Australian Government
Department of Transport and Regional Services
Bureau of Transport and Regional Economics

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Cost of Aviation Accidents and Incidents

BTRE Report 113

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Foreword

In 1998, the Bureau of Transport Economics published its Report 98—*Cost of Civil Aviation Accidents and Incidents*. That report was based on occurrences in 1996 and presented values in 1996 dollars. This report is an update of that analysis based on occurrences in the 2003/04 financial year and using 2004 dollar values.

Accident and fatality costs are used as inputs to various policies and programmes. With inflation and rising standards of living, the values per life and per accident are higher than in 1996.

The efforts of Kerri Hughes from the Australian Transport Safety Bureau (ATSB) in extracting data from ATSB's Accidents and Incidents database are much appreciated. Thanks are also due to Michael Watson and Dianne Coyne of ATSB in pursuing age related data.

Quentin Reynolds drafted this report, supervised by Tim Risbey.

Phil Potterton
Executive Director
Bureau of Transport and Regional Economics
Canberra
February 2006

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Executive summary

This report provides estimates of the total cost to Australia of aviation related accidents and incidents that occurred in the financial year 2003/04. It also reports the cost per accident and the cost attributable to a fatality.

It is an update of Cost of Civil Aviation Accidents and Incidents published by the Bureau of Transport Economics in 1998, which estimated costs for 1996.

Accident and fatality costs are used as inputs to various policies and programmes. With inflation and rising standards of living, the values per life and per accident are higher than in 1996.

The approach used is based on the human capital methodology, which puts the major value of a life as the productive output of an individual over their working life. To this has been added an estimate of the value of work in the household and volunteer work, and a value for quality of life.

Wages have increased for both men and women, and employment rates have changed. The people who died in 2003/04 accidents—where ages are known—were on average younger than those in 1996. Our methodology captures the effects of these changes in the estimates of cost.

The number of accidents in 2003/04 was less than two thirds the number in 1996. There were also fewer people killed or injured.

The total cost to Australia from all accidents and incidents in the aviation sector in 2003/04 is estimated at $114 million. There were no fatalities in the regular passenger transport sector and the total cost to Australia per reported accident is estimated at $745 000. The cost attributed to each fatality is $2.17 million.

Ideally, willingness to pay studies should be used to assess safety improvements on a project by project basis, incorporating the values and tradeoffs of actual people. This would be a context specific approach, allowing users to reveal how much safety they wish to buy.

It is recognised that, in circumstances where the group affected is unknown or a willingness to pay study is otherwise not feasible, the results in this study—incorporating the human capital approach—may possibly be used. Some advice on how the results are appropriately used is offered in the report.

Chapter 1 Introduction

BACKGROUND

In 1998, the Bureau of Transport Economics published its Report 98—*Cost of Civil Aviation Accidents and Incidents*[1]. That work reported on the economic costs of aviation accidents and incidents resulting from the operation of Australian aircraft in Australia in 1996. It presented results in 1996 dollar values.

Some of our stakeholders have wanted an update for some time—the average values of an accident and of a fatality are important inputs for policy and programme purposes.

Due to rising standards of living and productivity improvements, injuries that remove people from the workforce—either temporarily or permanently—will have a higher economic cost than in 1996. This provides a slow steady increase in costs associated with accidents. Further, albeit less smoothly, technology continues to advance, so the cost of reducing the risk of injury or death continues to decline. This suggests a never ending task, for operators and regulators, in balancing what safety can be provided and how much safety people want to buy.

OBJECTIVE

This report provides an update of our previous analysis. It reflects the reported accidents and incidents for Australian registered aircraft, as recorded in the ATSB's Accident and Incident database[2].

The analysis is based on reports to ATSB in the 2003/04 financial year, and provides estimates of the total cost to Australia, as well as the cost per fatality and per accident.

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1 BTE (1998).

2 BTE (1998) estimated 'the economic costs of aviation accidents and incidents resulting from the operation of Australian aircraft in Australia for 1996.'

ACCIDENT AND INCIDENT DEFINITIONS

Why and when certain aviation occurrences are reported to the ATSB is detailed on their website[3].

A serious injury means[4] an injury that requires, or would usually require, admission to hospital within 7 days after the day when the injury is suffered. A fatality as defined by ICAO is an injury resulting in death within thirty days of the date of the accident[5].

An accident is a matter involving a transport vehicle[6] where:

a) a person dies or suffers serious injury as a result of an occurrence associated with the operation of the vehicle; or

b) the vehicle is destroyed or seriously damaged as a result of an occurrence associated with the operation of the vehicle; or

c) any property is destroyed or seriously damaged as a result of an occurrence associated with the operation of the vehicle.

Matters not involving a), b), or c) above are incidents. There were 267 incidents involving minor aircraft damage and/or minor injuries in 2003/04, resulting in 18 people receiving minor injuries. Estimated costs for these incidents have been included in the estimates.

METHODOLOGY

This report updates key values to produce an estimate of the cost to Australian society of the accidents and incidents that occurred during the 2003/04 financial year. The approach taken in analysing the major contributor to costs—the value of human life—is the same as that used in BTE (1998). Some elements that were small or insignificant in that report (in monetary terms) are not valued comprehensively here. Rather, they are included in the overall results by applying a small contingency allowance, based on the BTE (1998) results—see Chapter 3 for details.

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3 < http://www.atsb.gov.au/aviation/occurs/reporting.cfm> —for reference, these pages are reproduced in Appendix A.

4 According to the Transport Safety Investigation Regulations 2003 <http://scaletext.law.gov.au/html/pastereg/3/1798/0/PR000060.htm>

5 Annex 13 to the Convention on International Civil Aviation.

6 This definition is taken from the Transport Safety Investigation Act 2003 <http://scaletext.law.gov.au/html/pasteact/3/3578/0/PA000070.htm> except that in that Act, the definition begins "An accident is an investigable matter involving ..." The change in this report is to capture Category 5 matters, which are not investigated, even though they meet the a), b), or c) categories, above. ATSB's website <http://www.atsb.gov.au/aviation/occurs/operates.cfm> gives guidance on the 1 to 5 categorisations — for reference, these pages are included in Appendix B.

By using age and gender specific life expectancy tables, an estimate is made of the probable length of life if a death had not occurred. An estimate of wages is applied to those remaining years of life, as well as an allowance for unpaid work outside the workplace. An allowance for lost quality of life is added for fatalities as well as for people who are injured[7]. The cost of the aircraft lost or damaged is estimated from insurance company data. Finally, a contingency is added for various minor elements that contribute to the overall cost to society.

Chapter 2 reviews some of the trends in statistics over the last nine years, including the major changes in inputs since the previous analysis. Chapter 3 reviews the methodology in BTE (1998) and shows the significant elements in the analysis. Chapter 4 presents the contributions made under various headings and Chapter 5 presents the results, as well as providing some qualifications on how the results might be used.

7 In accordance with the method used in BTE (1998).

Chapter 2 The Major Trends

This chapter compares the number of accidents and fatalities for 2003/04 with statistics in previous reports, then reviews some of the trends in aviation accidents between 1996 and 2004.

THE NUMBER OF ACCIDENTS

BTRE has used 2003/04 data supplied by the Australian Transport Safety Bureau (ATSB)[8].

For comparison with table S.1 in BTE (1998), the following table is provided.

TABLE 2.1: ACCIDENTS AND INJURIES OVER TIME

			People with injuries classed as	
Year	Accidents	Fatalities	Serious	Minor*
1988 (R98)	328	70	44	55
1993 (R98)	320	37	57	64
1996 (R98)	247	51	35	86
1996 (ATSB, 2004)	245	51	34	89
2003/2004 (ATSB, 2004)	153	37	32	73

Note: The statistics marked (R98) are reproduced from BTE (1998), page xi. That analysis covered 'aviation accidents that occurred in Australia during 1996' (BTE (1998) page 1). The statistics marked (ATSB, 2004) are from the present analysis by BTRE of data supplied by the Australian Transport Safety Bureau from September 2004. The latter cover Australian registered aircraft only and relate to accidents that occurred both inside and outside of Australian Territory; * minor injuries include injuries from 'Incidents'. The data for 1996 in BTE (1998) (3rd row of numbers in above table) are slightly different from that obtained from ATSB in 2004 (4th row of numbers). The differences are inconsequential.

Source: BTE (1998) and ATSB unpublished data, 2004, 2005. The data provided by ATSB for this report are preliminary. This reflects that, over time, adjustments become necessary as a consequence of further investigations and the outcomes of various court proceedings.

The number of accidents and the number of fatalities are major contributors to overall cost. Accidents decreased from 245 in 1996 to 153 in 2003/04, a reduction of over one third (37.6 per cent). There were 51 fatalities in 1996 and 37 in 2003/04 (27.5 per cent reduction).

The number of minor injuries from incidents varies considerably from year to year. Between July 1995 and June 2004, the number per annum varied between 11 and 80—it was 18 in 2003/04. Some occur in regular passenger transport—unforeseen turbulence is often the cause—

8 Accidents are defined in detail on page 1.

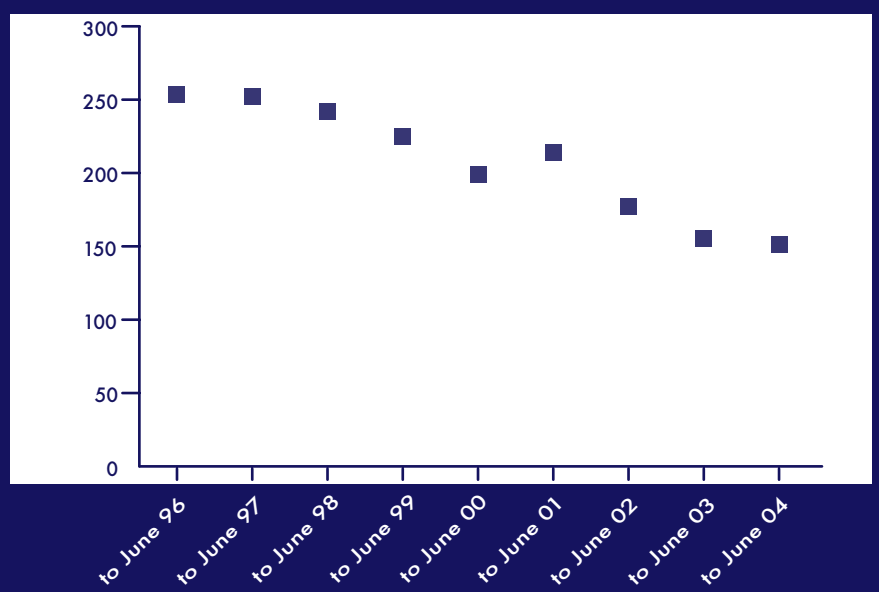
mostly resulting in falls to cabin crew but with passengers occasionally involved. Some incidents involved fumes entering the cabin.

