This report for inquiry 10-011 is suppressed

until 10.00am on 28 March 2013

Pursuant to its powers, including in sections 11, 14B(2) and 14K of the Transport Accident Investigation Commission Act 1990, the Transport Accident Investigation Commission directs that this report is provided to you in confidence and that its contents are supressed and must remain confidential until its public release at 10.00am on 28 March 2013.

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Transport Accident Investigation Commission is an independent Crown entity established to determine the circumstances and causes of accidents and incidents with a view to avoiding similar occurrences in the future. Accordingly it is inappropriate that reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

The Commission may make recommendations to improve transport safety. The cost of implementing any recommendation must always be balanced against its benefits. Such analysis is a matter for the regulator and the industry.

Transport Accident Investigation Commission
Te Komihana Tirotiro Aitua Waka

Inquiry 10-011

Report into flying training safety in New Zealand

Released March 2013

Transport Accident Investigation Commission

About the Transport Accident Investigation Commission

The Transport Accident Investigation Commission (the Commission) is a standing commission of inquiry responsible for inquiring into maritime, aviation and rail accidents and incidents in New Zealand, and co-ordinating and co-operating with other accident investigation organisations overseas. Its principal purpose is to determine the circumstances and causes of occurrences with a view to avoiding similar occurrences in the future rather than to ascribe blame. The Commission carries out this purpose by informing members of the transport sector, both domestically and internationally, of the lessons that can be learnt from transport occurrences.

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Important notes

Nature of this report

This inquiry report is the result of the Commission's inquiry into flying training safety in New Zealand. The Commission opened this inquiry under section 8(2)(a) of the Transport Accident Investigation Commission Act 1990 after it became concerned that previous occurrences involving flying training (including a near mid-air collision in New Plymouth on 10 May 2010 and a mid-air collision near Feilding on 26 July 2010) might be symptomatic of systemic or widespread matters affecting flying training safety in New Zealand. The purpose of this inquiry was to ascertain whether or not there were common factors or trends that may have contributed to the causes of these previous occurrences.

Ownership of report

Acknowledgements

The Commission is grateful to those individuals and organisations who prepared written submissions and those who appeared as witnesses. Their contributions assisted the Commission considerably in its research.

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Glossary and abbreviations

ab-initio training	the very first stage of flight training.
Advisory Circulars	most Civil Aviation Rules are accompanied by Advisory Circulars published by the Civil Aviation Authority, which provide explanatory information and examples of acceptable means of compliance with the Rules.
Aerosafe	Aerosafe Risk Management is an Australian-based aviation specialist company that the Civil Aviation Authority commissioned in 2011 to complete an independent review of New Zealand's flight training industry.
AIA	Aviation Industry Association.
Airways	Airways Corporation of New Zealand.
ASL	Aviation Services Limited holds a delegation from the Director of Civil Aviation to conduct flight crew licence written examinations, including International Civil Aviation Organization English language proficiency assessments. Its parent company is ASPEQ Limited.
ATSB	Australian Transport Safety Bureau.
BASI	Bureau of Air Safety Investigation (Australia).
CAA	Civil Aviation Authority of New Zealand.
CAA's occurrence database	the CAA's database, which contains data about aviation occurrences in New Zealand reported to the CAA.
CA Rules	Civil Aviation Rules.
CASA	Civil Aviation Safety Authority (Australia).
EFTS	equivalent full-time student.
FAA	Federal Aviation Administration (United States).
GAO	United States General Accounting Office.
ICAO	International Civil Aviation Organization.
MetFlight Commercial/MetJet	enhanced web-based aviation weather information services owned by MetService and provided to commercial air transport operation subscribers, including flight training organisations.
MetFlight-GA	an enhanced web-based aviation weather information service owned by MetService and provided to non-commercial pilots for pre-flight weather planning.
NTSB	National Transportation Safety Board (United States).
NZALPA	New Zealand Air Line Pilots' Association.
occurrence	an aviation accident or incident, as defined under section 2 of the Civil Aviation Act 1990.

TCAS	Traffic Collision Avoidance System. TCAS is an aircraft collision-avoidance system that monitors the airspace around an aircraft for other aircraft equipped with corresponding active transponders, and gives warnings of possible collision risks.
TEC	Tertiary Education Commission.

1 Executive summary

New Zealand's flying training sector

1.1 The New Zealand flying training sector is diverse, with pilot training opportunities ranging from recreational qualifications to advanced professional qualifications such as the air transport pilot licence. The sector has grown significantly in the past decade, from approximately 98 000 total training hours in 2000 to approximately 133 000 hours in 2011[1] (although this total has fluctuated widely year on year). In 2011, 12% of these hours were for helicopter training, with the remainder being for fixed-wing aeroplane training (Civil Aviation Authority [CAA], n.d. [unpublished data]).

1.2 There is a wide spectrum of flight training organisations catering to both domestic and international students, ranging from large commercial operators providing airline-structured ab-initio cadetships through to individual flying schools and aero clubs. The larger training organisations tend to be concentrated in certain geographical areas, such as around Auckland, Hamilton, Manawatu and Christchurch. The number of flying training establishments declined from 273 in 2000 to 174 in 2011 (CAA, n.d. [unpublished data]).

1.3 Private sector providers deliver theory and practical flight training for the initial issue of flight crew licences and ratings. Aviation Services Limited (ASL) provides theory testing under a delegation from the Director of Civil Aviation, and approved flight examiners conduct flight tests.

The Commission's inquiry into flying training safety in New Zealand

1.4 In July 2010 the Transport Accident Investigation Commission (the Commission) became concerned that systemic or widespread matters might be affecting flying training safety in New Zealand. This concern arose after a number of fatal and near-fatal occurrences in New Zealand involving flying training, including a near mid-air collision overhead New Plymouth Aerodrome on 10 May 2010 and a mid-air collision near Feilding on 26 July 2010.

1.5 After making initial inquiries into these 2 occurrences, the Commission reviewed previous occurrences involving flying training and analysed occurrence data held by the CAA. As a result of this preliminary work, the Commission opened an inquiry under section 8(2)(a) of the Transport Accident Investigation Commission Act 1990 to ascertain whether or not there were common factors or trends that may have contributed to the causes of these previous occurrences.

1.6 The first part of the Commission's inquiry involved it looking at whether flying training safety performance in New Zealand had improved or deteriorated. Occurrence data and research from the CAA and other overseas jurisdictions were analysed to help examine this area of interest.

1.7 The next part of its inquiry involved the Commission looking at specific issues relating to flying training safety in New Zealand, which were identified from written and oral submissions and from the Commission's own enquiries. In examining each of these issues, the Commission's primary objective was to determine whether these issues were affecting, or could potentially affect, flying training safety in New Zealand in any way. If yes, then to what extent?

1.8 This report sets out the findings of the Commission's research into each of these issues. It draws on data and research from the CAA and overseas agencies. It also draws on

[1] Based on actual training hours flown reported to the Civil Aviation Authority by flying training operators.

information from written and oral submissions that the Commission received as part of its public consultation.

1.9 The Commission's research findings are set out in Section 7. One key finding is that based on a preliminary analysis of occurrence data, it is not possible to conclude statistically whether flying training in New Zealand is less or more safe now than it used to be.

1.10 A recurring theme underpinning many of the findings is the lack of data and research examining factors that might have contributed to occurrences in flying training operations in New Zealand and overseas, and the limitations of the CAA's safety occurrence reporting system, which made it difficult for the Commission to analyse flight training accident causal factors and safety trends accurately. The CAA is aware of these limitations and has advised that it is "considering a range of actions associated with its underlying safety information and data systems … that should enable easier submission and recording of safety information" (CAA, n.d.[2] [unpublished data]).

1.11 The Commission's recommendations are set out in Section 8. In summary, it is recommended that the Director of Civil Aviation:

(a) review the CAA's data systems and processes, particularly regarding flying training data, including the information collected and the way this information is collected, categorised, recorded in the CAA's occurrence database and analysed to ensure that meaningful and complete data on flying training in New Zealand is available;

(b) undertake and publish further quantitative research and causal analysis of flying training-related accidents and incidents held in the CAA's occurrence database to assess fully and identify any potential systemic safety issues, trends and risks, so that appropriate safety strategies can be adopted to improve safety performance within the New Zealand flying training system;

(c) take all appropriate steps to ensure that information about flight instructor demographics (e.g. qualifications, experience levels, age) and flight instructor performance and competency levels is regularly collected, categorised and recorded in a way that will enable it to be analysed meaningfully;

(d) complete, as a matter of priority, the tasks that the CAA is required to do to progress the proposed amendments to CA Rule Part 141 (Aviation Training Organisations – Certification) and to CA Rule Part 61 (Pilot Licences and Ratings).

[2] n.d. = no date of publication available or applicable.

2 Scope of report

Scope of this report

2.1 This report focuses on flying training in New Zealand involving aeroplane and helicopter aircraft. Data and research examined as part of the Commission's review of flying training safety, and discussed in this report, include:

(a) occurrence data held by the CAA and overseas agencies;

(b) investigation reports and research literature published by the CAA and overseas agencies;

(c) inquiry reports published by the Commission;

(d) information provided by organisations in response to requests from the Commission;

(e) written and verbal submissions made to the Commission as part of its research;

(f) information and research held in the public domain about the flying training sector.

2.2 For the purposes of this report, "flying training" generally means flying under instruction from an appropriately licensed and rated flight instructor or flight examiner that is being conducted for the issue or the renewal of a licence or rating. Flying training includes all approved and supervised solo training, including solo navigation exercises conducted as part of the training.

2.3 This report focuses on solo and dual flight instructional activity undertaken by a student or trainee pilot as part of their training towards a private or commercial pilot licence. It does not examine flying training involving agricultural flying and adventure and sports aviation such as gliding, parachuting, hot air ballooning, paragliding, hang gliding and microlight operations. Nor does it examine pilot training towards advanced qualifications such as the airline transport pilot licence, instrument ratings, or aircraft type endorsements and recurrent training.

Caveats

2.4 This report is subject to the following caveats:

(a) the data sourced from the CAA and other agencies involved a relatively small data sample. Any quantitative analysis based on this data, therefore, must be done with care. Although broad differences between periods can be established, any detailed analysis of changes in rates over time is difficult to make;

(b) unless otherwise stated, occurrence statistics are based on data derived from the CAA's Mandatory Occurrence Information System;

(c) the Commission's inquiry into flying training in New Zealand involved a high-level descriptive analysis of selected data and research to try to gauge whether potential safety issues regarding flying training were valid and, if so, to what extent. A significant amount of data and research came from published material, mostly international. Other data was requested from relevant organisations such as the CAA, ASL, the Tertiary Education Commission (TEC) and Airways Corporation of New Zealand (Airways);

(d) the Commission focused on a selected range of aviation safety performance indicators (for example, flying training fatalities and fatal accidents) for the purposes of this report. This select range, plus the limited occurrence data and research available, made it difficult for the Commission to gain a complete picture of trends in flying training safety.

3 Conduct of inquiry

Inquiries into flying training occurrences

3.1 The Commission and the CAA have separately investigated a number of fatal and non-fatal flying training occurrences in recent years. These have include:

(a) an "impact with terrain accident" in the Ruahine Ranges on 12 July 2010, involving a commercial pilot licence flight test where the instructor and student pilot were both seriously injured;

(b) a mid-air collision near Paraparaumu Aerodrome on 17 February 2008, between a light aeroplane flown by a student pilot and a light helicopter with an instructor and student pilot on board. All three pilots were killed;

(c) an "impact with terrain accident" near Cass Saddle on 16 January 2008, involving a cross-country training flight, where the 2 trainee pilots on board were killed;

(d) an "impact with terrain accident" in the Urewera Ranges on 26 October 2007, where the instructor was killed and the student pilot was seriously injured after their aircraft struck the ground.

