehicles on the ground
199802817	1998	Incident	CHARTER	NONE	Preoccupation with performance during practice ILS approach
199802197	1998	Incident	UNKNOWN	NONE	Entering transponder code
199802029	1998	Accident	CHARTER	NONE	Bad weather
199801708	1998	Incident	FLYING TRAINING	NONE	Dead rabbit on runway
199801676	1998	Accident	AGRICULTURE	NONE	Irregular movements of GPS guidance lightbar
199801051	1998	Accident	AGRICULTURE	MINOR	Monitoring GPS
199800674	1998	Accident	PRIVATE	NONE	Aircraft in same circuit area
199800574	1998	Incident	UNKNOWN	NONE	Testing GPS and VOR equipment
199800421	1998	Accident	AGRICULTURE	NONE	Manoeuvring to avoid a tree
199800065	1998	Accident	AGRICULTURE	NONE	Adjusting spray pressure
199704324	1997	Accident	BUSINESS	NONE	Mobile phone call
199704041	1997	Incident	HIGH CAPACITY	NONE	No. 3 engine's low N1
199703878	1997	Accident	FLYING TRAINING	NONE	Problem with radio
199703129	1997	Accident	CHARTER	NONE	Radio jammed on continous transmission
199701226	1997	Accident	PRIVATE	NONE	Slow traffic in circuit area
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Australian Government

Australian Transport Safety Bureau

Media Release

ATSB Research Report finds 325 cases of pilot distraction

No pilot is immune from distraction. Like all humans, pilots are susceptible to becoming preoccupied and distracted with one task to the detriment of another, according to an Australian Transport Safety Bureau (ATSB) report released today.

The ATSB Research report – Dangerous distraction: An examination of accidents and incidents involving pilot distraction in Australia between 1997 and 2004 – found that 325 occurrences reported to the ATSB between 1997 and 2004 probably involved pilot distraction, but the majority were incidents rather than accidents or serious incidents.

Most of the occurrences did not result in injuries, but there were two fatal accidents.

According to the report, distraction can affect pilots operating in any type of organisation – from small regional operations to large commercial airlines. Distractions can occur unexpectedly, during periods of high or low workload and during any phase of operation, including on the ground or in-flight.

The report identifies a wide range of distraction sources including equipment malfunctions, radio communication problems, passengers, and weather.

The report groups the majority of distractions into the categories of 'flight management tasks,' 'external objects,' and 'people on board the aircraft.'

The ATSB research was suggested by Victorian State Coroner Mr Graeme Johnstone who was concerned that some aviation accidents may be linked to sightseeing and the use of videos or cameras by passengers which could distract the pilot from flying the aircraft.

In 2003 a light aircraft which hit a powerline over Lake Eildon in Victoria killed all four people on board. Video camera film retrieved from the wreckage showed the aircraft flying at a low level over the lake with the front seat passenger filming houseboats.

The Coronial finding suggested the possibility of pilot distraction as the pilot had descended the aircraft to an unsafe height.

The ATSB report also discusses distraction in other transport modes and incorporates material supplied by Australian Coroners who assisted with the study.

Dangerous distraction: An examination of accidents and incidents involving pilot distraction in Australia between 1997 and 2004, is available on the ATSB website at www.atsb.gov.au

Media contact: Mr George Nadal