A summary of accidents by statistical group for 2003/04 is provided in appendix C.

TRENDS

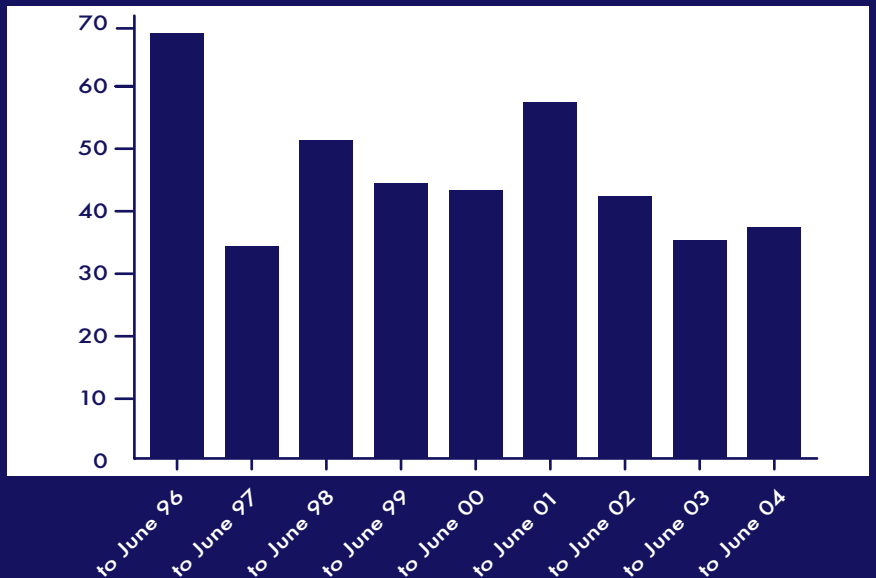
Accidents in general aviation have been trending downward over the last decade. This is shown below in figures 2.1, 2.2 and 2.3.

FIGURE 2.1 ACCIDENTS, ANNUALLY



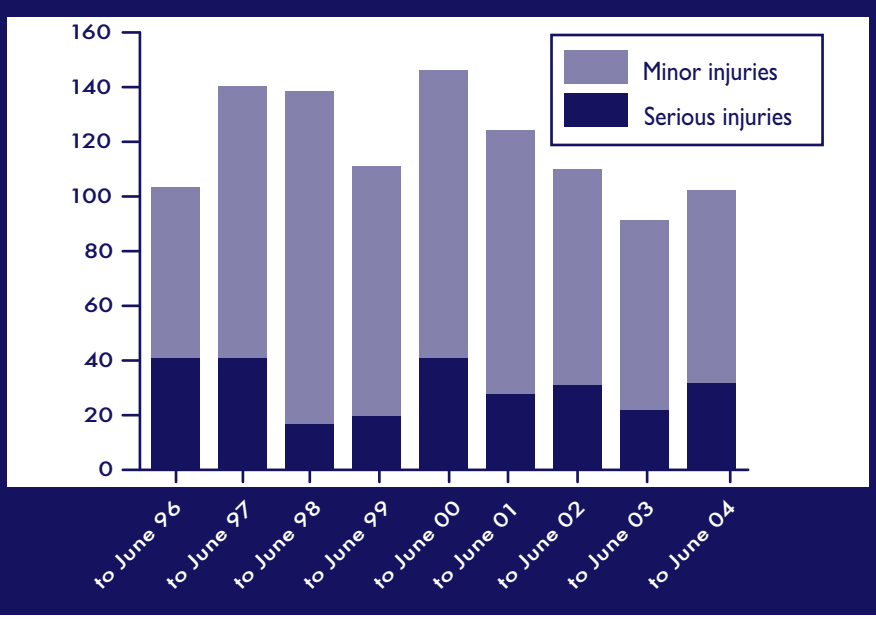
Source: BTRE analysis of ATSB Accidents and Incidents database.

FIGURE 2.2 FATALITIES, ANNUALLY



Source: BTRE analysis of ATSB Accidents and Incidents database.

FIGURE 2.3 SERIOUS AND MINOR INJURIES, ANNUALLY



Source: BTRE analysis of ATSB Accidents and Incidents database.

CASA (2004) states[9] that over the decade 1994 to 2003:

- *the total number of general aviation accidents per 100 000 hours flown is estimated to have decreased at a steady rate of 4.4 per cent per year*
- *the number of fatal accidents per 100 000 hours flown in the general aviation sector is estimated to have declined by 5.7 per cent each year*
- *the number of fatalities per 100 000 hours flown in the general aviation sector is estimated to have declined by 3.7 per cent each year.*

BTRE carried out a number of regressions to test the significance of the apparent downward trends using 6-monthly periods. The number of pilot-in-command fatalities has a statistically significant downward trend, with only a 1 per cent chance that this is not the case. There were 15 pilot-in-command fatalities in July to December 1995 and only 8 in January to June 2004. The best fit line had a downward slope of -0.7 fatalities per annum.

The number of accidents per annum declined at an average rate of 6.9 per annum. This too was statistically significant, with negligible probability that the downward trend was a chance occurrence.

Summary

- In BTE (1998), the number of accidents in 1996 was reported as 247. In this study we found that the number of accidents in 2003/04 was only 153. Similarly, the number of fatalities has reduced from 51 to 37, the number of serious injuries from 35 to 32 and the number of minor injuries from 86 to 73.
- There appears to be a general downward trend in the number of accidents, fatalities and injuries when comparing data for 1996 with the 2003/04 figures in this study.
- For two categories investigated—the number of pilot-in-command fatalities and the number of accidents—there was a downward trend that is statistically significant.
- With small numbers of occurrences per annum, large fluctuations year to year, and relatively few years, the apparent downward trends were not able to be statistically proven for most categories.

9 In their 2003-04 Annual Report, pages 15 and 16, <http://www.casa.gov.au/corporat/annualreport/htm/part2b.htm>

Chapter 3 Methodology

This chapter details the methodology used in this update of the cost of aviation accidents and incidents.

THE COSTING FRAMEWORK

The Human Capital approach puts the major value of a person's life as the productive output of that individual over their working life. This assumes that productive output of the economy would be foregone if a significant input to the production process—one employed person—were removed. The loss is valued at the wages that would have been earned—during recuperation for people injured, or over a persons expected remaining life for fatalities. To this losses of paid work base has been added an estimate of the value of work in the household and volunteer work, values for lost quality of life, and other costs associated with accidents and incidents.

This framework is the one used in BTE (1998) and other recent BTRE work. Some minor variations to the detailed approach in BTE (1998) are described below in APPROACH VARIATION.

Life years lost

By using age and gender specific life expectancy tables, an estimate is made for each fatality of the probable expected length of life if their death had not occurred. Life expectancy is taken from ABS (2004b).

Earnings

Life expectancy data is combined with wage rate data to model typical periods of earnings over life. The value of labour used is the dollar amount an employer pays for a unit of labour as an input to production. Average earnings data is used from ABS (2005).

Wages growth

Weekly earning figures are annualised and a 1 per cent real annual growth rate was applied to take account of real increases in labour costs over time. This is discussed under the heading KEY PARAMETERS, below.

Employment

At each age, only a proportion of the population hold paid positions. In general, the remainder are unemployed persons, voluntary workers and other people who are not part of the labour force. To represent this, the earnings stream over time was adjusted using age and gender specific employment rates[10]. The estimated losses were then discounted to their present value. (Discount rates are discussed in KEY PARAMETERS below.)

Unpaid work

Average hours of unpaid work outside the workplace were obtained from time use data, from ABS. This is the same source as in BTE (1998) and provides average hours per week spent in work in the home and work for the community by age group, gender and employment status. Wage rates derived from the ABS were applied to obtain estimates of the total value of unpaid work. The value per hour for those in the formal workforce has been used to value the loss of household and community activities.

Lost quality of life

In BTE (1998), compensation paid to road crash victims in Australia was used to estimate the value of lost quality of life. Except for valuing fatalities, the values used in BTE (1998) have been used in this analysis, increased in line with the Consumer Price Index to bring them to current dollars.

In BTE (1998), a cost for lost quality of life was attributed to injuries as well as fatalities. Loss of quality of life for a fatality was based on court awards for damages in cases of the most extreme health impairment. In that report[11] the value used was $214 000 in 1996 dollar values.

The same philosophy was used in BTE (2000), using more recent data and correcting for an apparent anomaly. In that report the lost quality

10 ABS (2004a).

11 BTE (1998), page 31.

of life attributable to a fatality was $319 030 in 1996 dollar values[12]. This higher value is used in this analysis, with allowance for inflation.

This modification to the human capital approach—the attribution of a lost quality of life to a fatality—has been adopted by BTRE in recent reports, but not without criticism. Abelson (2003)[13] noted BTRE's approach, but observed that 'It is not clear that this is relevant to a fatal accident.'

It is perhaps illustrative to consider how this is treated in the law. In personal injuries cases, quality of life compensation for the living is meant as compensation due to the injured party being unable to enjoy the quality of life that they previously had. Ongoing pain and suffering would certainly be an issue. However, if someone dies, their bodily functions cease and they will have no understanding of what is being missed, no ongoing pain and suffering, and no need for compensation.