3.2 These investigations highlighted a range of safety issues, including loss of pilot and air traffic controller situational awareness, pilot failure to maintain an effective visual lookout, and insufficient training for flying in mountainous terrain. In response to these safety issues, the Commission has made findings and issued recommendations to various parties, including to the Director of Civil Aviation, to minimise the risk to public safety.

3.3 On 10 May 2010 a helicopter and a light aeroplane almost collided overhead New Plymouth Aerodrome. Each aircraft had an instructor and student pilot on board. The aeroplane student pilot was preparing for a private pilot licence flight test and the helicopter student pilot had yet to have his first solo flight.

3.4 Both aircraft were being operated under visual flight rules and the pilots acted in accordance with their respective air traffic control clearances. The aeroplane descended from overhead using the standard circuit joining procedure for a left-hand circuit for the runway. The helicopter was operating above the normal circuit altitude in a right-hand circuit for the same runway. The aeroplane descended through the downwind leg of the helicopter's circuit.

3.5 The Commission found that air traffic control had not properly managed the increased risk of collision presented by the aeroplane's descending circuit altitude. It also found that the incident would not have occurred had the instructor or student pilot of the aeroplane stopped their descent after losing sight of the helicopter (Transport Accident Investigation Commission [TAIC], 2011a).

3.6 About 11 weeks later (on 26 July 2010), 2 training aeroplanes collided near Feilding. An instructor and a pilot student were on one of the aeroplanes, which crashed, killing both occupants. The solo student pilot of the other aeroplane successfully landed the aeroplane at the nearby aerodrome and was uninjured. The Commission immediately opened an inquiry after being informed of this accident (TAIC, 2012).

Examination of flying training safety in New Zealand

3.7 As a result of these previous occurrences involving flying training, particularly the New Plymouth and Feilding occurrences in 2010, the Commission became concerned that systemic or widespread matters might be affecting flying training safety. It therefore opened

an inquiry under section 8(2)(a) of the Transport Accident Investigation Commission Act 1990 to ascertain whether or not there were common factors or trends that may have contributed to the causes of these previous occurrences. This inquiry involved the Commission looking at whether flying training safety performance had deteriorated, as well as examining specific issues identified from written and oral public submissions, and from the Commission's own enquiries.

3.8 In November 2010 the Commission invited public submissions. In total, 54 written submissions were received – 34 from private individuals and 20 from organisations and clubs, mostly from the aviation sector. Some submissions raised issues outside the scope of the Commission's inquiry, including, for example, the noise levels around aerodromes. Notwithstanding these, the Commission fully considered all submissions, many of which raised common themes and issues. These included:

(a) the standard of flying training in New Zealand;

(b) the effects of increasing air traffic;

(c) the level of English language proficiency;

(d) radiotelephony communications;

(e) the failure of pilots to maintain situational awareness and to exercise effective see-and-avoid;

(f) the government funding structure for pilot training in New Zealand;

(g) access to weather information;

(h) the flying training regulatory system.

3.9 These issues are discussed in Section 5 of this report. In examining each of these issues, the Commission's primary objective was to determine whether these issues were affecting, or could potentially affect, flying training safety in New Zealand. If yes, then to what extent?

3.10 In addition to calling for submissions, the Commission's investigator-in-charge of the Feilding inquiry met with representatives from the CAA, ASL, the Aviation Industry Association (AIA), the TEC, the New Zealand Qualifications Authority, the Royal New Zealand Aero Club, Air Nelson and Eagle Airways to obtain their comments about flying training safety in New Zealand. The key themes arising from these meetings were similar to those raised in the written submissions.

3.11 In October 2011 Commissioners held a hearing to examine in more detail the key issues identified during its enquiries to date. This hearing comprised 3 separate meetings with the CAA, the TEC and the AIA. The AIA was represented by its Chief Executive and representatives from CTC Aviation Training, Ardmore Flying School, Air Hawke's Bay Limited, Air Manawatu, Nelson Aviation College, Mainland Aviation College and Nelson Marlborough Institute of Technology. The main themes from these meetings are included in the discussion in Section 5 of this report.

3.12 The Commission also reviewed an extensive range of published material from a range of sources, including the CAA, the Australian Transport Safety Bureau (ATSB), the Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile the Federal Aviation Administration (FAA) and the National Transportation Safety Board (NTSB). It also requested data from the CAA, ASL, the TEC and Airways.

4 Flying training safety performance in New Zealand

4.1 The comments received by the Commission as part of its inquiry into flying training safety in New Zealand indicated a general view among submitters based on anecdotal evidence that flying training in New Zealand is less safe than it used to be. The Commission sought to test this view by examining relevant statistics on flying training occurrences. In doing this, it asked 3 questions:

(a) is flying training in New Zealand less safe than it used to be?

(b) how safe is flying training in New Zealand compared with other countries?

(c) how safe is flying training compared with other aviation activities?

Is flying training in New Zealand less safe than it used to be?

Fatality rate for flying training

4.2 Figure 1 shows the annual rate of flying training fatalities in New Zealand between 2000 and 2011. The highest rate was in 2010 when 2.6 fatalities occurred per 100 000 flying training hours flown. Between 2000 and 2002, and 2004 and 2005, the fatality rate was zero, while in the remaining years the rate ranged from 0.5 to 2.2 fatalities per 100 000 hours.

4.3 Overall, the rate gradually trended upwards, with flying training recording an average of 0.9 fatalities per 100 000 hours flown annually. In total, there were 16 fatalities during the period, with an average of 1.6 deaths per fatal accident.

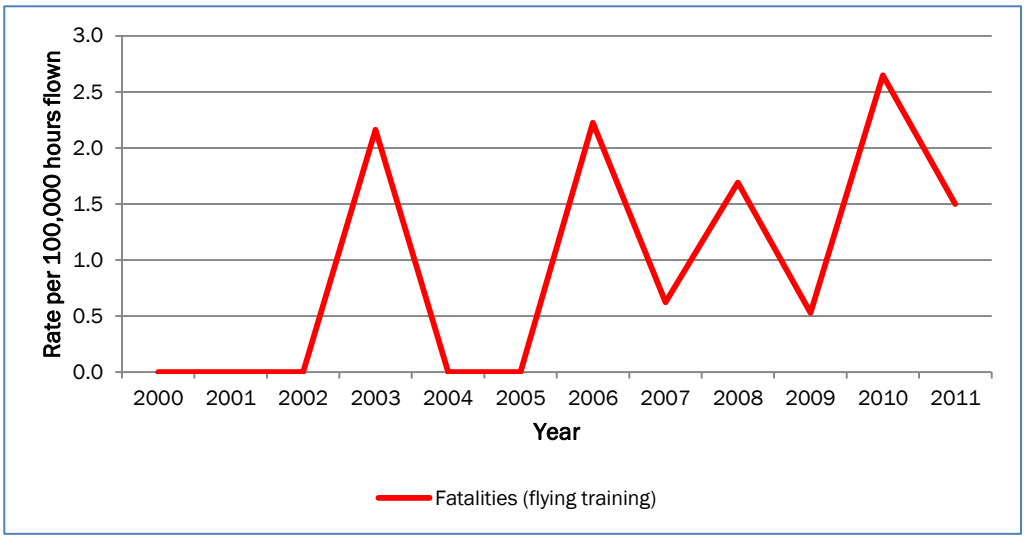

Figure 1
Fatalities per 100 000 flying training hours flown, 2000 to 2011
(CAA, n.d. [unpublished data])

Fatal accident rate for flying training

4.4 Figure 2 shows the annual fatal accident rate for flying training between 2000 and 2011. It shows a similar pattern to that in Figure 1, with the highest annual fatal accident rate occurring in 2003 with 2.2 fatal accidents per 100 000 hours flown. Between 2000 and 2002, and 2004 and 2005, the annual fatal accident rate was zero. Although there was

some variability between 2000 and 2011, overall the rate slowly trended upwards, with the annual average rate of fatal accidents being 0.6 per 100 000 hours flown.

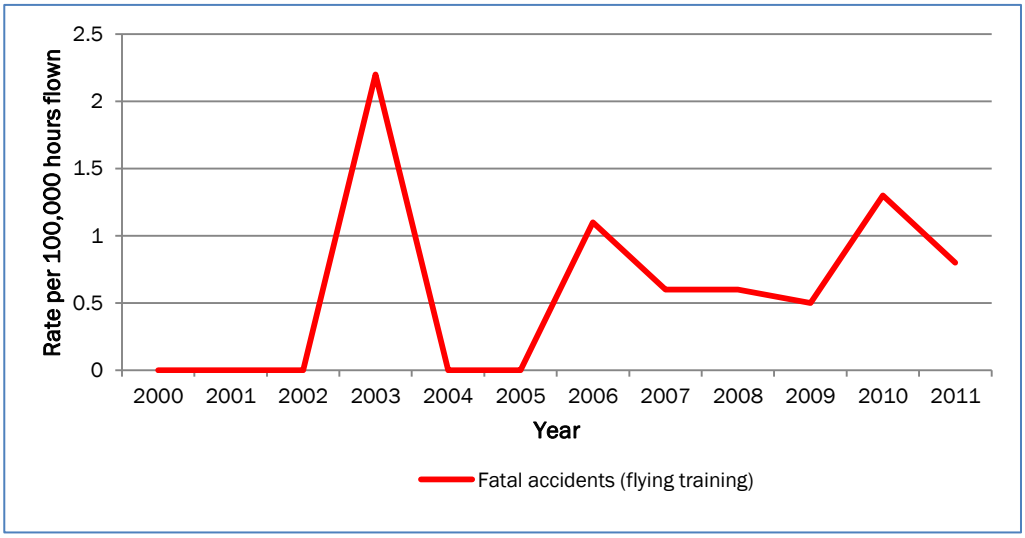

Figure 2
Fatal accidents per 100 000 flying hours flown, 2000 to 2011
(CAA, n.d. [unpublished data])

4.5 Overall, there were 10 fatal flying training accidents[3] between 2000 and 2011 involving 4 helicopters and 9 aeroplanes (i.e. 3 accidents in 2003, one in 2006, one in 2007, one in 2008, one in 2009, 2 in 2010 and one in 2011). The fatal accidents involved 7 solo training flights, 5 dual instruction flights, and one flight test[4].

4.6 In the preceding period 1988-1999, there were 4 training accidents with 4 fatalities compared with 10 accidents with 16 fatalities between 2000 and 2011. Although there was an increase during 2000-2011 in the number of fatal accidents and fatalities, the Commission could not determine if a significant long-term trend had started to develop.

Flying training occurrences

4.7 The rate of reported occurrences for flying training steadily increased from 80 per 100 000 hours flown in 2000 to 200 reported occurrences per 100 000 hours flown in 2010 (Aerosafe Risk Management [Aerosafe], 2011). This increase must be viewed with care as it may reflect a growth in flying training activity and an improvement in the reporting cultures of aviation participants, rather than a decline in the overall safety performance for the flying training sector.

4.8 The Commission reviewed controlled airspace incidents involving training aircraft that were reported to the CAA by Airways between 2000 and 2012 (Airways, 2011 [unpublished data]). This data showed a substantial increase in the number of incidents reported between 2009 (6 incidents) and 2010 (73 incidents). Data for 2011 exhibited a continual rise, with 135 incidents reported. The initial data for the first quarter of 2012 showed 66 reported incidents. These figures suggest that controlled airspace incidents are becoming a significant proportion of total flying training airspace incidents, with the majority occurring around Hamilton where

[3] A mid-air collision is counted as one accident.

[4] Care should be exercised when viewing the data in Figures 1 and 2. The annual fatality and fatal accident rates between 2000 and 2011 are based on very small numbers, with 5 of those years recording a rate of zero. Although broad differences between periods may be observed from these rates, any significant safety trends would be difficult to see, particularly as the small numbers cause the rates to be very volatile and to change substantially from year to year.

flying training activity is heavily concentrated. Further data, research and causal analysis would help to determine if this is a developing safety issue (it is possible, for example, that the observed increase may be the result of a stronger reporting practice by Airways).

4.9 In terms of all incident types reported to the CAA, according to Aerosafe (2011), the number of uncontrolled and controlled airspace-related incidents[5] attributable to flying training had significantly increased. For example, there was a noticeable rise from 2006 onwards, while other incident types remained relatively constant in the period. Generally, there had been a long-term upward trend in all airspace incident rates attributable to pilots and air traffic services (CAA, 2011a).

4.10 Aerosafe's (2011) research also found that airspace incidents had accounted for 55% of solo training occurrences and 30% of dual training occurrences. Further analysis indicated that "unauthorised airspace incursion" followed by "breach of other clearance" were the most frequently recorded airspace incidents for flying training. Aerosafe also noted that this could have been due to the training schools being located in areas of high air traffic and increased flying training in controlled airspace. The recent large-scale expansion of flying training at Hamilton is a good example. Equally, controlled aerodromes would be less tolerant of breaches than uncontrolled aerodromes

Flying training mid-air collisions

4.11 Figure 3 shows the number of reported flying training mid-air collision[6] and aircraft separation occurrences[7] in New Zealand between 1993 and 2011 involving at least one aircraft conducting either solo or dual training (including flight tests).

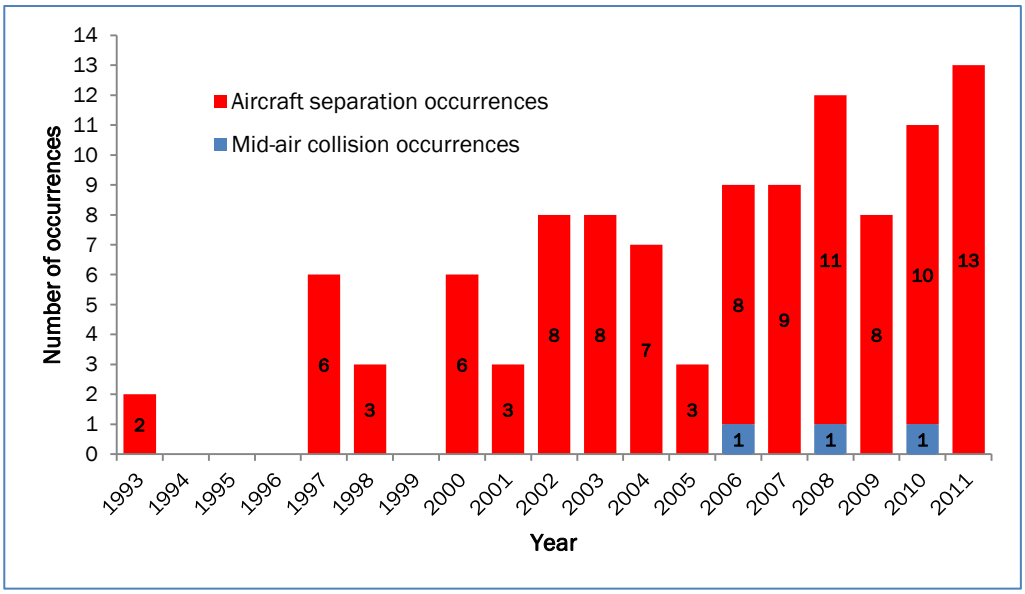

Figure 3
Number of reported flying training mid-air collision and aircraft separation occurrences, 1993 to 2011 (CAA, n.d. [unpublished data])

[5] An airspace-related incident means an incident involving a deviation from, or shortcomings of, the procedures or rules for avoiding a collision between aircraft or avoiding a collision between aircraft and other obstacles when an aircraft is being provided with an air traffic service.

[6] A mid-air collision occurrence is where at least 2 aircraft come in to contact with each other while both are airborne.

[7] An aircraft separation occurrence is either a "near collision" or a "loss of separation", as reported on the CAA's Occurrence Report (Form CA005) and is classed as an airspace incident. Advisory Circular AC12-1 describes a near collision as a "serious incident requiring an avoidance manoeuvre to avoid a collision or an unsafe situation or when an avoidance action would have been appropriate".

4.12 In particular, Figure 3 shows 3 fatal flying training mid-air collision accidents between 2006 and 2010[8]. These mid-air collision accidents accounted for about 2% of all flying training accidents between 2000 and 2010, but approximately 33% of all fatal accidents involving flying training aircraft. In the same period, 50% of the dual and 57% of the solo flights that were involved in flying training fatal accidents were mid-air collisions.

4.13 The average mid-air collision frequency rate for all locations from 1993 to 2011 was 0.2 collisions per annum, with an average of 2.3 fatalities per collision (or 1.2 fatalities per training flight involved), resulting in an average fatality rate of 0.4 per annum. The number of hours flown per collision for flying training aircraft in the period 1995-2011 was 361 883 hours.

4.14 Figure 4 shows the annual fatal mid-air collision accident rate for flying training between 1995[9] and 2011, with an average annual rate of 0.1 per 100 000 hours flown. Although there appears to have been a marked increase in flying training mid-air collisions from 2006 onwards, the elevated rate is due to the relatively quick succession of 3 mid-air collisions between 2006 and 2010. CAA records indicate that during the preceding 13-year period, there had been no reported flying training mid-air collisions. The Commission could not identify any systemic issues to account for this trend.

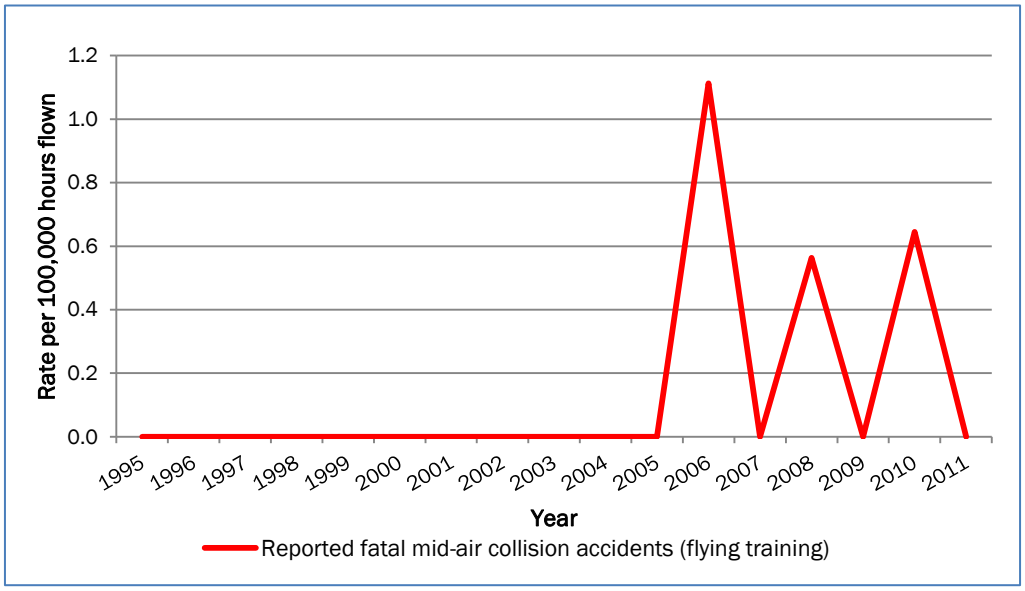

Figure 4
Reported fatal flying training mid-air collision accident rate, 1995 to 2011
(CAA, n.d. [unpublished data])

4.15 The very low frequency of flying training mid-air collisions does not enable reliable conclusions to be drawn about any future long-term safety trend. Nor does the actual mid-air collision data provide a reliable overall indication of the mid-air collision risk associated with flying training in New Zealand. A meaningful comparison of mid-air collision rates with other types of general aviation activity in New Zealand, to assess any potential increase or decrease in flying training mid-air collision risk over time, was not considered feasible owing to the very small number of occurrences that would be expected.

4.16 The Ambidji Group (2009) experienced the same issue when analysing mid-air collision data in Australia, noting that "the small number of accidents means that any statistical trend analysis

[8] These took place in Shannon (2006), Paraparaumu (2008) and Feilding (2010).

[9] Total flying training hours flown not available for 1993 and 1994.

should be treated with caution as 'runs' of two or three accidents in a short period could be due to statistical bunching or 'random chance', rather than an accurate prediction of an increase in long term accident rates".

Flying training aircraft separation incidents

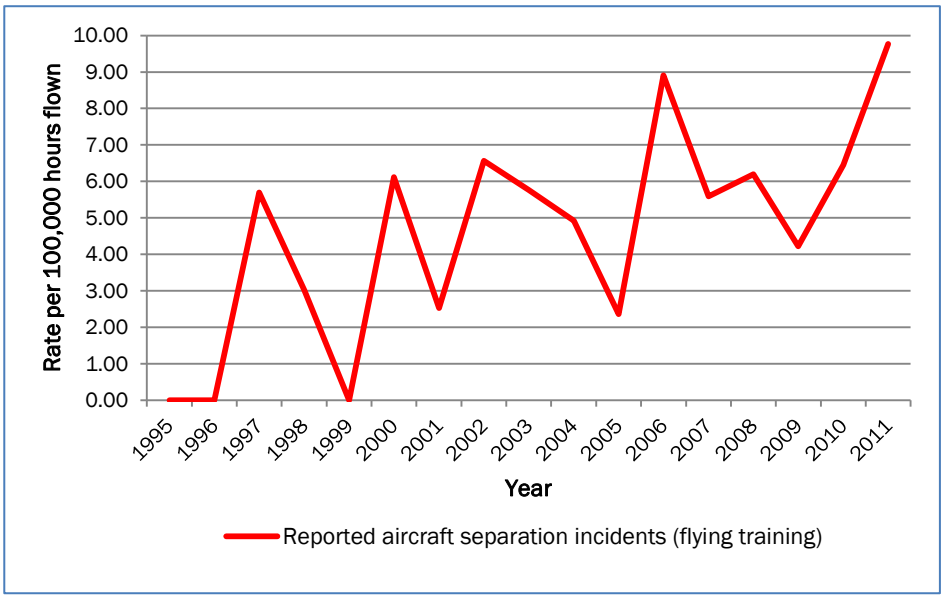

Figure 5
Reported flying training aircraft separation incident rate, 1995 to 2011
(CAA, n.d. [unpublished data])

4.17 Figure 3 above shows that 105 aircraft separation incidents (reported as either near collisions or a loss of separation) occurred between 1993 and 2011, involving at least one flying training aircraft where the safety of both aircraft may have been compromised.

4.18 On average, there were 5.5 aircraft separation incidents per annum from 1993 to 2011, with near collisions accounting for 48% and a loss of separation for 52% of incidents. As a proportion of total flying training reported airspace incidents in 2010, aircraft separation incidents accounted for approximately 8%.

4.19 Figure 5 shows that since 1995 there has been a sustained upwards trend in the rate of aircraft separation incidents recorded each year involving flying training aircraft. For example, the rate of reported incidents increased from zero in 1995/96 to a peak of 9.8 per 100 000 hours flown in 2011. Notably, there was a wide fluctuation in the trend from year to year. The average flying training annual aircraft separation incident rate was 4.6 per 100 000 hours flown between 1995 and 2011.