Common law rules hold that personal claims for damages are extinguished with the death of a person. Some States and Territories have legislated to overturn these common law rules. The legislation is not identical and allows for the survival of some claims for pain and suffering after someone has died—but only in special circumstances, and none directly related to aviation or transport generally[14].

The Bureau has included a value of quality of life of a fatality in this report, consistent with the approach in BTE (2000). The inclusion of a value of lost quality of life for a fatality overcomes a moral issue—if it was excluded, then in BTRE's human capital approach the value of the most serious injury cases would have a higher monetary value than the value of a fatality.

In the present analysis, the lost quality of life values used are $386 000 per fatality, $154 000 per serious injury and $11 200 per minor injury (in 2004 dollar values).

Property damage

There is little evidence of damage to any other property, other than loss or damage to aircraft that are involved in the various accidents and incidents. As in BTE (1998), damage to property other than aircraft is assumed to be zero.

Confidential claim payout data from industry sources were initially factored up to represent the whole industry. This suggested that the property damage costs for 2003/04 totalled in the order of $21.6 million.

12 BTE (2000), page 37.

13 Abelson's comment (page S8 of Abelson (2003)) related to BTE (2000) which used the same philosophy as in BTE (1998) as discussed above.

14 Luntz (2002), especially page 479: 'Survival of action to the estate'.

This approach might produce a slight bias, in that insurance coverage did not extend to sports aircraft such as gyro-planes and ultralights—generally lower in value—or major airlines—larger passenger aircraft may be expected to have substantially higher repair costs.

In an attempt to overcome any possible bias in the above approach, a more detailed allocation of costs was done. This involved assigning a representative payout cost to each accident, depending on whether the aircraft was a glider; rotary wing—with different costs for piston or turbine engine; or fixed wing—with different costs for single or multiple engine, and with different costs for piston or turbine engine. Representative costs were also added for balloons, ultralights and gyro-planes.

Two cases in 2003/04 are noteworthy. A Boeing 767 suffered minor damage (hail damage to wings, nose, engines and engine nacelles) but no injuries[15]. The aircraft was subsequently retired from service, along with six others in the operator's fleet of the same type and age—these aircraft were retired at various times during calendar years 2003 and 2004. The cost of the damage is unknown, but this analysis has assumed a zero value for repair costs.

Additionally, a fire ignited on the right wing landing gear of a Boeing 747 when it arrived at the terminal[16]. This prompted an evacuation during which nine people were injured. Average injury costs were included. The cost of the minor aircraft damage—wheels and brake units replaced—is unknown, but has been assumed to be $100 000 in this analysis.

Apart from 153 accidents, there were 255 incidents involving aircraft damage. 80 of these involved aircraft which were involved in passenger transport activities and 13 of these involved damage or failure of an engine, fan blade or propeller. In testing the impact that these 13 incidents might have on the average cost per incident, an average engine repair within passenger transport activities was estimated to cost $500 000 (see Property damage in chapter 4).

The more detailed allocation of costs produces an industry wide estimate for cost of aircraft damage of $23.4 million in 2003/2004 dollar values for accidents and incidents.

APPROACH VARIATION

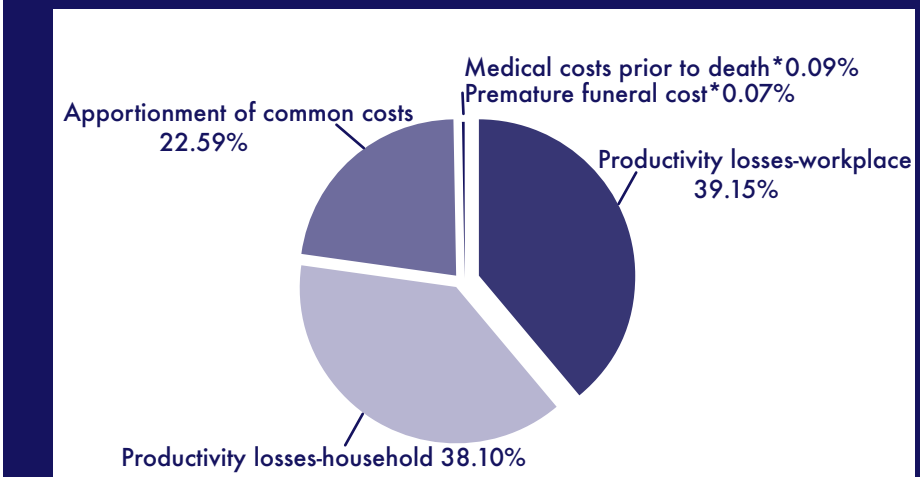
A larger number of different cost categories were estimated in BTE (1998). Fatality costs totalled $74.4 million in 1996 (figure 3.1).

Categories marked with an asterisk in figure 3.1 are not significant in monetary terms and have been omitted in this study. In total, they contribute only 0.13 per cent to the total cost of fatalities.

15 A report on this occurrence (number 200304400) is available from the ATSB < http://www.atsb.gov.au/aviation/occurs/occurs_detail.cfm?ID=590>.

16 A report on this occurrence (number 200302980) is available from the ATSB <http://www.atsb.gov.au/aviation/occurs/occurs_detail.cfm?ID=578>.

FIGURE 3.1 COMPOSITION OF FATALITY COSTS IN 1996



Note: *Fatality costs total $74.4 M in 1996 dollars.*

Source: *BTE (1998) table 3.4*

Non-fatality injury costs totalled $37.2 million in 1996 (figure 3.2). Rehabilitation and Medical cost categories—marked with an asterisk in figure 3.2—have little impact on the results, with a contribution towards the total of non-fatality injury costs of only 4.6 per cent. To account for them in this analysis, a contingency of 4.8 per cent is added to the sub-total of the main cost categories for non-fatal injuries[17].

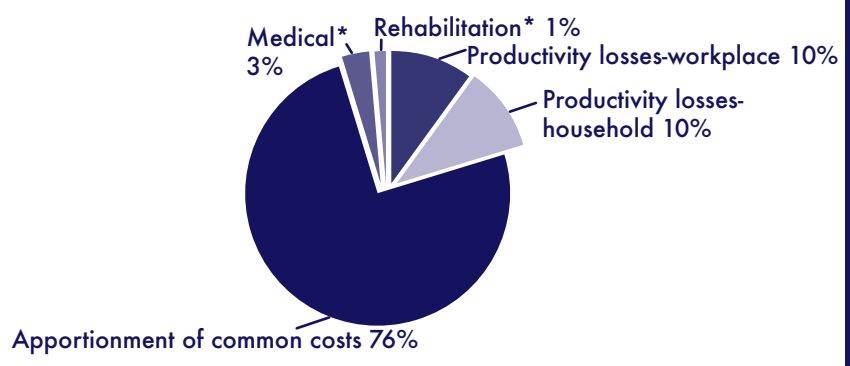
Common costs totalled $44.6 million in 1996 (figure 3.3). These are costs generally attributable to aviation accidents and incidents, but the available data do not provide sufficient basis to allocate them amongst fatalities, injuries, accidents or incidents. The categories marked with an asterisk have a fairly small impact on the results, having a total contribution to common costs of 17 per cent. This includes a provision for investigation costs.

Between 1996 and 2003/04, the costs in these categories—marked with an asterisk in figure 3.3—are likely to have changed, due to the number and type of accidents, and due to inflation. However, the percentage contributions of these categories is not likely to have changed significantly, other than due to differential inflation—some categories may have increased in cost per occurrence at slightly more or slightly

17 Productivity losses plus common costs contribute 95.4 per cent (100-4.6). This has to be increased by 4.8 per cent to represent the total (95.4x1.048=100).

less than the inflation rates applicable to the property damage and the loss of quality of life categories.

FIGURE 3.2 COMPOSITION OF NON-FATALITY INJURY COSTS IN 1996



Note: *Common costs total $37.2 M in 1996 dollars.*

** Categories marked with an asterisk are not separately estimated in this paper as they represent only 4.6 per cent of the total cost of a non-fatal injury.*

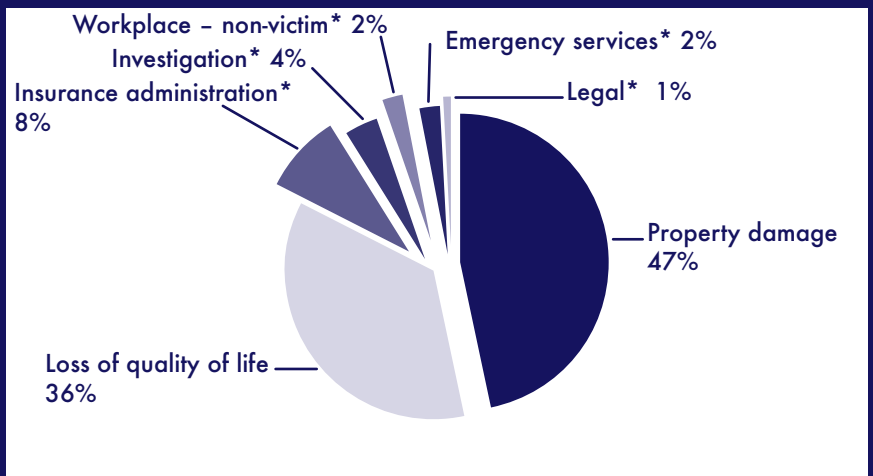
Source: *BTE (1998) table 4.1*

To account for them in this analysis, a contingency of 21 per cent is added to the costs estimated for property damage and loss of quality of life categories[18].

The total of the categories marked with asterisks in figures 3.1, 3.2 and 3.3, accounts for less than 9 per cent of the total of all accident and incident costs—4 per cent of fatality costs and 7.5 per cent of non-fatality costs. These small contributions are estimated by adding a contingency to the major cost contributors.