4.20 It was difficult to determine if the increasing rate of reported aircraft separation incidents represented a positive or negative outcome for flying training safety. When analysing the data and considering overseas studies, the following was found:

(a) a flying training aircraft involved in an aircraft separation incident did not necessarily mean that the pilot of that aircraft or the other conflicting aircraft had done something wrong. In several incidents, for example, it was apparent that actions by air traffic controllers were a contributing factor;

(b) it was not possible to assess from the CAA data the extent to which the incidents involved training-aircraft-to-training-aircraft conflicts. As such, the increasing trend may not necessarily be training specific but could involve other forms of aviation;

(c) the significant increase in the number of reported aircraft separation incidents could have been due to an improved awareness of and a greater willingness by the aviation industry to report, particularly in the aftermath of a mid-air collision. For example, the FAA observed that near mid-air collision reports could be influenced by factors not easily quantified, including the "heightened awareness caused by the recency and notoriety of aviation accidents and pilots' interest in filing NMAC [near mid-air collision] reports" (United States General Accounting Office [GAO], 1989), and that following a serious mid-air collision or near collision reporting tended to increase, sometimes substantially, but then decline over time to near previous levels. Similar reporting behaviour has been seen in regard to other incident categories; for example, fire, smoke and fume events following the Swissair MD-11 accident off Nova Scotia in 1998. Accordingly, the rise in aircraft separation incidents observed since 2006 could have been partly attributable to the 3 mid-air collisions in 2006, 2008 and 2010, all of which attracted media and industry attention;

(d) a pilot-filed aircraft separation report is effectively a written account of a pilot's perception that, when airborne, "another aircraft came dangerously close and a potential for collision existed" (GAO, 1989). The ATSB (2012) has noted that aircraft separation incident reports from general aviation pilots "are not clear on 'how close' the aircraft got, and it is difficult to determine what the likelihood of a mid-air collision was".

Conclusion

4.21 Based on a preliminary analysis of the occurrence data above, it is not possible to conclude statistically that flying training in New Zealand is less safe now than it used to be. Although the rates of fatality and fatal accident have steadily increased over time, the actual number of fatal accidents is very low (from zero to 3 per annum). With such low numbers, caution needs to be exercised in drawing statistical conclusions as to whether there has been any significant underlying change in the rates of fatality or fatal accident. As numbers have fluctuated during the reported period, it is difficult to discern any long-term safety trends for flying training.

How safe is flying training in New Zealand compared with other countries?

4.22 Time and resources meant that the Commission could not undertake an extensive comparable analysis of flying training safety performance indicators from multiple overseas jurisdictions. Accordingly, the Commission limited its research to data from the ATSB in Australia and the NTSB and the FAA in the United States. This data indicates that the overall rates of flying training fatality and fatal accident in New Zealand are broadly comparable with the rates found in Australia and the United States for the period 1999-2009.

4.23 For example, Figure 6 shows New Zealand's fatality rate for flying training in the period 1999-2009 against those of Australia and the United States. Error bars show the year-to-year fluctuations in the rate. Because New Zealand has a much smaller flying training industry than Australia and the United States, its rate of fatalities is much more affected by random fluctuation. Its error bar therefore has a wider span.

4.24 Figure 6 also indicates that flying training in New Zealand is probably just as safe as it is in Australia and the United States. Although the variability in the rate of fatalities in New Zealand is much greater than in Australia and the United States because the flying training industry is smaller, the overall fatality rates for all 3 countries for the 1999-2009 period appear to be broadly similar.

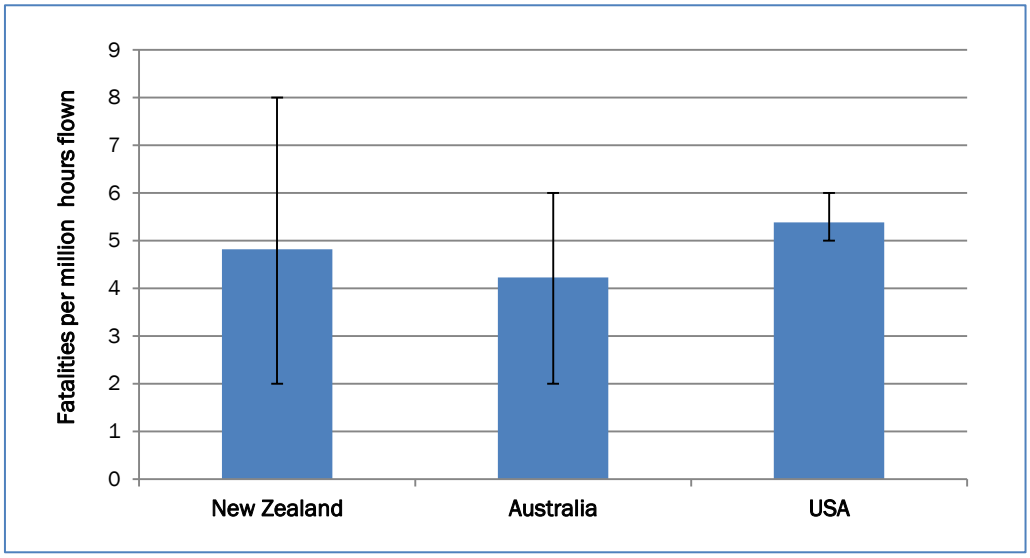

Figure 6
Flying training fatality rates by country, 1999 to 2009
(CAA, n.d. [unpublished data]; ATSB, 2010a; FAA, 1999; NTSB, n.d.)

How safe is flying training compared with other aviation activities?

4.25 Data and research reviewed by the Commission indicate that in comparison with other modes of aviation, flying training is generally one of the safest forms of flying activity. This was confirmed by CAA (2005) research, which compared fatal fixed-wing accident rates for different operational groups in New Zealand between 1995 and 2004. This research showed that flying training (solo and dual) was on average safer than any other form of flying and that it produced relatively few accidents compared with other types of operation. This was possibly due to training taking place in controlled environments, with attention to safety procedures, and sometimes with instructors creating safe learning environments for the students.

4.26 More recent data, as shown in Figure 7, also suggests that flying training is much safer than other forms of flying in Australia. Between 1999 and 2009 there were 28.7 fatalities per million flight hours for private flying compared with 4.2 fatalities per million flight hours for flight training.

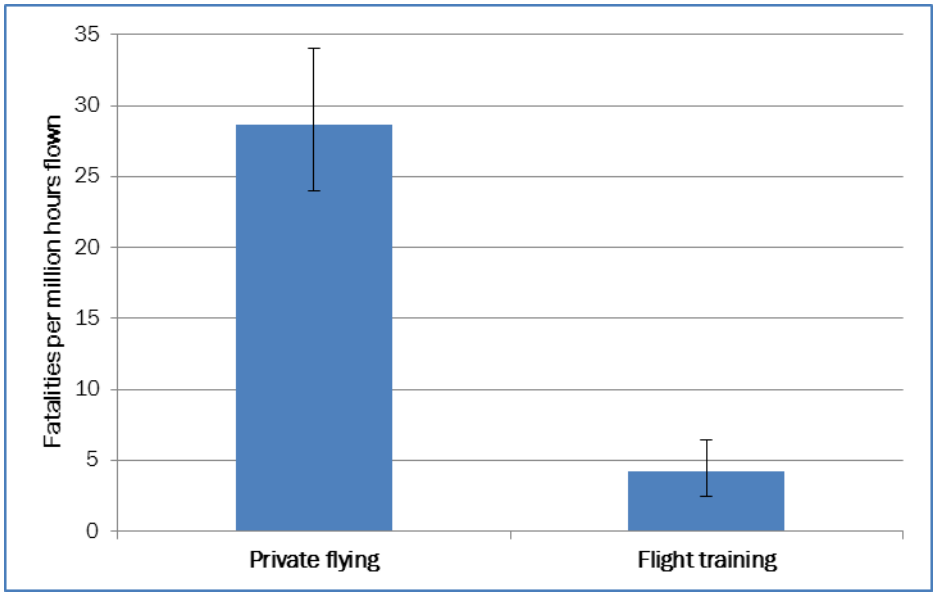

Figure 7
Private flying and flying training fatality rates, Australia 1999 to 2009 (ATSB, 2010a)

Findings

1. Based on a preliminary analysis of occurrence data, it is not possible to conclude statistically whether flying training in New Zealand is less or more safe now than it used to be.

2. The rate of fatalities changes from year to year much more in New Zealand than it does in other countries, because the flying training industry is smaller. Overseas data, however, indicates that the overall rate of flying training fatalities and fatal accidents in New Zealand is broadly comparable with the rates found in Australia and the United States for the period 1999-2009.

3. Research and data from the CAA and the ATSB indicate that flying training is likely to be safer than other forms of flying.

5 Issues applicable to flying training safety in New Zealand

Introduction

5.1 Enquiries made by the Commission and written and oral submissions received from interested persons identified several aspects of the New Zealand flying training system and flying in general that could be affecting safety. The following discussion looks at each of these aspects in turn, drawing on comments from submitters, where appropriate, to highlight particular issues. In examining each of these issues, the Commission's primary objective was to determine whether these issues are affecting, or could potentially affect, flying training safety in New Zealand in any way (as suggested by submitters or anecdotally). If yes, then to what extent?

Standard of flying training in New Zealand

5.2 The Commission received considerable and varied feedback about the overall standard of flying instruction in New Zealand, with some submitters (mostly training organisations) commending the quality of training, and others (mostly individuals) expressing concerns about a range of aspects of flying training, including the low experience levels of flight instructors and the differences between flight schools regarding the quality of training, the method of teaching and the material taught.

5.3 Unquestionably, the quality of flying instruction is fundamental to the long-term safety performance of aviation. A multitude of factors acting in combination influence the correct knowledge, skills, attitudes and behaviours acquired during flight training to ensure that pilots operate safely and exhibit good airmanship. The quality of the training given to flight instructors and flight examiners is just as important.

5.4 The Commission did not find any specific research examining the quality of the flight training system in New Zealand. If research in this area were to be conducted, a closer analysis of the results of flight tests and written examinations would be useful to determine if there is a link between examination performance and the frequency and severity of occurrences during and after training. This was recommended by Aerosafe (2011), which noted that this type of analysis might "reveal a trend between student pilot performance in examinations and performance in the air, during and post training". Such an exercise might also help to identify any weaknesses in certain areas of the training syllabus, such as theory, knowledge and practical airmanship. This, in turn, might provide a general indicator of training standards and performance in New Zealand.

5.5 Although the Commission did not examine this matter in any detail, it did receive data from ASL (ASL, 21 February 2011) showing the 2010 pass rates for the private pilot licence written exam (75%), the commercial pilot licence exam (71%) and the airline transport pilot licence exam (78%). These pass rates were similar to those in Australia (Civil Aviation Safety Authority [CASA], 2011).

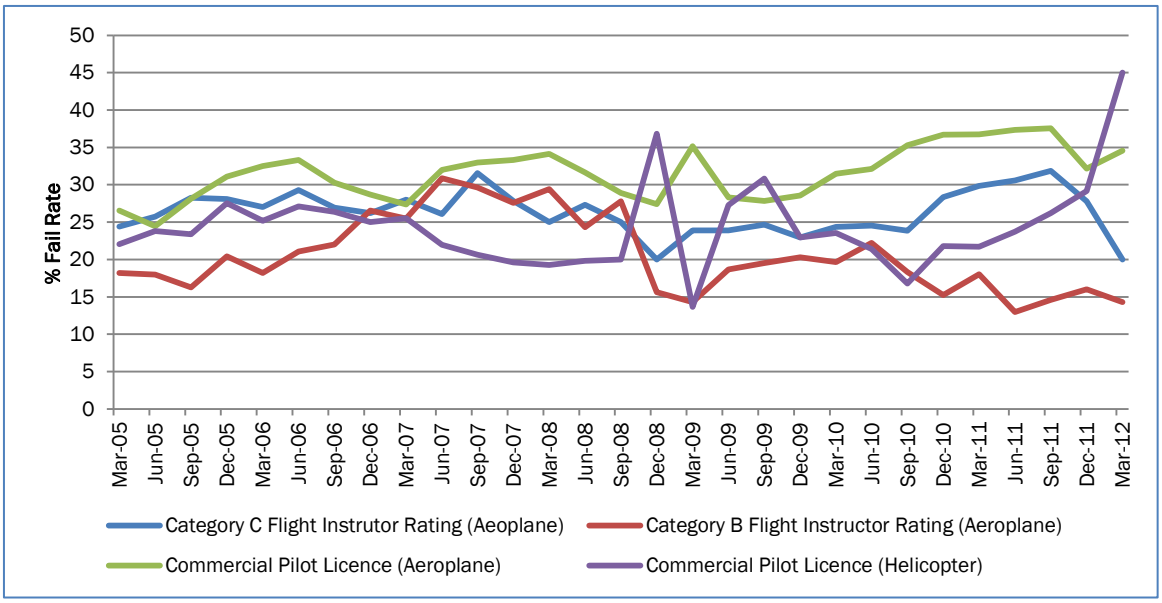

Figure 8
Initial issue flight test failure rates, 2005 to 2012 (ASL, n.d.)

5.6 The Commission also looked at published data from ASL showing the quarterly initial issue flight test results since 2005 for commercial pilot licences (aeroplane and helicopter) and for Category B and C Flight Instructor Ratings (aeroplane only) (ASL, n.d.). These appear in Figure 8, and show that the fail rates for each group were generally constant between 2005 and 2012 (to date). The average quarterly fail rate for the commercial pilot licence (aeroplane) was 32%, and for the commercial pilot licence (helicopter) it was 24%. The average quarterly fail rate for Category B instructors was 21%, and for Category C instructors it was 26%. In comparison, in 2010 the fail rate for the initial issue of Flight Instructor Ratings tests (aeroplane and helicopter) in Australia was approximately 24% (CASA, 2010).

5.7 At a high level, the information in Figure 8 indicates that there has been a consistent standard of pilot training achieved in New Zealand, but an ongoing analysis is required to identify opportunities to improve student pilots' pass/fail rate performance. For example, the more recent rise in the fail rate for commercial helicopter pilot licences would warrant monitoring.

5.8 Overall, the Commission did not find any evidence of significant gaps with the flying training programme. This is not to say that gaps (significant or otherwise) do not exist. It simply means that the Commission did not find any evidence of this.

5.9 The Commission also requested data from the CAA, including information about flight instructor demographics (e.g. qualifications, experience levels, age) and flight instructor performance and competency levels. However, this information was either not available (i.e. because the CAA did not collect it) or not easily accessible (i.e. because of the way the information had been recorded in the CAA's database). This lack of basic information is concerning. General information of this nature is important and should be collected and analysed as a matter of practice. The CAA, as the regulator, seems the most appropriate agency to do this.

Findings

4. The Commission was unable to conclude whether the standard of flight training in New Zealand presents risks to flight training safety. It did not find any specific research examining the quality of the flight training system in New Zealand or any evidence of significant gaps with the flying training programme. This is not to say that gaps (significant or otherwise) do not exist. It simply means that the Commission did not find any evidence of this.

5. General information about flight instructor demographics (e.g. qualifications, experience levels, age), performance and competency levels is difficult to obtain, with no one agency responsible for collecting this. This data gap should be addressed.

Effects of increasing air traffic

5.10 A common issue identified by a number of submitters was the increase in student pilot numbers and air traffic in the past 10 years, and how this might be contributing to flying training occurrences.

5.11 The pilot training market in New Zealand, particularly that catering for international students, is a high-growth market. In 2008 an article in the CAA's industry magazine, Vector, noted an increase in the number of students training for commercial pilot licences from about 300 to more than 800 per year ("Flight Training Growing Pains", 2008). In 2010 a CAA paper noted that the capacity of the training sector was estimated to be in the region of 500 trainee pilots a year (CAA, 2010), and a further paper found that approximately 448 aircraft were being used for training purposes in New Zealand as at 2010 (Knotridge Limited, 2010).

5.12 Notwithstanding some consolidation in the past few years, the flying training industry in New Zealand is optimistically forecast to nearly double in value by 2015, with overseas students accounting for most of the revenue growth and their contribution increasing to $56 million (Knotridge Limited, 2010). It is reasonable to assume that flying training activity and the aircraft training fleet will increase commensurately at a time when other forms of aviation activity will expand.

5.13 Several international studies have analysed the relationship between specific occurrence types and increasing air traffic. For example, when considering the mid-air collision potential in Australia, the ATSB hypothesised that the probability (likelihood) of a collision in any given airspace would grow more quickly than the growth in traffic (ATSB, 1991).

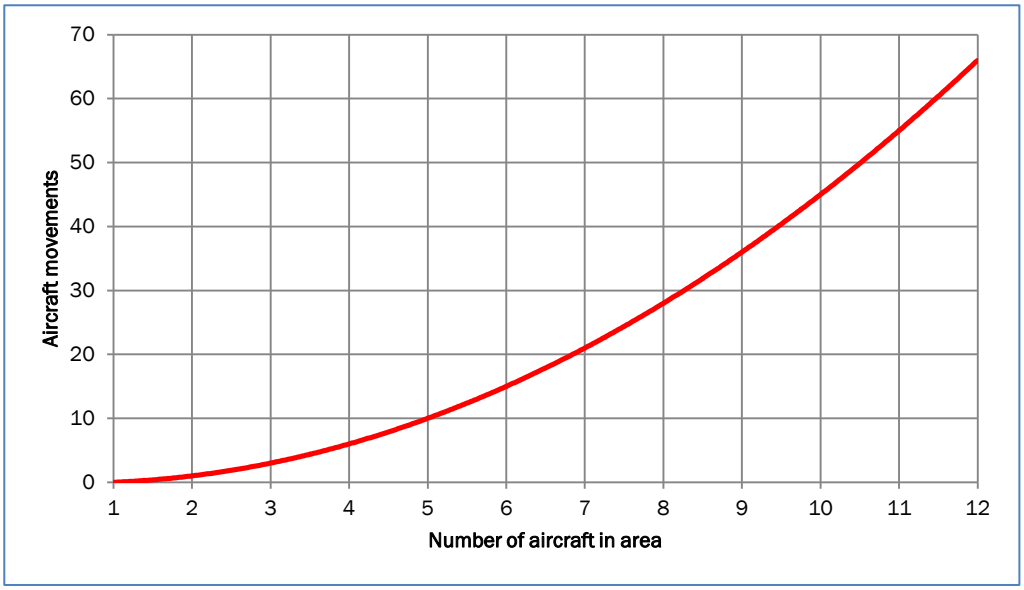

Figure 9
Number of possible collisions with increasing air traffic (ATSB, 1991)

5.14 Figure 9 illustrates the theoretical increase in potential collision pairs (each involving 2 aircraft) as a result of increasing traffic density. For example, with 5 aircraft in the area there are 10 possible collision pairs and with 10 aircraft there are 45 (ATSB, 1991).

5.15 If this model were to reflect reality accurately, and with all other things being equal, even a modest increase in the number of aircraft flying could result in a disproportionately large increase in potential and actual occurrences. This, however, assumes that no mitigation measures are implemented to prevent mid-air collisions in a period.

5.16 Another ATSB study found a positive relationship between the number of runway incursions and the level of aerodrome traffic (ATSB, 2004a). A similar trend was documented in a Transport Canada report, which noted that as aerodrome traffic increased there was a rise in the potential risk of incursions that could in turn result in a rise in actual incursions (Transport Canada, 2000). The report attributed the increase in traffic and potential risk to the use of capacity-enhancing aerodrome procedures (e.g. parallel runways).

5.17 However, the results of these studies must be viewed with caution. It would be over simplistic to assume that there will be a positive correlation between occurrences and air traffic volumes. The second ATSB report noted above, citing Australian and United States occurrence data, deduced that an increase in incursions in some years was not solely due to an underlying increase in aircraft activity. A further ATSB discussion paper reported that there had been 37 mid-air collisions at a static rate of about one collision per year since 1968, despite the growth in aviation experienced in Australia (ATSB, 2004b).

5.18 The Commission did not find any data or research specific to flying training or general aviation in New Zealand on this matter. Accordingly, it is not clear to what extent increasing air traffic could be a problem or what the ongoing trends are in New Zealand. It is clear though that increased traffic density may not be the only explanation for the number of occurrences to increase in the flying training sector. Other contributing factors could be relevant, such as pilot demographics, the inherent difficulties of pilots sighting other aircraft in time to avoid collisions, and the configuration of aerodromes, including the type and mix of air traffic at those aerodromes, traffic separation standards and their use of capacity-enhancing procedures. Even the increased presence of ground vehicles could be a factor as an aerodrome expands its infrastructure to meet increased aviation demand. Having said that, increasing aerodrome traffic is certainly likely to increase the risk of occurrences.

Findings

6. The effects of increasing aviation activity in New Zealand on flying training and aviation safety in general are uncertain. There is insufficient data and research on this matter.

7. International research (which is limited and not conclusive) shows that increasing traffic is likely to be a contributing factor but not a dominant cause of flying training occurrences. Accidents do not happen solely because there is an increase in traffic, although the risk is likely to be elevated.

English language proficiency

5.19 Several submissions commented on the level of English language proficiency required by students and pilots, including an industry trade body, which wrote:

> At these [non-air traffic control] airports, aircraft transmissions are recorded primarily for the purpose of obtaining information for invoicing landing fees. Notwithstanding, considerable difficulty is often experience[d] when attempting to recover the transmissions from the recording system as the standard of radio procedure is frequently poor with many important calls often unintelligible. Of particular concern is the inability of many student pilots, principally from overseas countries, to enunciate the phonetic alphabet and accordingly pass clearly their aircraft registration, or call sign, and the relevant information pertaining to their intentions.

5.20 Another submitter (a pilot organisation) highlighted another aspect of this issue, stating that:

> It also appears that the large number of foreign students being trained in this country now days [sic] creates its own issues, particularly from English proficiency students. The concept of "pay an amount and get a PPL [private pilot licence] or CPL [commercial pilot licence]" often encourages the instructors at large training schools to release students at a planned point in time rather than on a competency basis and includes that instructor's acceptance that English proficiency has been achieved yet for the majority of these students, that is not the case. If a student is struggling with standard phraseology in English then the extent to which that student has understood the instructional flying training to become a competent aviator is doubtful.

English language proficiency requirements

5.21 In 2008 the International Civil Aviation Organization (ICAO) promulgated English language proficiency standards for radiotelephony communications in international air transport (ICAO, 2010), following several high-profile accidents where insufficient English language proficiency by the pilots or air traffic controllers was a contributing factor. These requirements were designed to improve the level of English language proficiency in civil aviation and to reduce the frequency of communication errors. They focused on oral communication only rather than on writing and reading ability, and they covered 6 areas of proficiency: pronunciation, structure, vocabulary, fluency, comprehension and interactions.

5.22 ICAO introduced a 6-level English language proficiency rating scale, ranging from Level 1 (Preliminary) to Level 6 (Expert), and mandated Level 4 (Operational) as the minimum proficiency skill level required by licensed pilots to fly safely.

5.23 In New Zealand, these ICAO requirements are largely incorporated in CA Rule Part 61 (Pilot Licences and Ratings) for private pilot licence holders and above. For example, Part 61.11(b) requires an applicant for a pilot licence to have sufficient ability to speak, understand and communicate in the English language to enable that applicant to exercise the privileges of their licence adequately (CAA, 2011b). An applicant must demonstrate this level of compliance by demonstrating proficiency to at least ICAO Level 4 (Operational) and completing a number of other tasks such as communicating effectively in voice-only (radiotelephone) communications and using a dialect or accent that is intelligible to the aeronautical community. If, at any time, the Director of Civil Aviation believes on reasonable

grounds that a pilot's English language ability is inadequate, the pilot may be required to undertake a language proficiency assessment[10].

5.24 A student pilot may also demonstrate their English proficiency to at least ICAO Level 4, although this is not mandatory under Part 61 until applying for a private pilot licence. When a flight instructor is satisfied that a student pilot has met an accepted English language assessment requirement, the flight instructor must endorse the student pilot's log book.