18 Property damage plus loss of quality of life costs contribute 83 per cent (100-17). This has to be increased by 21 per cent to represent the total (83x1.21=100).

FIGURE 3.3 COMPOSITION OF COMMON COSTS IN 1996



Note: *Common costs total $44.6 M in 1996 dollars.*

** Categories marked with an asterisk represent 17 per cent of the total common costs. They are not rigorously estimated in this paper but are included as a contingency.*

Source: *BTE (1998) table 5.1*

KEY PARAMETERS

In BTE (1998), analysis was based on 51 fatalities in 1996. For those with known age, the average age is nearly 42. Of the 37 fatalities in 2003/04, the ATSB provided ages for all but four people. For the productive output loss analysis, these four were allocated an average age of 35 years, which is the average age of those with known age who died in 2003/04. Of fatalities where gender was known, 76 per cent were male (26 of 34).

In this update compared to BTE (1998), the average number of years of productivity losses per fatality has increased for two reasons.

The average age of fatalities in BTE (1998) was 42 years and was 35 in 2003/04. This is not matched by a reduction in retirement age and so adds seven years of lost productive working life for each fatality. The consequences are discussed in chapter 5 under the heading SENSITIVITY ANALYSIS.

Additionally, the latest life expectancy tables[19] were used, rather than the data from 1992 used in BTE (1998). Life expectancy for a person killed—at average age of about 40 for those killed in aircraft accidents—

19 ABS (2004b).

has increased by about 1.5 years over the intervening period[20]. This small increase will have further increased the period of productivity losses for every death. However, this is at the end of each productive life and, with the effects of discounting, the impact of this small increase in life expectancy is minor.

Since BTE (1999), BTRE has suggested that the government bond rate is an appropriate discount rate. The government bond rate is represented by the real yield on Australian Treasury Capital Indexed Bonds[21]. In 1995 and 1996 this rate was about 5 per cent; in 1997 it was about 4.5 per cent; between 1998 and 2003 it fluctuated between 3 per cent and 4 per cent. Since August 2004, the rates for 5, 10 and 15 year bonds have all been under 3 per cent[22]. A 4 per cent discount rate was used in BTE (1998). In this analysis, a 3 per cent discount rate is used. This has the effect of increasing the present value of productivity losses by about 15 per cent.

Between 1996 and 2004, nominal wages have increased by about 30 per cent. This increases the value of productive output losses (foregone future earnings in the workplace and foregone future contributions to household and volunteer work).

In comparison, the Consumer Price Index increased by 21 per cent between June 1996 and June 2004. This means that real wages grew at about 1 per cent per annum. In this paper real wages are assumed to continue growing at 1 per cent per annum. BTE (1998) used a real wages growth rate of 2 per cent. Changing the real wages growth rate from 2 per cent to 1 per cent reduces the present value of productivity losses by about 14 per cent.

20 Ibid, Table 7.3

21 Recent and historical data on these yields is available from the Reserve Bank of Australia <http://www.rba.gov.au/Statistics/indicative.html>

22 On 16 March 2005, real yields were 2.69 per cent, 2.75 per cent and 2.765 per cent for bonds with maturity dates of August 2010, August 2015 and August 2020 respectively. Historical data available from the RBA website show the trends described.

Chapter 4 Cost Estimates

This chapter outlines the estimated social costs in terms of fatalities, non-fatal injuries and common costs in 2003/04. These estimates are compared to the 1996 estimates.

FATALITY COSTS

The costs attributable to the 37 fatalities in 2003/04 total $80.2 million. The vast majority of this cost ($59.7 million, 74 per cent) comes from our estimate of productive output loss—which totals lost contributions to workplace, household and volunteer work.

In BTE (1998), the fatality costs totalled $74.4 million in 1996 dollar values—$89.9 million in 2004 dollar values, CPI adjusted, of which 77 per cent was attributable to productive output losses.

NON-FATAL COSTS

The total cost attributable to accidents and incidents without a fatality that occurred in 2003/04 is $33.7 million. $20.7 million of this (61 per cent) comes from Bureau estimates of costs for the loss or repair of aircraft, with the majority ($16.1 million) attributable to incidents.

In BTE (1998), the costs attributed to non-fatal accidents and incidents was $37.2 million in 1996 dollar values ($45.0 million in 2004 dollar values, CPI adjusted). 45 per cent was attributable to repair/replacement costs of aircraft damage.

COMMON COSTS

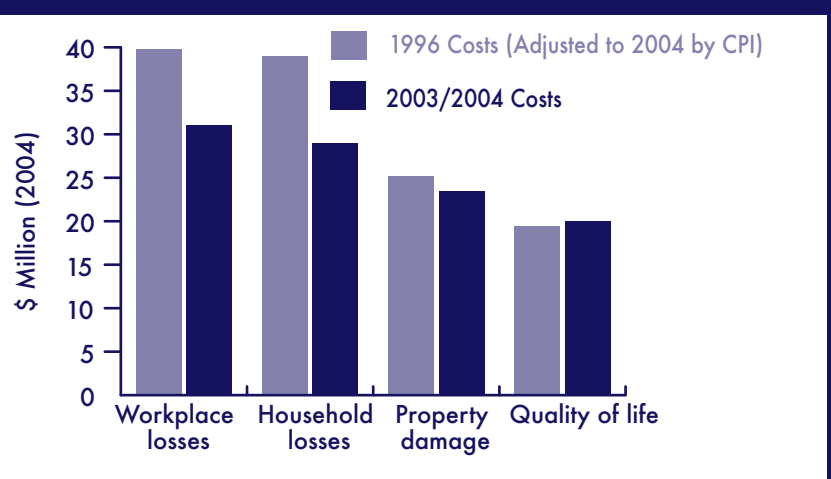
The refined allocation of aircraft damage costs (detailed in chapter 3) produces an industry wide estimate for cost of $23.4 million in 2003/2004 dollar values. This compares to $20.9 million in 1996 dollar values in BTE (1998) ($25.2 million in 2004 dollars, CPI adjusted).

The quality of life costs for all accidents and incidents total $20.0 million in 2003/04. This compares to $16.1 million in 1996 dollar values in BTE (1998) ($19.5 million in 2004 dollars, CPI adjusted).

COMPARISON TO 1996 COSTS

As detailed in chapter 3, four categories of costs contributed over 92 per cent of the total cost of crashes in 1996. These four were analysed and updated in this paper and the remaining categories were added as a contingency. The values in BTE (1998) of these major contributors to total cost have been increased by the Consumer Price Index to enable some comparison with the 2003/04 results. The comparison is in figure 4.1 below. Lower Workplace and Household losses largely reflect the reduction in fatalities (37 in 2003/04 compared with 51 in 1996).

FIGURE 4.1 THE MAJOR CONTRIBUTORS TO TOTAL COST



Note: *Includes minor injury costs associated with Incidents.*

Source: *BTRE estimates. CPI adjustments based on ABS (2004c).*

Workplace and household[23] losses

Productivity losses are linked to the number of people killed or injured. Between 1996 and 2003/04, numbers in the categories of fatalities,

23 'Household' includes community or volunteer work.

serious injuries and minor injuries all reduced, tending to reduce the total productivity losses.

The average age of those dying in 2003/04—where known—is less than in 1996. This will increase the lost remaining-life earnings from the average death, tending to increase the total productivity losses.

In BTE (1998), the productivity loss associated with the average fatality was attributed to each of five people of the 35 in the seriously injured category (14 per cent). It was assumed that these five would be in permanent care and produce no paid or unpaid work for the remainder of their lives. For the present analysis, the number of seriously injured that will never resume work is not known and has been set to zero. If this number was five, workplace and household losses would total $8.42 million more (see SENSITIVITY ANALYSIS in chapter 5).

Changing the discount rate—from 4 per cent in BTE (1998) to 3 per cent in this report—has increased the present value of remaining-life earnings. However, this has been offset by changing the real growth in wages from 2 per cent in BTE (1998) to 1 per cent in this analysis.

The above effects change workplace and household losses equally. They do not explain the relative contribution between workplace and household losses. As shown in figure 4.1, estimated workplace losses have reduced, but the reduction in household losses is more substantial. This change is attributed to women over 25 years of age having generally higher wages growth than men between 1996 and 2004, as well as women 25 to 35 and all over 45 having higher employment rates in 2004 relative to 1996[24]. These changes increase the value of an average workplace loss. At the same time, they reduce the value of household losses since employed women undertake over 11 hours less unpaid work per week than those who are unemployed[25].

Overall, the estimated total productivity loss—workplace plus household, community and volunteer work—has decreased in real terms. This would still be the case if five of the seriously injured were considered to be permanently disabled and incapable of future work.

24 Men of all ages are modelled as having slightly higher employment rates in 2004 compared to 1996, again increasing the value of workplace losses. In 2004 women have a lower employment rate than men after the age of nineteen, but the increases in employment rates for women from 1996 to 2004 are generally higher than those for men.

25 Both BTE (1998) and this study relied on unpublished 1996 ABS data showing that the number of hours of unpaid work undertaken by women (employed and unemployed) was more than 50 per cent above that for men (employed and unemployed, respectively). Between 1996 and 2004, the contributions to household and community work by males versus females may have changed, but more recent data is not available. Life tables in ABS (2004b) also suggest different expected lives for men and women in 2003 compared to 1996. But this is unlikely to make a significant difference in household versus workplace contributions.

Property damage

Comparing 1996 to 2003/04, the number of accidents has decreased by 37 per cent. The total estimated real cost of aircraft damage has decreased slightly, compared to 1996.

Privacy provisions prevented insurance companies disclosing individual insurance payout claim figures. Hence, the attribution of property damage costs to both fatal and injury type accidents was undertaken using average costs. Additional uncertainty arose when factoring up individual company payout figures to account for the rest of the Australian aviation industry—this relies on estimates of market shares.