5.25 Two forms of ICAO English language proficiency assessment are available. These involve supervised listening and speaking telephone tests. Both assessments are designed to measure a pilot's ability to communicate accurately in English. A person's "spoken aviation English" and general English skills, as specified by ICAO, are assessed. "Aviation English" includes standard radiotelephony phraseology and common language relevant to the aeronautical environment.

5.26 For Levels 4 and 5, the "Formal Language Evaluation" assessment is more suitable for persons who are not fully proficient in English. It includes a semi-automated test and a live interview. The "Level 6 Proficiency Demonstration" assessment is designed to confirm that native or very proficient non-native English speakers can clearly meet ICAO's Level 6 language criteria. This assessment is suitable for persons who are confident that they are able to communicate fluently at Level 6 in all respects. Even native English-speakers who have speech defects or strong regional accents that could render communication difficult with air traffic control or pilots of other aircraft may not qualify for Level 6.

Accidents and related research

5.27 Statistics published by ICAO indicate that during the period 1976-2000, more than 1100 people lost their lives worldwide in aviation accidents in which a lack of understanding of the English language was a contributing factor ("English Language Proficiency", 2007). In addition, ICAO found that multiple incidents and near misses resulting from language problems were reported annually (ICAO, 2010).

5.28 A study by the FAA looked at the types and frequency of communication problems experienced by airline pilots who may or may not have had English as their primary or official language (FAA, 2008). The findings revealed that when the registry of an aircraft was foreign and its primary or official language was not English, not only did pilots spend more time communicating with air traffic control but they also exchanged more transmissions and had more communication problems. It was reported that English language proficiency was a factor in 75% of the sampled communication problems among the foreign, non-native English aircraft and 29% involving United States-English aircraft.

5.29 Another FAA study found that non-English speaking airline pilots were at a disadvantage when flying into countries where their primary or native language was not spoken (FAA, 2009). The report indicated that although there were fewer foreign aircraft in the communication sample, proportionally, the pilots of these aircraft made more communication errors.

5.30 This research also noted that a pilot's general English proficiency, especially accent, often resulted in the traffic controller not being able to understand completely what the pilot was attempting to say. Although more problematic for foreign pilots, it was noted that dysfluencies[11] were a fairly common factor for English-speaking pilots too. Notably for all pilots, accent affected the intelligibility of 40% of pilot messages.

[10] Part 61.43(a) of the CA Rules.
[11] Speech that is not smoothly delivered or grammatically well formed.

5.31 Within New Zealand there is a lack of data on, and no perceivable trend about, the prevalence of occurrences attributable to English language proficiency problems in either controlled or uncontrolled airspace, or to student pilots being unable to communicate because of their inadequate knowledge of the English language. Although numerous overseas studies have looked at this safety issue, the Commission was not able to find any that specifically looked at English language proficiency in the context of flying training.

5.32 A review of the CAA's occurrence database revealed a total of 8 incidents between 1986 and 2012 that, to judge by the occurrence descriptions, involved poor English language proficiency. Of these, 5 were training flights that involved foreign student pilots. It was not possible to conclude if the student pilots were English-speaking or non-English-speaking. There were no fatalities or injuries as a result of these incidents. The last notified incident occurred in 2000.

5.33 The Commission has investigated only one aviation incident where the English language proficiency of the flight crew may have been a contributing factor. This incident occurred in 2004 (before ICAO introduced its English language proficiency requirements) and it involved an international scheduled airline operator. In that case the Commission found that the effect of English as a second language on the flight crew's competency and compliance was a safety issue (TAIC (a) n.d.).

Findings

8. International studies have found that poor English language proficiency has played a contributing role in a number of significant international accidents.

9. Anecdotal evidence suggests that poor English language proficiency and comprehension of English may have been contributing factors in some New Zealand occurrences. However, with the exception of one occurrence that it investigated, the Commission did not find any data or research to support this.

10. New Zealand has a pertinent and specific framework for testing English language proficiency in civil aviation, as required by ICAO. The Commission found no evidence to suggest that this testing regime is not providing reliable, valid and practical evaluations of pilot language proficiency in accordance with ICAO criteria.

Radiotelephony communications

5.34 Several written submissions raised concerns about non-standard radio calls, the inappropriate use of radio equipment and inadequate training in radiotelephony. One submitter (an airport operator) wrote:

> Generally our experienced staff have had difficulty in understanding pilots who do not have English as their first language. There is also an issue with the radio procedure employed by local pilots through either familiarity or complacency. The major issue centres on pilots not speaking clearly, rushing their communications (particularly call signs) and not being clear about their location and intentions. Within the circuit normal "Base" or "Finals" calls are frequently omitted along with the intentions of the pilot. Overall the standard of radio procedure is generally poor.

Radiotelephony communication requirements

5.35 In its simplest form, radiotelephony provides the means by which pilots and ground personnel communicate with each other. Radiotelephony is essential for the safe operation of aircraft in a busy environment.

5.36 In the past 50 years ICAO has promulgated standards, recommended practices and guidance material to harmonise radiotelephony speech and to improve the use of standard aviation phraseology in international aviation.

5.37 New Zealand, like many other countries, has incorporated ICAO requirements and international best practice in its aviation legislation, for both international and domestic air transport operations. For example, under CA Rule Part 61.105(a)(5), a flight instructor must certify that their student has received instruction and demonstrated competence in practical flight radiotelephony before permitting that student to fly solo. Before receiving a private pilot licence a student pilot must pass a written exam that requires a good knowledge of the applicable rules and radio procedures. As part of the private pilot licence flight test, a student pilot must successfully demonstrate to the flight examiner competency in radiotelephony procedures and phraseology.

5.38 In addition to the CA Rules, the CAA has produced a number of Advisory Circulars and guidance material containing information about the standards, practices and procedures to facilitate compliance with the radiotelephony communication rules. The New Zealand Radiotelephony Manual contains a compendium of clear, concise, standardised phraseology and associated guidelines for radiotelephony communication in New Zealand (CAA, 2011c).

New Zealand occurrence data and research

5.39 The Commission could not clearly identify radiotelephony communication occurrences in New Zealand that were specific to flying training. A review of the CAA's occurrence database for the period 1993-2012 found approximately 290 incidents that, judging from the occurrence descriptions, *may* have involved radiotelephony miscommunication events of some nature. These incidents typically resulted in the following occurrence types being recorded: unauthorised airspace incursion, loss of separation, unauthorised altitude penetration, and breach of other clearance. None of the incidents resulted in fatalities or injuries. Notably, there was a prevalence of incidents involving air traffic controllers using non-standard radiotelephony phraseology.

5.40 Neither the CAA nor Airways has closely examined the role of radiotelephony errors in flying training incidents or generally. Nor could the Commission find any other data, research or analysis conducted on the prevalence of radiotelephony communication-related incidents in New Zealand.

5.41 Notwithstanding this, when the CAA met with Commissioners in October 2011, it acknowledged an issue with phraseology and the practice and use of radiotelephony in aircraft. In promoting its 2012 series of AvKiwi safety seminars for pilots, it commented that poor radio calls could lead to airspace infringements, blocked runways, near misses and collisions (CAA, 2012b). It also noted that in 2011 there were almost 300 incidents of aircraft reported as being in the wrong place in New Zealand skies, often with poor communication as the cause.

5.42 The Commission has previously investigated incidents involving non-adherence to standard procedures for radiotelephony use, and made recommendations regarding compliance with published radiotelephony techniques. Two of these incidents, which involved scheduled air transport operations, resulted in critical runway incursions but no fatalities, injuries or damage (TAIC (b) n.d.).

5.43 In 2011 the Commission recommended "that the Director of Civil Aviation promote to all pilots and operators, through the best means available, the need to use appropriate phraseology to declare a level of urgency or distress that reflects the true nature of an emergency (001/11)" (TAIC, 2011b). In response to this recommendation the CAA used its 2012 series of AvKiwi safety seminars to promote the use of correct phraseology in various situations. The seminars covered the principles of good radiotelephony, radiotelephony discipline and phraseology, with

practical examples of good and bad radio calls plus an electronic interactive education radio course called Plane Talking. The CAA also produced a new guide to good radio operating practice titled Plane Talking, A Guide to Good Radio Use (CAA, 2012a).

International occurrence data and research

5.44 Cushing (1994) examined problems with radiotelephony and cited many instances, worldwide, where occurrences had happened because of:

(a) pilots turning down their radio volumes either intentionally or unintentionally

(b) pilots forgetting to use their radios

(c) pilots mistakenly turning to the wrong frequencies

(d) pilots using their radios for unnecessary communications

(e) pilots using incorrect phraseology.

5.45 Data from the United Kingdom suggested that the 3 main types of communication error were read-back and hear-back errors, call sign confusion and non-adherence to radiotelephony standards. Communication errors were present in 40% of United Kingdom runway incursions in 2005 (National Air Traffic Services, 2006).

5.46 A United States survey of general aviation incidents during dual instruction revealed that one-third of these incidents were associated with communication difficulties (Etem & Patten, 1998). These problems included failure to comply with air traffic control clearances, communication equipment malfunctions and poor radio technique. The study also found a prevalence of tower-communication reports, reinforcing the notion that the effective management of instructional communications while monitoring tower frequencies was crucial to the effective and safe conduct of dual training operations.

5.47 In 2006/07 the ATSB reviewed surface movement control frequency tapes in response to industry concerns about the use of excess and non-standard phraseology in read-backs, resulting in radio congestion (ATSB, 2007a). The review identified a high level of compliance with the aeronautical information publication read-back requirements, but it noted that the use of pleasantries was commonplace. Although these did not appear to affect frequency congestion adversely, in times of high traffic density they were considered inappropriate.

5.48 The ATSB's review also noted 2 other key points: that despite technological advancements (e.g. digital datalink systems) verbal communication remained the most common form of communication in the air traffic system; and that the use of standard radiotelephony phrases and procedures, such as read-backs, was one of the inherent risk controls in pilot-controller communications.

Findings

11. Aviation investigation authorities and civil aviation regulators worldwide acknowledge that radiotelephony communication-related occurrences are a significant risk to aviation safety.

12. Anecdotal evidence suggests that radiotelephony miscommunication may have been a contributory factor in some New Zealand occurrences; however, the Commission did not find any data or research to support the concern that a significant problem exists with radiotelephony communications in the New Zealand flying training sector or in general. Overall, reported radiotelephony communication-related incidents in New Zealand account for only a very small proportion of total reported occurrences

(statistically insignificant).

13. New Zealand has a pertinent and specific regime for teaching and testing radiotelephony communications, which is consistent with ICAO's standards and recommended practices. The Commission found no evidence to suggest that this regime is not providing reliable, valid and practical evaluations of pilot radiotelephony proficiency in accordance with ICAO criteria.

Situational awareness and see-and-avoid

5.49 Several written submissions commented on situational awareness, particularly the need for greater training in this area and the effects of cockpit workload on pilots' ability to keep track of where they are. Other written submissions commented on the effectiveness of the see-and-avoid principle, with 2 submitters referencing a French study (Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile, n.d.) to support their conclusions that the see-and-avoid principle is flawed.

5.50 Factors that limit the see-and-avoid principle include: "diffusion of responsibility", where a pilot might assume that another pilot in the cockpit is keeping watch; cockpit workload, where pilots are tempted to keep their heads down rather than look out their windows; aircraft design features or ergonomics, where cockpit layout and windshield obstructions prevent proper views outside the aircraft; pilots' visual blind spots; and pilots not being able to actually see aircraft owing to sun glare.

5.51 The problem with cockpit workload was noted by a pilot organisation in its written submission to the Commission. It wrote:

> Also, because of the growing number of glass cockpit aircraft being used in the training arena these days plus the natural lean towards automated navigation equipment etc [it] seems to be resulting in student pilots concentrating more [on the] inside [of] the cockpit than out which negates both the "see and avoid" principle and situational awareness which are crucial in congested airspace, particularly when uncontrolled.