On the one hand, factoring up insurance data will inevitably miss those aviation activities where the operator is uninsured. However, these people are likely to be engaged in low cost aviation—some balloons, hang gliders, gyrocopters, gliders and purpose built aircraft are generally inexpensive to build/own/operate. On the other hand, Australian insurance companies do not provide insurance cover for all of the biggest regular public transport providers and these are likely to have the highest payout costs.

Of 255 reported incidents with minor aircraft damage in the ATSB database, 80 involved High or Low Capacity Air Transport. Of these 80, 13 involved damage or failure of engine, fan blade or propeller, and all 13 would have been expensive to repair—more than $1 million each for the biggest Boeing engines[26]. A further 35 of the 80 incidents involved bird-strike, but with no mention of engine damage.

The estimate of property damage attributed to accidents involving injury or death was $7.3 million. The total estimate for property damage is $23.4 million which includes a balancing item of $16.1 million attributed to 'Incidents'. This balancing item, and hence the total estimate, involves considerable uncertainty. The balancing item produces an estimated average aircraft damage cost *per incident* of $64 000.

If the 13 engine repairs (mentioned above) cost say $6.5 million in total, then the remaining reported incidents with minor aircraft damage would have an estimated average aircraft damage cost *per incident* of $40 000. These average aircraft damage costs can be compared with the estimated average aircraft damage cost *per accident*, in table 4.1.

26 All multi-engined aircraft are capable of landing with one engine not operating and 10 of the 13 engine damage incidents were the result of bird strike. Clearly 'minor aircraft damage' does not necessarily equate with low cost of repair.

TABLE 4.1: AVERAGE ESTIMATED AIRCRAFT DAMAGE COST PER ACCIDENT BY INJURY TYPE, 2003/04.

Accident injury category	Aircraft damage cost per accident
Fatal	$142 000
Serious injury	$121 000
Minor injury	$113 000

Source: BTRE estimates.

Quality of life

The valuations used for quality of life for minor and serious injuries were based on those used in BTE (1998). For fatalities, the value is based on that used in BTE (2000)—this is 49 per cent larger than that used in BTE (1998)[27]. These were all in 1996 dollar values and have been increased by the CPI for the intervening period (which was about 21 per cent).

Comparing the number of accidents by injury type in 1996 with 2003/04 (reported in table 2.1), all have decreased: fatalities by 27 per cent; serious injuries by 9 per cent; and minor injuries by 30 per cent. Despite the decline in the number of injuries, the estimated cost attributed to total quality of life losses has increased slightly, due to the larger cost attributed to each fatality.

Summary

- The major contributors to total cost were compared to the 1996 values reported in BTE (1998) adjusted for inflation:
  - Property damage costs may have decreased, although the analysis for 2003/04 involves considerable uncertainty.
  - Quality of life costs have changed little.
  - Costs attributed to lost productive output have decreased, mainly due to fewer fatalities and a change in methodology which reduces the costs attributed to serious injuries.

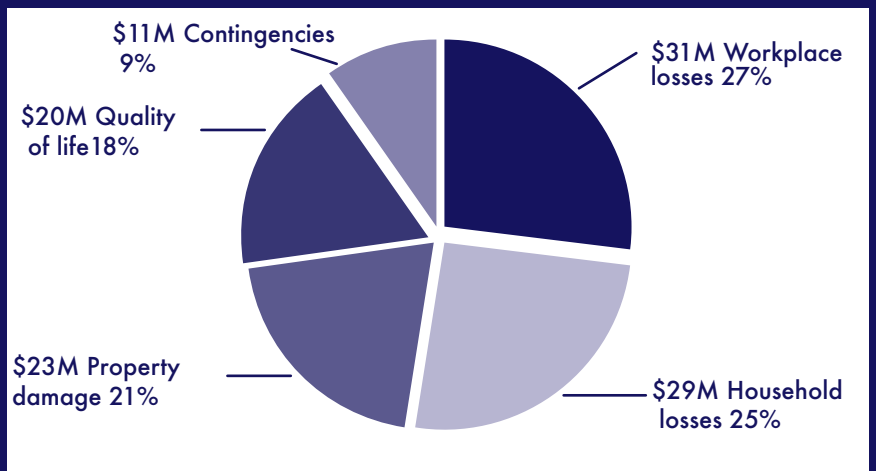
27 The two reports use the same principle, but BTE (2000) increases the actual court awards by about 50 per cent to account for a methodological error related to contributory fault. See BTE (2000), page 37.

Chapter 5 Results

COST OF AVIATION ACCIDENTS AND INCIDENTS, 2003/04

The total cost to Australia from all accidents and incidents in the aviation sector is estimated at $114 million. The four major contributors to this total are shown in figure 5.1 and table 5.1 below.

FIGURE 5.1 CONTRIBUTIONS TO COST OF AUSTRALIAN AVIATION ACCIDENTS AND INCIDENTS, 2003/04



Source: BTRE estimates

TABLE 5.1: CONTRIBUTIONS TO COST OF AUSTRALIAN AVIATION ACCIDENTS AND INCIDENTS, 2003/04.

Item	$ Million	Portion of total
Workplace losses	31.0	27%
Household losses	28.9	25%
Property damage	23.4	21%
Quality of life	20.0	18%
Contingencies	10.7	9%
Total	114.0	100%

Note: As detailed in chapter 3, contingencies is an allowance for: premature funeral costs and medical costs prior to death for fatalities; rehabilitation costs and medical costs for non-fatal injuries; and other common costs – legal costs, emergency services costs, workplace non-victim costs, investigation costs and insurance administration costs.
Source: BTRE estimates.

With 153 accidents, the estimated cost per accident is $745,000.

The estimated cost attributed to each fatality that occurred in 2003/04 is $2.17 million.

SENSITIVITY ANALYSIS

Discount Rate

A 3 per cent discount rate is used in this report—previous analyses have used 4 per cent. Changing the discount rate from 4 per cent to 3 per cent has the effect of increasing the present value of things that occur in the future. In this report, productivity losses over what should have been the remaining expected life for each fatality are discounted to produce a present value. The change in discount rate from 4 per cent to 3 per cent increases the estimated productivity losses by about 15 per cent.

Wages Growth

BTE (1998) used a real wages growth rate of 2 per cent—in this report, 1 per cent is used. Changing the real wage growth rate from 2 per cent to 1 per cent reduces the estimated productivity losses by about 14 per cent.

Average Income

The total cost attributed to each fatality is $2.17 million and the average present value of productivity loss within that is $1.61 million. The methodology suggests that an individual fatality 35 years old is estimated to have a present value of productivity loss of about $1.65 million, based on average income. If a 35 year old person were assessed to have say 25 per cent higher income than average Australians and likely to maintain that difference throughout their remaining expected life, then the estimated productivity loss would also be 25 per cent higher. The total cost attributable to such a fatality would increase to about $2.6 million.

Average Age

The age distribution of fatalities affects the estimate of total productivity losses from those who die. The methodology used produces a maximum present value of productivity loss for people in their mid twenties.

In BTE (1998) the average age of fatalities was 42. In 2003/04 the average age was only 35. If all the people who died in 2003/04 were seven years older—assuming an average age of 42 years—the analysis

would attribute a 15 per cent lower present value of productivity loss. The estimated total cost attributed to each fatality would fall to about $1.9 million.

Permanent Serious Injuries

In BTE (1998) page 25: ... *permanent injury costs were considered to be applicable to five victims who had suffered severe spinal injuries leading to quadriplegia.* And in considering the magnitude of the productivity losses: *the productivity losses have been estimated using the same method as ... for fatality victims* (ibid page 21).

The source of the statement that five of the 35 serious injuries in 1996 resulted in quadriplegia is unclear. Our investigations suggest that there is currently no readily available source that would suggest the number of cases of quadriplegia resulting from the 32 serious injuries in the aviation sector that occurred in 2003/04. In any event, hospital admission codes or diagnoses of physical condition would generally give little if any indication of the ability to resume paid and unpaid work.

In the current analysis, persons with serious injuries are all assumed to be unable to work—both paid and unpaid—for five weeks on average[28] before returning to the workforce. Age data is not available for those with serious injuries. For calculating the productivity losses associated with their recuperation, they are assumed to be at the average age of those who received fatal injuries.

If say five of the 32 people seriously injured in 2003/04 are assumed to never recover from their injuries and be unable to participate in useful work, then using the approach in BTE (1998) outlined above, total costs would be higher by $8.4 million or 7.4 per cent of the total $114 million.

A way to improve this aspect of the analysis in future updates would be to carry out a separate study of those actually seriously injured[29] in some particular year, and determine the degree to which each has returned to paid and unpaid work say two years after their injury.

EFFECTS OF SMOOTHING

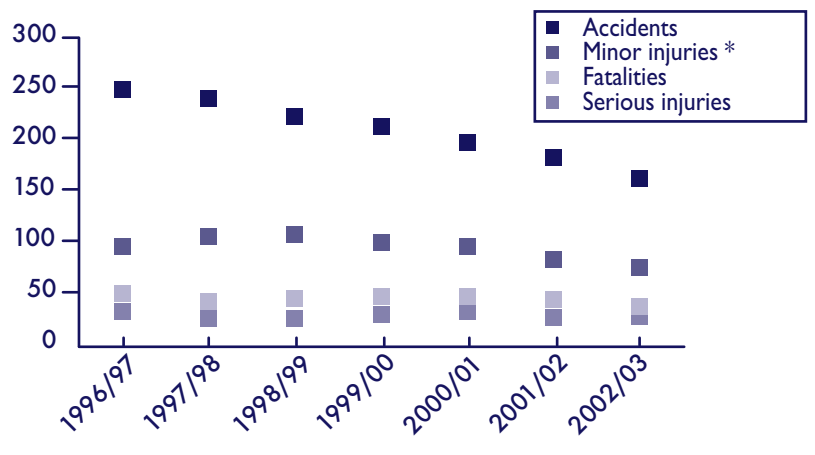
During the consultation process, stakeholders asked the Bureau to provide 3-year rolling average so as to smooth fluctuations from year to year. The Bureau obtained data for the last nine years in 6 monthly intervals, beginning July to December 1995 and finishing with January to June 2004. Seven three-year rolling averages can be calculated. These are shown below in figure 5.2.

28 The same period of recuperation used in BTE (1998).

29 Privacy legislation generally prohibits the gathering of such information on individuals. However, under certain conditions, ATSB may be able to collect such data in the pursuit of safety research.

The last data point in figure 5.2 is labelled 2002/03. It covers the three years from July 2001 to June 2004, centred on the 2002/03 financial year. The first and last data sets are shown in table 5.2 below. The final

FIGURE 5.2 ANNUAL OCCURRENCES (3-Y ROLLING AVERAGES)



** Minor injuries includes injuries from incidents*
Source: BTRE analysis of ATSB Accidents and Incidents database.

3-year rolling average annual numbers are re presented in table 5.3 below, together with the actual numbers for 2003/2004.

TABLE 5.2: THREE YEAR ROLLING AVERAGES

			People with injuries classed as	
Time frame	**Accidents**	**Fatalities**	**Serious**	**Minor***
7/1995-6/1998	251	51	33	97
7/2001-6/2004	163	38	28.3	75.7

** Minor injuries includes injuries from incidents. Time frame '7/1995-6/1998' shows the average annual numbers over the three years from July 1995 to June 1998 (this corresponds to 1996/97 in figure 5.2); '7/2001-6/2004' shows the average annual numbers over the three years from July 2001 to June 2004 (this corresponds to the values for 2002/03 in figure 5.2).*
Source: BTRE analysis of ATSB Accidents and Incidents database.

TABLE 5.3: ANNUAL ACCIDENTS, INCIDENTS AND INJURIES

Category	3 y Rolling avg 7/2001-6/2004	2003/2004 Actual
Accidents	163	153
Fatalities	38	37
Serious injuries	28.3	32
Minor injuries*	75.7	73

* Minor injuries includes injuries from incidents. '3 y Rolling avg 7/2001-6/2004' is the sum for July 2001 to June 2004 divided by three (this corresponds to the values for 2002/03 in figure 5.2).
Source: BTRE analysis of ATSB Accidents and Incidents database.

USING THE RESULTS

The results are not intended as an evaluation tool for particular initiatives. It should be noted that there were no fatalities and only a few accidents involving regular passenger transport (RPT) in 2003/04. Hence the analysis is heavily influenced by activity in the general aviation sector and do not reflect the likely cost of an RPT accident.

The results are best estimates of the cost to the Australian economy of the accidents and associated injuries that did occur as a result of aviation operations in 2003/04, using a human capital type analysis and based on average earnings.

With no deaths in RPT in recent years, then for a possible future RPT crash, the airframe cost is likely to be higher than in our estimates. And if there are fatalities, then the number is likely to be substantially higher than average[30]. Moreover, if international passengers were to be involved, then tourism could be affected, with wider impacts on the Australian economy.

In May 2000 a Piper Chieftain crashed in Spencer Gulf. The aircraft was destroyed and the pilot and seven passengers killed. With an independent estimate of the airframe cost, and using the results in this study, a total estimate for this crash is $16.9 million.

While this analysis based on the human capital approach is transparent, human capital type analyses are often considered likely to produce lower bound estimates[31].

Preferably, and in principle, willingness to pay studies of Australians should be used to determine the value of specific safety improvements in Australia. Such studies should be context specific, allowing those

30 For each accident in 2003/04 which involved a fatality, the average number of fatalities was 1.95.

31 BTE (2000) on page 21 suggests willingness to pay values are generally higher, particularly for fatalities.

who will be affected by certain proposals to express their own view on how much safety they wish to buy[32].

In practice, a human capital approach may still be more appropriate in some cases, particularly if doubts about the reliability of valuations that individuals nominate or reveal in willingness to pay studies cannot be overcome, or if carrying out willingness to pay studies is constrained by cost and time considerations.

Summary

- The estimated total cost of aviation accidents and incidents was $114 million in 2003/04.
- Sensitivity testing revealed that two changes in methodology cancelled each other out. These involved changing the discount rate from 4 per cent to 3 per cent and changing future wages growth from 2 per cent to 1 per cent.
- Tests also showed that the methodology is particularly sensitive to the estimates of income and age of those involved.
- In principle, willingness to pay studies of Australians should be used to determine the value of specific safety improvements in Australia. However, for a range of reasons, this may often not be practical.

32 For the importance of context in valuing safety improvements, see Loomes and Jones-Lee (1995).

Appendix A

ACCIDENT & INCIDENT REPORTING

The following pages were taken from the ATSB's website on 31 May 2005 <http://www.atsb.gov.au/aviation /occurs/reporting.cfm>:

1. REPORTING OF OCCURRENCES

1.1 Regulation 2.5 of the Transport Safety Investigation Regulations 2003 (TSI Regulations) contains a list of 'responsible persons' for reporting aviation occurrences (Immediately and Routine reportable matters listed below) to the ATSB.

1.2 Responsible persons are:

- **a.** a crew member of the aircraft concerned;
- **b.** the owner or operator of the aircraft;
- **c.** a person performing an air traffic control service in relation to the aircraft;
- **d.** a person performing a dedicated aerodrome rescue or fire fighting service in relation to the aircraft;
- **e.** a person who:
  - **(i)** is licensed as an aircraft maintenance engineer under the Civil Aviation Regulations 1988 or the Civil Aviation Safety Regulations 1998, and
  - **(ii)** does any work in relation to the aircraft;
- **f.** a member of the ground handling crew in relation to the aircraft;
- **g.** a member of the staff of the Civil Aviation Safety Authority; and
- **h.** the operator of an aerodrome.

1.3 A responsible person is excused from the legal requirement to report if they have reasonable grounds to believe another responsible person has reported the occurrence.

1.4 The occurrences a responsible person is required to report are listed as either Immediately Reportable Matters (IRM) or Routine Reportable Matters (RRM) in the TSI Regulations. IRM must be reported as soon as reasonably practicable by telephone (ss.18(1) TSI Act) on 1800 011 034, and then a follow up written report must be made within 72 hours (ss.19(1) TSI Act). RRM require only a written report within 72 hours (ss.19(1) TSI Act).

1.5 Listed below are the IRM and RRM that must be reported by all aircraft operations, those involved in air transport operations, and those involved in aircraft operations other than air transport operations.

Note: *An "air transport operation" is a regular public transport operation or a charter operation. The TSI Regulations contain a more comprehensive definition for the term as well as definitions for other terms used in the list of reportable matters below. Refer to the ATSB website (http://www.atsb.gov.au/atsb/tsi_act/index.cfm) for a complete copy of the TSI Act, TSI Regulations and explanatory material.*

2. REPORTING REQUIREMENTS FOR ALL AIRCRAFT OPERATIONS

2.1 Immediately Reportable Matters

2.1.1 IRM for all aircraft operations are:

a. subject to the exclusions in the note below, the death of, or a serious injury to:
  (i) a person on board the aircraft or in contact with the aircraft, or anything attached to the aircraft, or anything that has become detached from the aircraft; or
  (ii) a person who has been directly exposed to jet blast;

Note: *"The death of, or a serious injury to, a person" does not include:*
- ***a.*** *death or serious injury resulting from natural causes (except to a flight crew member); or*
- ***b.*** *death or serious injury that is intentionally self-inflicted; or*
- ***c.*** *death or serious injury that is intentionally caused by another person; or*
- ***d.*** *death or serious injury suffered by a stowaway in a part of the aircraft that is not usually accessible to crewmembers or passengers after take-off; or*
- ***e.*** *death occurring more than 30 days after the occurrence that caused the death, unless the death was caused by an injury that required admission to hospital within 30 days after the occurrence.*

b. the aircraft being missing;

c. the aircraft suffering serious damage, or the existence of reasonable grounds for believing that the aircraft has suffered serious damage;

d. the aircraft being inaccessible and the existence of reasonable grounds for believing that the aircraft has been seriously damaged;
e. breakdown of separation standards, being a failure to maintain a recognised separation standard (vertical, lateral or longitudinal) between aircraft that are being provided with an air traffic service separation service.

Note: *This may result from air traffic service, pilot or other actions, and may occur even if only one (1) of the aircraft involved is under control of an air traffic service.*

3. REPORTING REQUIREMENTS FOR ALL AIR TRANSPORT OPERATIONS

3.1 Immediately Reportable Matters

3.1.1 IRM for all air transport operations include:

a. airprox;
b. violation of controlled airspace;
c. a near-collision involving aircraft manoeuvring on the ground;
d. an occurrence in which flight into terrain is narrowly avoided;
e. the rejection of a take-off from a closed or occupied runway;
f. a take-off from a closed or occupied runway with marginal separation from an obstacle or obstacles;
g. a landing on a closed or occupied runway;
h. a significant failure to achieve predicted performance during take-off or initial climb;
i. a fire (even if subsequently extinguished), smoke, fumes or an explosion on, or in, any part of the aircraft;
j. an uncontained engine failure;
k. a mechanical failure resulting in the shutdown of an engine;
l. the use of any procedure for overcoming an emergency;
m. an event requiring the use of oxygen by a flight crewmember;
n. malfunction of an aircraft system that seriously affects the operation of the aircraft;
o. a flight crew member becoming incapacitated during flight;
p. fuel exhaustion;
q. the aircraft's supply of useable fuel becoming so low (whether or not as a result of fuel starvation) that the pilot declares an emergency in flight;
r. undershooting, over-running or running off the side of a runway during take-off or landing, or any other similar occurrence;
s. any of the following occurrences, if the occurrence causes difficulty controlling the aircraft:
   (i) a weather phenomenon; or
   (ii) operation outside the aircraft's approved envelope;
t. the failure of two (2) or more related redundant systems for flight guidance and navigation; and

u. serious damage to, or destruction of, any property outside the aircraft caused by contact with the aircraft or anything that has become detached from the aircraft.