5.52 It was also noted by the CAA when it met with Commissioners in October 2011 that:

> … the technology that is coming into those sorts of VFR [visual flight rules] aircraft is astonishing… But we are increasingly seeing a generation of pilots who are operating now heads down in the cockpit managing the technology.

5.53 Despite these known limitations, the see-and-avoid principle remains a fundamental element of good airmanship. It is generally accepted that it does work effectively in the vast majority of situations, preventing many collisions, although time and resources meant that the Commission could not fully examine the extent to which this was the case. In some situations it is the best, if not the only, form of ensuring separation between aircraft. A 1979 study, however, did estimate that without air traffic services and in the absence of any ability to see-and-avoid there would be 34 times more mid-air collisions en-route and 80 times more mid-air occurrences in terminal areas (Machol, 1979).

New Zealand occurrence data and research

5.54 Anecdotal evidence suggests that the number of occurrences involving a loss of situational awareness or the failure to use proper see-and-avoid is potentially high; however, the Commission was unable to verify this. Apart from Commission and CAA investigation reports where a loss of situational awareness was a factor during training, the Commission did not find any relevant research specific to flying training in New Zealand.

5.55 In addition, the Commission found it difficult to ascertain the number of occurrences in New Zealand where pilots had failed to apply the see-and-avoid principle effectively or where losses of situational awareness contributed to occurrences. This was partly because of the CAA's taxonomy for recording occurrences in its occurrence database, which did not specifically require it to record these 2 events as contributing factors. Also, analysing the CAA's occurrence database to identify and quantify the number of occurrences would have been a considerable task for the Commission.

5.56 As a crude indication, the Commission examined flying training occurrences held in the CAA's occurrence database between 1970 and 2012. This revealed 7 incidents where a loss of situational awareness was reported and 2 incidents where the pilot did not use proper see-and-avoid. However, for a number of these incidents the pilots-in-command of the training aircraft were not at fault. In these cases, it was determined that the pilots of the non-training aircraft had lost situational awareness, thereby resulting in the training flights having to take evasive action. In one incident the air traffic controller lost situational awareness, while in another incident the pilot of a dual training flight failed to see-and-avoid a ground obstruction while manoeuvring the aircraft on the ground in the aerodrome.

International occurrence data and research

5.57 A review of international literature showed that a loss of situational awareness was a significant factor in a high number of occurrences. Situational awareness was typically categorised as a human factor issue, and research by the ATSB, for example, found that human factors were a contributing cause in around 70-80% of all incidents and accidents (ATSB, 2007b).

5.58 Further ATSB research determined that see-and-avoid conflicts where situational awareness errors were involved made up about 15% of all occurrences at non-towered aerodromes between 2003 and 2008 (ATSB, 2010b). Furthermore, there were 60 serious incidents in which an accident almost occurred, mostly owing to a lack of communication between pilots or an insufficient awareness of nearby traffic. In 87 occurrences a Traffic Collision Avoidance System (TCAS) alert occurred when a potential separation issue arose. In over half of these cases the pilots were unaware of the potential separation issue until the TCAS alert was generated.

Findings

14. International data shows that a loss of situational awareness and the failure of, or failure to use, proper see-and-avoid techniques were significant factors in a high number of occurrences.

15. Anecdotal evidence suggests that there may be a high number of occurrences in New Zealand involving a loss of situational awareness and/or the failure of, or failure to use, proper see-and-avoid techniques. However, the Commission did not find any data or research specific to flying training in New Zealand or in general to support this.

Government funding structure for pilot training

5.59 Several submissions highlighted potential negative effects of the current government funding structure for flying training, commenting that:

(a) a misalignment exists between funding and employment outcomes

(b) flight training schools have an incentive to enrol students up to their equivalent full-time student (EFTS) level but not to make sure that the training given is relevant to employers

(c) the decision criteria for the allocation of EFTS funding to providers are not transparent

(d) the government funding level is inadequate and therefore has the potential to reduce safety margins for businesses. Training organisations' ability to invest in new technology is constrained, thereby resulting in small or non-existent profit margins. This leads to financial business decisions influencing operational decisions, which may have an impact on training and training safety.

Funding system for pilot training

5.60 The arrangements for government funding of pilot training for domestic students in New Zealand were significantly changed in 2011 for all new student enrolments from 2012 onwards. These changes were implemented following a significant review of aviation pilot training by the TEC.

5.61 The total amount of funding is determined annually as part of the government's Vote Education budget process. Also, course tuition fees are capped annually in accordance with the Annual Maximum Fee Movement policy, and were reduced in 2012. The government also reduced the EFTS cap for government-funded pilot training courses from 600 to 450 EFTS.

5.62 Government funding only covers a proportion of the costs of pilot training. The remainder is made up with student loan contributions. Students are eligible for student loans if the flight training they receive is offered in conjunction with recognised tertiary education providers.

Potential implications for aviation safety

5.63 Several submitters identified a range of issues regarding the government's funding structure for flying training. Many of these issues, although legitimate, did not raise safety issues for flying training in New Zealand or were outside the scope of the Commission's inquiry. They included issues such as the student loan process.

5.64 The recent changes to government funding resulted from several independent reviews of pilot training funding undertaken on behalf of the TEC and followed a period of industry consultation. The government's review of pilot training was prompted by a number of concerns about the efficacy and value for money of the public investment in pilot training, including high student debt levels.

5.65 The government's decision was also informed by findings and recommendations made in the Strategic Training Plan and Map of Provision, a joint industry and government agency initiative led by the Aviation Travel and Tourism Industry Training Organisation. Although these reviews considered issues related to the efficiency and effectiveness of the pilot training funding system, they did not specifically consider the potential impacts of the proposed changes on aviation safety *per se*. However, it is a precondition of government funding that flight training organisations meet minimum aviation safety standards.

5.66 The Commission did not find any other research that considered the impacts of pilot training funding arrangements on flying training safety. Nor did its own air accident inquiry reports raise any safety findings or recommendations in relation to government funding of pilot training.

5.67 Anecdotally, however, a number of potential issues could arise from the recent changes to the funding structure for flight training. In its submission to the Ministry of Education in 2011, the New Zealand Air Line Pilots' Association (NZALPA) was concerned that quality training providers, who were facing higher overheads, would be placed under significant financial pressure to reduce costs and thereby reduce safety margins (e.g. cutting costs on

maintenance to meet minimum training requirements, or deferring investments in new aircraft and technology) (NZALPA, n.d.).

5.68 The NZALPA also noted that the changed funding arrangements could result in fewer students being trained or more students being less inclined to self-fund. This could provide an incentive to training organisations to complete training in the minimum number of hours. This problem was noted by the Australian Bureau of Air Safety Investigation (BASI) in relation to the economic effects of a recession on flying training (BASI, 1996). BASI considered that training organisations would either accept additional flying hours at no additional cost to students or graduate its students at lower levels of skill than might otherwise have been the case.

5.69 A 2010 report for New Zealand Trade and Enterprise acknowledged the challenge for the training sector to maintain profitability given that the current EFTS funding level had been fixed at 2003 levels and that operational costs, particularly fuel costs, had increased (Knotridge Limited, 2010). As a result, most of the training organisations were under severe financial pressure. Conversely, the report noted that New Zealand had a number of competitive advantages to drive future growth in the sector, predominantly by attracting international pilot students who do not rely on government funding.

Findings

16. The Commission found no evidence that the government funding structure for domestic pilot training is affecting flying training safety in New Zealand.

17. The Commission found no data or research about the impacts of pilot training funding arrangements on flying training safety. Nor was it able to establish from occurrence data any connection between pilot training funding and flying training safety in New Zealand.

Accessibility of weather information

5.70 Some submissions raised concerns about the accessibility of weather information, commenting that the user-pays model for MetFlight-GA was discouraging pilots and other aviation participants from accessing pertinent pre-flight weather information. Members of the AIA, in particular, noted that without this information pilots were putting themselves and their aircraft at risk. A consultant with the AIA, for example, stated:

> I actually think it's a huge downgrade of safety. While the flight training organisations – they will actually pay for the weather because, really, they have to, there will be a lot of general aviation pilots flying around that I know don't...

History of MetFlight-GA

5.71 MetFlight-GA is an enhanced web-based aviation weather information service available to non-commercial pilots for pre-flight weather planning. It was introduced in 2004 and was entirely owned and operated on a commercial basis by the Meteorological Service of New Zealand (MetService). As a safety initiative, the CAA agreed to sponsor MetFlight-GA. The aviation community, specifically recreational pilots and flight training organisations, was therefore able to access this service free of charge. Neither MetService nor the CAA was funded to support this service.

5.72 The CAA's initial financial support was only intended to be short term until MetService was able to find other funding or sponsorship. It nevertheless continued its sponsorship for about

7 years until 30 June 2011, at a total cost of about $650 000. During this period MetService was unable to secure an alternative source of funding for MetFlight-GA.

5.73 From 1 August 2011 MetService continued to make MetFlight-GA available to non-commercial, recreational (private) licenced pilots but for an annual fee of $95 plus GST. Commercial air transport operation subscribers, including flight training organisations, were required by MetService to switch to either MetFlight Commercial or MetJet (both available for a fee). By 1 August 2011 the more significant flight training establishments in New Zealand had already done this. For example, MetService statistics show that the number of flight training organisations registered to access MetFlight Commercial or MetJet before the switchover was 17 (as at 30 June 2011). As at March 2012 approximately 26% of flight training organisations had subscribed to access MetFlight Commercial or MetJet (up from 17 organisations in June 2011 to 46 in March 2012).

5.74 In terms of the effects of moving from a funded to a user-pays model for MetFlight-GA on subscriptions, MetFlight-GA had 3991 registered users in 2007, which by 30 June 2011 (just before the CAA's sponsorship ended) had increased to 5779 users (consisting of individual, recreational, private pilot users as well as flight training organisations and their staff, and other commercial operators) (CAA, n.d. [unpublished data]).

5.75 However, as at March 2012, according to MetService, there were 570 registered users of MetFlight-GA comprising individual recreational users and some smaller commercial operators granted special dispensation to continue utilising MetFlight-GA. This represented a significant fall in subscriptions, by approximately 90%. As a rough guide, 570 users represent approximately 10-16% of the potential number of active pilot licence holders exercising private pilot licence (recreational) privileges in New Zealand[12].

Potential impacts on flying training safety

5.76 A review of the CAA's occurrence database revealed only one incident since 1993 where the pilot-in-command did not obtain a weather briefing. The Commission did not find any comparable situations overseas where a fully funded weather information service had been replaced by a user-pays model. Although other countries did provide free access to some form of pre-flight weather information, it was beyond the scope of this inquiry to compare others' information sources, service delivery methods and charging mechanisms with those of MetFlight-GA.

5.77 Overseas research and investigation reports, however, did indicate that pilots failing to access pre-flight weather information did contribute to fatal occurrences. An ATSB study, which looked at fatal accidents in private operations between 1999 and 2008, found that problems with pilots assessing and planning were the most common contributing factors and were present in nearly half of the fatal accidents (46%) (ATSB, 2010c). These included accidents where the pilots had failed to check the weather forecast before the flights. Also, recent research by the FAA found that failure to get a pre-flight weather briefing, or a briefing from only a low-grade (non-aviation-orientated) source, seemed to constitute a problem for 5% of United States general aviation pilots (FAA, 2010).

5.78 The Commission did not find evidence to show that free access to MetFlight-GA incrementally improved safety in New Zealand after its introduction in 2004. Conversely, it did not find evidence to show that the withdrawal of free access to MetFlight-GA had an adverse impact on the level of flying training safety in New Zealand (although this is not surprising given that the change occurred less than a year ago).