3.2 Routine Reportable Matters

3.2.1 RRM for all air transport operations include:

a. an injury, other than a serious injury, to:
   (i) a person on board the aircraft or in contact with the aircraft or anything attached to the aircraft or anything that has become detached from the aircraft; or
   (ii) a person who has been directly exposed to jet blast;
b. the aircraft suffering damage that compromises, or has the potential to compromise, the safety of the flight, but is not serious damage;
c. flight below the minimum altitude, except in accordance with a normal arrival or departure procedure;
d. a ground proximity warning system alert;
e. a critical rejected take-off, except on a closed or occupied runway;
f. a runway incursion;
g. any of the following occurrences, if the occurrence compromises, or has the potential to compromise, the safety of the flight:
   (i) a failure to achieve predicted performance during take-off or initial climb;
   (ii) malfunction of an aircraft system, if the malfunction does not seriously affect the operation of the aircraft;

Note: *Aircraft systems include flight guidance and navigation systems.*

   (iii) fuel starvation that does not require the declaration of an emergency;
h. any of the following occurrences, if the occurrence compromises or has the potential to compromise the safety of the flight, but does not cause difficulty controlling the aircraft:
   (i) a weather phenomenon;
   (ii) operation outside the aircraft's approved flight envelope;
i. failure or inadequacy of a facility used in connection with the air transport operation, such as:
   (i) a navigation or communication aid; or
   (ii) an air traffic control service or general operational service; or
   (iii) an airfield facility, including lighting or a manoeuvring, taxiing or take-off surface;
j. misinterpretation by a flight crewmember of information or instructions, including:
   (i) the incorrect setting of a transponder code; or
   (ii) flight on a level or route different to the level or route allocated for the flight; or
   (iii) the incorrect receipt or interpretation of a significant radio, telephone or electronic text message;

k. breakdown of coordination, being an occurrence in which traffic related information flow within the air traffic service system is late, incorrect, incomplete or absent;
l. failure of air traffic services to provide adequate traffic information to a pilot in relation to other aircraft;

Note: *The information may have been incomplete, incorrect,late or absent.*

m. a traffic collision avoidance system resolution advisory being given to the pilot of the aircraft;
n. an occurrence arising from the loading or carriage of passengers, cargo or fuel, such as:
   (i) the loading of an incorrect quantity of fuel, if the loading of the incorrect quantity is likely to have a significant effect on aircraft endurance, performance, balance or structural integrity; or
   (ii) the loading of an incorrect type of fuel or other essential fluid, or contaminated fuel or other essential fluid; or
   (iii) the incorrect loading of passengers, baggage or cargo, if the incorrect loading has a significant effect on the mass or balance of the aircraft; or
   (iv) the carriage of dangerous goods in contravention of Commonwealth, State or Territory legislation; or
   (v) the incorrect securing of cargo containers or significant items of cargo; or
   (vi) the incorrect stowage of baggage or cargo, if the incorrect stowage is likely to cause a hazard to the aircraft or its equipment or occupants, or to impede emergency evacuation; or
   (vii) a significant contamination of the aircraft structure, systems or equipment, arising from the carriage of baggage or cargo; or
   (viii) the presence of a violent or armed passenger;
o. a collision with an animal, including a bird.

4. REPORTING REQUIREMENTS FOR ALL AIRCRAFT OPERATIONS OTHER THAN AIR TRANSPORT OPERATIONS

4.1 Routine Reportable Matters

4.1.1 RRM for all aircraft other than air transport operations include:

a. an injury, other than a serious injury, to a person on board the aircraft;
b. a flight crewmember becoming incapacitated while operating the aircraft;
c. airprox;
d. an occurrence in which flight into terrain is narrowly avoided;
e. the use of any procedure for overcoming an emergency;

f. an occurrence that results in difficulty controlling the aircraft, including any of the following occurrences:
(i) an aircraft system failure;
(ii) a weather phenomenon;
(iii) operation outside the aircraft's approved flight envelope;
g. fuel exhaustion;
h. the aircraft's supply of useable fuel becoming so low (whether or not as a result of fuel starvation) that the safety of the aircraft is compromised;
i. a collision with an animal, including a bird, on a licensed aerodrome.

5. WRITTEN REPORT

5.1 The written report required to be submitted under Section 19 of the Act should preferably use the Air Safety Accident or Incident Report (ASAIR) format. For a reportable matter other than for a collision with an animal or bird, a requirement of regulation 2.6 of the TSI Regulations is that the report should contain as much of the following information as is within the person's knowledge:

a. the name and contact details of the person making the report;
b. the person's role in relation to the aircraft concerned;
c. the type, model, nationality, registration marks and flight number (if any) of the aircraft;
d. the name of the owner of the aircraft;
e. the name and contact details of the operator of the aircraft;
f. if the aircraft was under hire when the reportable matter occurred, the name of the hirer;
g. the name and nationality of the pilot, and the type and licence number of the licence held by the pilot;
h. the name and nationality of each other flight crew member (if any), and the type and licence number of the licence held by each member;
i. the day and local time when the reportable matter occurred;
j. if, when the reportable matter occurred, the aircraft was in-flight:
(i) the place where the flight started; and
(ii) the place where the flight ended, or was intended to end; and
(iii) the purpose of the flight;
k. unless the reportable matter occurred at an airport, the location of the aircraft immediately after the occurrence of the reportable matter, including the geographical coordinates of that location;
l. the number of persons on board the aircraft when the reportable matter occurred;
m. the nature of the reportable matter, including:
(i) its outcome or effect on the flight of the aircraft;
(ii) the phase of the aircraft's flight when the matter occurred;
(iii) the weather conditions;

(iv) the airspace designation;
(v) the altitude at which the matter occurred;
(vi) if the matter occurred at, or in relation to, an airport, the name of the airport, and, if it occurred on, or in relation to, a runway, the runway number;
(vii) if the matter involved a collision with an animal, including a bird, the nature of the collision;
(viii) the causes of the occurrence (if known), including any human performance issues;
(ix) any safety action carried out to prevent a recurrence of the matter; and
(x) the nature and extent of any damage to the aircraft;

n. the physical characteristics of the area where the reportable matter occurred (eg, the terrain, vegetation cover, and existence and location of any buildings, runways or aerodromes);
o. the flight rules under which the aircraft was operating at the time of the reportable matter;
p. the type of aircraft operation the aircraft was engaged in at the time of the reportable matter;
q. if the matter resulted in a fatality or serious injury, and the aircraft carried an emergency locator transmitter:
(i) the manufacturer and model of the emergency locator transmitter;
(ii) whether it was fixed or portable;
(iii) its location in the aircraft; and
(iv) whether it was activated;
r. if the aircraft's pilot has died:
(i) the pilot's date of birth; and
(ii) the pilot's total flying hours on all aircraft and flying hours on the same type of aircraft;
s. if any crew members have died or been seriously injured as a result of the reportable matter, how many, and their names and nationalities;
t. if any passengers have died or been seriously injured as a result of the reportable matter, how many, and their names and nationalities; and
u. if any other persons have died or been seriously injured as a result of the reportable matter, how many, and their names and nationalities.

5.2 For a reportable matter that amounts to a collision with an animal or bird only the report must contain as much of the following information as is within the knowledge of the person making the report:

a. the name and contact details of the person making the report;
b. the day and local time when the reportable matter occurred;
c. the nature of the reportable matter, including:

(i) if the matter occurred at, or in relation to, an airport, the name of the airport, and if it occurred on, or in relation to, a runway, the runway number; and

(ii) the nature and extent of any damage to the aircraft; and

d. any other information that the person making the report considers appropriate.

5.3 The completed Air Safety Accident or Incident Report (ASAIR), should be forwarded directly by mail, facsimile, or the online form (https://www.atsb.gov.au/aviation/m3vco6t/notiffrm.cfm) to the ATSB central office in Canberra.

5.4 An ASAIR form may be obtained online from https://www.atsb.gov.au/aviation/m3vco6t/notiffrm.cfm or by contacting the ATSB on freecall phone number 1800 011 034 (primary notification number) or 1800 020 616 (safety information number and secondary notification number).

Appendix B

ATSB INVESTIGATION CATEGORIES

The following pages were taken from the ATSB's website on 31 May 2005, <http://www.atsb.gov.au/aviation/occurs/operates.cfm>:

PROCEDURES

The *Transport Safety Investigation Act 2003* forms the basis of procedures followed by the Bureau. The ATSB uses the categories below when prioritising its aviation investigations to meet international obligations and achieve the most important safety outcomes within its given budget.

DECISION GUIDELINES FOR ACCIDENT/INCIDENT CATEGORISATION

The ATSB is resourced each year to undertake a finite number of aviation investigations. It is acknowledged, however, that an occurrence with a large number of deaths would represent a 'major accident' and supplementary funding may be required.

In categorising aviation transport safety matters and selecting which of those the ATSB should investigate, the decision-makers must consider:

1. The potential safety value that may be gained by conducting an investigation
2. On board fatalities and/or serious passenger injuries, and provision of support to state coroners
3. The public profile of the occurrence
4. The extent of resources available and projected to be available and, in the event of conflicting priorities,
5. Any risks associated with not investigating
6. The requirement under s21(2) of the TSI Act for the Executive Director to publish reasons (justification) for discontinuing an investigation where an investigation has already commenced.

The following broad hierarchy should also be taken into account when making the decision to initiate and categorise an investigation:

1. Passenger operations
2. Freight and other commercial operations
3. Non-commercial operations.

The decision to investigate will also have regard as to whether, in the absence of an ATSB investigation, a credible safety investigation is likely.

In view of these considerations, initiation of a formal ATSB investigation can only be made at or above Team Leader level after discussion and agreement with the Deputy Director and Executive Director. Each investigation will be categorised on a scale of 1–5 (see below).

Following the initial assessment of an occurrence, and the allocation of an investigation category, a decision will be made whether or not to conduct an on-scene investigation. Subsequently an investigation may be upgraded or downgraded. The decision to upgrade (and commit extra resources) or to downgrade must be made at Deputy Director level after discussion with the Executive Director. Any decision to discontinue an investigation must be endorsed by the Executive Director.

The following guidance on the categorisation of aviation transport safety matters is intended to serve as a suggested starting point based on initial information. This guidance is not intended to cover all possible scenarios but illustrates a broad range of typical events. It is expected that judgment will be required in order to categorise some events which do not neatly fit these categories or where the circumstances, potential safety value and available resources suggest that they should be assigned a different category.

Category 1

- An accident involving one or more High Capacity Air Transport (scheduled and non-scheduled) passenger aircraft with fatalities.
- An accident involving one or more High Capacity Air Transport (scheduled and non-scheduled) passenger aircraft without fatalities
  - where there was a significant risk of fatalities or serious injuries and a substantial commitment of investigative resources is likely to significantly mitigate future High Capacity Air Transport accidents.
- A serious incident (as defined by ICAO see Attachments A & B) involving one or more High Capacity Air Transport (scheduled and non-scheduled) passenger aircraft
  - where there was a significant risk of fatalities or serious injuries and a substantial commitment of investigative resources is likely to significantly mitigate future High Capacity Air Transport (scheduled and non-scheduled) accidents.

Category 2

- An accident involving one or more High Capacity Air Transport cargo aircraft with fatalities and serious injuries.
- An accident involving one or more High Capacity Air Transport cargo aircraft without fatalities and serious injuries
  - where there was a significant risk of fatalities or serious injuries and a substantial commitment of investigative resources is likely to significantly mitigate future High Capacity Air Transport cargo aircraft accidents.
- An accident involving one or more Low Capacity Air Transport (scheduled) passenger aircraft with a significant number of fatalities (for example, it may involve more than five fatalities) and serious injuries.
- An accident involving one or more Low Capacity Air Transport (scheduled) passenger aircraft without fatalities or with a relatively low level of fatalities (eg less than five) and serious injuries
  - where there was a significant risk of more fatalities or serious injuries and a substantial commitment of investigative resources is likely to significantly mitigate future Low Capacity Air Transport (scheduled) accidents.
- A serious incident (as defined by ICAO see Attachments A & B) involving one or more Low Capacity Air Transport (scheduled) passenger aircraft
  - where there was a significant risk of multiple fatalities (eg more than five) and serious injuries and a substantial commitment of investigative resources is likely to significantly mitigate future Low Capacity Air Transport (scheduled) accidents.
- An accident involving one or more Low Capacity charter (non-scheduled) aircraft with fare-paying passengers and multiple fatalities and serious injuries (for example it may involve more than five fatalities)
  - where a substantial commitment of investigative resources is likely to significantly mitigate future Low Capacity Air Transport (scheduled) and charter (non-scheduled) accidents.

Category 3

- An accident involving one or more Low Capacity Air Transport passenger (scheduled) or charter (non-scheduled) aircraft with fatalities and/or serious injuries not classified as a category 2 investigation.
- An accident involving Air Transport cargo operations with fatalities.
- An accident involving one or more training aircraft with fatalities.
- An accident (as defined by ICAO, see Attachment A) without fatalities involving one or more High or Low Capacity Air Transport aircraft not

classified as a category 1 or 2 investigation and where investigation is likely to significantly mitigate future accidents.

- An accident involving one or more general aviation aircraft (other than sport aviation) with fatalities.
- An accident involving one or more charter or other general aviation aircraft
  - where there was a significant risk of fatalities or serious injuries and a substantial commitment of investigative resources would significantly mitigate accidents.
- A serious incident (as defined by ICAO see Attachments A & B) involving one or more High or Low Capacity Air Transport passenger aircraft not classified as a category 1 or 2 investigation and where investigation is likely to significantly mitigate future accidents.
- A serious incident (as defined by ICAO see Attachments A & B) involving one or more Air Transport cargo, charter or training aircraft where investigation is likely to significantly mitigate future accidents.
- An incident involving one or more High or Low Capacity Air Transport aircraft where investigation is likely to significantly mitigate future accidents.

Category 4

- An accident involving a foreign aircraft covered by Article 26 of the Chicago Convention that is not being investigated as category 1, 2, or 3.
- An accident (as defined by ICAO, see Attachment A) involving one or more charter or general aviation aircraft (other than sport aviation) without fatalities
  - where a limited commitment of investigative resources could significantly mitigate future aviation accidents.
- An accident or serious incident (as defined by ICAO, see Attachments A & B) involving Australian designed and manufactured aircraft types on the Australian Register with international safety implications not being investigated as category 1, 2, or 3.
- An accident or serious incident (as defined by ICAO, see Attachments A & B) involving one or more High or Low Capacity Air Transport aircraft not being investigated as category 1, 2, or 3.
- A serious incident (as defined by ICAO, see Attachments A & B) involving one or more non Air Transport aircraft
  - where a limited commitment of investigative resources could significantly mitigate future accidents.

Category 5

- An accident (including with fatalities) or serious incident involving a sport aviation aircraft unless foreign and required to be investigated under Article 26 of the Chicago Convention.

- An accident involving aircraft without fatalities

  - where the potential safety lessons do not, after initial review, justify the commitment of investigative resources. Basic incident data will be filed for statistical purposes.

- A serious incident or incident involving aircraft
  - where the potential safety lessons do not, after initial review, justify the commitment of investigative resources. Basic incident data will be filed for statistical purposes.

Attachment A

ICAO definitions for aircraft accidents and serious incidents

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 the aircraft, or

– direct contact 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 which:

– adversely affects the structural strength, performance or flight characteristics of the aircraft, and

– would normally require major repair or replacement of the affected component,

except for engine failure or damage, when the damage is limited to the engine, its cowlings or accessories; or for damage limited to propellers, wing tips, antennas, tires, brakes, fairings, small dents or puncture holes in the aircraft skin; or

c) the aircraft is missing or is completely inaccessible.

Note 1. For statistical uniformity only, an injury resulting in death within thirty days of the date of the accident is classified as a fatal injury by ICAO.

Note 2. An aircraft is considered to be missing when the official search has been terminated and the wreckage has not been located.

Serious incident. An incident involving circumstances indicating that an accident nearly occurred.

Note 1. The difference between an accident and a serious incident lies only in the result.

Note 2. ICAO examples of serious incidents can be found in Attachment B.

Attachment B

List of examples of serious incidents

The incidents listed are typical examples of incidents that are likely to be serious incidents. The list is not exhaustive and only serves as guidance to the definition of serious incident.

- Near collisions requiring an avoidance manoeuvre to avoid a collision or an unsafe situation or when an avoidance action would have been appropriate.
- Controlled flight into terrain only marginally avoided.
- Aborted take-offs on a closed or engaged runway.
- Take-offs from a closed or engaged runway with marginal separation from obstacle(s).
- Landings or attempted landings on a closed or engaged runway.
- Gross failures to achieve predicted performance during take-off or initial climb.
- Fires and smoke in the passenger compartment, in cargo compartments or engine fires, even though such fires were extinguished by the use of extinguishing agents.
- Events requiring the emergency use of oxygen by the flight crew.
- Aircraft structural failures or engine disintegrations not classified as an accident.
- Multiple malfunctions of one or more aircraft systems seriously affecting the operation of the aircraft.
- Flight crew incapacitation in flight.
- Fuel quantity requiring the declaration of an emergency by the pilot.
- Take-off or landing incidents. Incidents such as undershooting, overrunning or running off the side of runways.

- System failures, weather phenomena, operations outside the approved flight envelope or other occurrences which could have caused difficulties controlling the aircraft.
- Failures of more than one system in a redundancy system mandatory for flight guidance and navigation.

Safety Action Statements

Safety Action Statements contain details of any ATSB safety outputs or other safety actions. ATSB safety outputs include Recommendations and Safety Advisory Notices. Recommendations and Safety Advisory Notices issued prior to the release of the final report are published in the final investigation report together with any responses. The final report will also contain any necessary Recommendations and Safety Advisory Notices. Safety Actions taken by organisations other than the ATSB, which were initiated as a result of the investigation (referred to as Local Actions), are also published in the final report. The ATSB encourages organisations to take safety action ahead of a final report which reduces the need to make Recommendations and leads to more timely improvement.

APPENDIX C

SUMMARY OF ACCIDENTS, 2003/04 *

		Agriculture	Ballooning	Business	Charter	Flying Training	Gliding	High Capacity Transport	Low Other Capacity Transport	Aerial Work	Private	Sports Aviation	Total
Injuries													
Crew	Fatalities	0	0	0	1	5	1	0	0	5	4	6	22
	Serious Injuries	2	0	0	0	3	0	1	0	2	2	4	14
	Minor Injuries	4	0	0	3	4	1	1	0	6	9	1	29
Injuries													
Passenger	Fatalities	0	0	0	3	0	0	0	0	3	7	2	15
	Serious Injuries	1	3	0	0	0	0	3	0	5	4	2	18
	Minor Injuries	0	1	0	4	0	0	4	0	3	14	0	26
Total													
Injuries	Fatalities	0	0	0	4	5	1	0	0	8	11	8	37
	Serious Injuries	3	3	0	0	3	0	4	0	7	6	6	32
	Minor Injuries	4	1	0	7	4	1	5	0	9	23	1	55
Aircraft	Destroyed	4	1	0	1	5	1	0	0	9	8	8	37
Damage	Substantial	12	0	0	19	6	4	1	2	10	47	8	109
Level	Minor	0	1	0	0	1	0	1	0	1	1	0	5
	Unknown	0	0	0	0	1	0	0	0	0	1	0	2
Total Persons Involved		15	11	0	61	23	6	370	7	42	110	25	670
Total Accidents		16	2	0	20	13	5	2	2	20	58	16	154
Total Accidents (excluding duplicates **)													151

* Data for the period from 01 January to 30 June 2004 was provisional.
* *Accidents involving more than one aircraft with injuries from more than one statistical group*

Source: ATSB database, for Australian registered aircraft only and relate to accidents that occurred both inside and outside of Australian Territory.

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