5.79 In the long term it is unlikely that the user-pays model will have adverse impacts on flying training safety because student pilots and flight training organisations are required to have

[12] Based on CAA published statistics (as at March 2012) retrieved from www.caa.govt.nz.

access to weather forecasts. Even though the number of flight training organisations subscribing to MetFlight Commercial and MetJet remains low, some can access MetFlight-GA using personal logons from staff to provide pre-flight weather information to students in training. Others may also have access to alternative information sources or suppliers (e.g. Airways). Notwithstanding this, it is important that the CAA remain alert to any possible trends that may develop as a direct consequence of the user-pays model.

Findings

18. The Commission found no evidence to show that free access to MetFlight-GA incrementally improved safety in New Zealand after its introduction in 2004.

19. Conversely, the Commission found no evidence to show that the level of flying training safety in New Zealand was adversely affected by MetFlight-GA changing from a free to a user-pays weather information service. Flight training organisations must always access weather information in some form.

Flying training regulatory system

5.80 Some submitters made general comments about the New Zealand regulatory system for flying training and, in particular, questioned whether there were any significant gaps or issues with this system that could be affecting flying training safety. Although no specific concerns or issues were raised by submitters about the regulatory system, the Commission nevertheless looked at this, for completeness.

5.81 Flying training in New Zealand operates within a regulatory system governed by the Civil Aviation Act 1990. This Act provides minimum safety standards that aviation participants (also referred to as aviation document holders) must meet. These safety standards are further prescribed in CA Rules and supported by Advisory Circulars and guidance material. In many cases, these rules reflect standards set by ICAO.

5.82 The CAA issues licences and ratings and sets the minimum standards of skill and knowledge required by aviation document holders to operate safely within the civil aviation system. The CA Rules set out what pilots and flight instructors must do in order to gain, and to continue exercising the privileges of, their licences and ratings. Typically, this involves their periodically demonstrating their flying skills and knowledge to CAA-approved flight instructors or examiners. Flight training organisations are also subject to surveillance and monitoring by the CAA.

5.83 The CAA is responsible for formulating the theory and practical assessment syllabi to enable applicants to undergo the skills and knowledge training needed to attain the required minimum standards. In turn, the flight training industry develops structured training and course material that pilots follow to achieve the required minimum standards.

5.84 After reviewing the relevant legislation and other supporting material regarding flying training, the Commission did not find any significant gaps in the regulatory system for flying training in New Zealand. Again, this is not to say that gaps (significant or otherwise) do not exist. It simply means that the Commission did not find any evidence of this.

5.85 What the Commission did find is that New Zealand has designed a competency-based flying training model and licensing system that meets or exceeds ICAO minimum standards and international best practice. The regulatory licensing minima for pilots and aviation training

personnel are generally in accord with proficiency and currency standards in Europe, the United Kingdom, the United States and Australia.

5.86 The Commission also found that New Zealand has a well respected training system that, by all accounts, is producing competently trained pilots. Given that the minimum standards required to obtain pilot qualifications reflect the standards set by ICAO, it is reasonable to expect that a person who successfully completes the prescribed training and meets these minimum standards will have the qualifications and skills needed to exercise the privileges of their licence. If this were not the case, the international recognition of CAA-issued licences would be at risk. The New Zealand pilot qualification continues to be recognised by international aviation authorities and is considered to be of good standing.

Proposed Civil Aviation Rule amendments

5.87 When meeting with Commissioners, the CAA identified expected improvements to the flying training system through proposed amendments to CA Rules Part 61 (Pilot Licences and Ratings) and Part 141 (Aviation Training Organisations – Certification), which apply to flight crew licensing and flight training operators respectively.

5.88 The proposed amendments to Part 61 are intended to legally formalise specific training requirements for pilot licensing, which are already incorporated into the training syllabi, and eligibility requirements for gaining private pilot and commercial pilot licences. These requirements, which will introduce English language proficiency requirements, mountain flying and terrain awareness training, and threat and error management training, are expected to raise training standards, promote consistency and improve levels of safety in the flying training sector. The Part 61 rule-making project commenced in 2000 and was being progressed at the time of writing this report. The proposed amendments are expected to come into force in 2013.

5.89 The proposed amendments to Part 141 are intended to require all flight training organisations conducting certain training activities to be certificated. At present, only a limited range of training and assessments must be conducted by organisations approved under Part 141. This is in contrast to Australia and the United Kingdom, where all flying training for pilot licences must be conducted by authorised certificate holders. ICAO also recommends[13] that pilot training be conducted by organisations approved by the Contracting State. The CAA has commented that until all flight training organisations are certificated, there will continue to be a varied and inconsistent approach to flight training in terms of regulatory oversight, organisational supervision, training delivery and outcomes. In addition, non-certificated training organisations may not be held to account under the CA Rules for the quality of the training that they provide to students.

5.90 It is unclear when the proposed amendments to Part 141 will be completed. The Part 141 rule-making project commenced in 2001 but it was removed from the annual rules development programme in 2011 following comments from the Ministry of Transport that the CAA needed to conduct further regulatory impact and safety analysis. Until further work is done to address these comments, the rule change programme for Part 141 may be deferred indefinitely (CAA, 2011d).

5.91 If the proposed amendments to Part 61 and Part 141 are expected to improve safety within the New Zealand flying training system (and there appears to be general agreement within the aviation sector that they will), every effort should be made to complete both rule change programmes without further significant delay. The Commission therefore recommends, as a matter of priority, that the CAA complete the work required to progress the proposed amendments to Part 141 and that it also complete draft final rule-making to implement proposed amendments to Part 61 for submission to the Minister of Transport for approval.

[13] See Annex 1 to the Convention on International Civil Aviation – Personnel Licensing.

Findings

20. The Commission did not identify any significant gaps in the design of the regulatory system for flying training in New Zealand. This is not to say that gaps (significant or otherwise) do not exist. It simply means that the Commission did not find any evidence of this.

21. Proposed amendments to CA Rules Part 61 and Part 141 are expected to improve safety within the New Zealand flying training system; however, both amendments have been delayed. Every effort should be made to complete both rule change programmes without further significant delay.

6 Data and research

6.1 In researching flying training safety in New Zealand, the Commission examined relevant CAA occurrence data on flying training accidents and incidents in New Zealand. The Commission also completed a wide-ranging literature review to identify any relevant empirical research on the subject of flying training safety in New Zealand and other countries.

6.2 Although the Commission found a large amount of international research that looked at some of the safety issues it was considering, there was virtually no recent research in New Zealand or overseas that examined the factors contributing to occurrences specifically in the context of flying training. This made it difficult for the Commission to draw any firm conclusions on the state of flying training in New Zealand.

6.3 It is also notable that, compared with other countries, the CAA has not widely or periodically published any comprehensive safety reviews of aviation in New Zealand (of which flying training is one activity) that have a major emphasis on accident and incident trends, and analyses of precursors, contributing factors and lessons learned, in order to enhance stakeholders' safety focus.

6.4 The Commission's own review of the data in the CAA's occurrence database highlighted limitations in the CAA's existing safety occurrence reporting and monitoring system, which prevented an accurate and meaningful analysis of flying training accident causal factors and historical safety trends. These included limitations with the analysis the CAA conducts and the comprehensiveness of the safety data it collects, as well as an absence of data in some areas where it appears that key data is missing or was not reported. For example, in contrast to other countries the CAA does not have clear definitions of, or a risk assessment process for categorising or analysing, aircraft loss-of-separation events in controlled and uncontrolled airspace.

6.5 The CAA is aware of these limitations. In 2011 it commissioned an independent review of New Zealand's flying training industry as part of its efforts to understand fully and resolve concerns about the sector's safety performance. In response to a recommendation from this review, the CAA noted that (n.d.):

> NZ [New Zealand] will always suffer from relative data scarcity compared to other jurisdictions, because of the size of the civil aviation activity, which in turn will always impose some limitations on the type of statistical analysis that can be undertaken, including regular statistical and other types of quantitative analysis on an ongoing basis.

6.6 Notwithstanding its comments, it is important that the CAA commits to strengthening the collation, analysis and reporting of safety data for specific aviation sub-sectors, including flying training, otherwise it will continue to be difficult to assess fully and identify any potential systemic safety issues, trends and risks with flying training in New Zealand. This in turn will make it difficult to identify appropriate safety strategies that can help to improve safety performance within the New Zealand flying training system.

Findings

22. There is a lack of data and research examining factors that might or that have contributed to occurrences in flying training operations in New Zealand and overseas. There are also limitations with the CAA's occurrence database, which make it difficult to analyse flight training accident causal factors and safety trends accurately.

23. Quantitative research and a causal analysis of flying training-related occurrences held in the CAA's occurrence database are needed to assess fully and identify any potential systemic safety issues, trends and risks so that appropriate safety strategies can be adopted to improve safety performance within the New Zealand flying training system.

7 Findings

Flying training safety performance in New Zealand

7.1 Based on a preliminary analysis of occurrence data, it is not possible to conclude statistically whether flying training in New Zealand is less or more safe now than it used to be.

7.2 The rate of fatalities changes from year to year much more in New Zealand than it does in other countries, because the flying training industry is smaller. Overseas data, however, indicates that the overall rate of flying training fatalities and fatal accidents in New Zealand is broadly comparable with the rates found in Australia and the United States for the period 1999 to 2009.

7.3 Research and data from the CAA and the ATSB indicate that flying training is likely to be safer than other forms of flying.

Standard of flying training in New Zealand

7.4 The Commission was unable to conclude whether the standard of flight training in New Zealand presents risks to flight training safety. It did not find any specific research examining the quality of the flight training system in New Zealand or any evidence of significant gaps with the flying training programme. This is not to say that gaps (significant or otherwise) do not exist. It simply means that the Commission did not find any evidence of this.

7.5 General information about flight instructor demographics (e.g. qualifications, experience levels, age), performance and competency levels is difficult to obtain, with no one agency responsible for collecting this. This data gap should be addressed.

Effects of increasing air traffic

7.6 The effects of increasing aviation activity in New Zealand on flying training and aviation safety in general are uncertain. There are insufficient data and research on this matter.

7.7 International research (which is limited and not conclusive) shows that increasing traffic is likely to be a contributing factor but not a dominant cause of flying training occurrences. Accidents do not happen solely because there is an increase in traffic, although the risk is likely to be elevated.

English language proficiency

7.8 International studies have found that poor English language proficiency has played a contributing role in a number of significant international accidents.

7.9 Anecdotal evidence suggests that poor English language proficiency and comprehension of English may have been contributing factors in some New Zealand occurrences. However, with the exception of one occurrence that it investigated, the Commission did not find any data or research to support this.

7.10 New Zealand has a pertinent and specific framework for testing English language proficiency in civil aviation, as required by ICAO. The Commission found no evidence to suggest that this testing regime is not providing reliable, valid and practical evaluations of pilot language proficiency in accordance with ICAO criteria.

Radiotelephony communications

7.11 Aviation investigation authorities and civil aviation regulators worldwide acknowledge that radiotelephony communication-related occurrences are a significant risk to aviation safety.

7.12 Anecdotal evidence suggests that radiotelephony miscommunication may have been a contributory factor in some New Zealand occurrences; however, the Commission did not find any data or research to support the concern that a significant problem exists with radiotelephony communications in the New Zealand flying training sector or in general. Overall, reported radiotelephony communication-related incidents in New Zealand account for only a very small proportion of total reported occurrences (statistically insignificant).

7.13 New Zealand has a pertinent and specific regime for teaching and testing radiotelephony communications, which is consistent with ICAO's standards and recommended practices. The Commission found no evidence to suggest that this regime is not providing reliable, valid and practical evaluations of pilot radiotelephony proficiency in accordance with ICAO criteria.

Situational awareness and see-and-avoid

7.14 International data shows that the loss of situational awareness and the failure of, or failure to use, proper see-and-avoid techniques were significant factors in a high number of occurrences.

7.15 Anecdotal evidence suggests that there may be a high number of occurrences in New Zealand involving a loss of situational awareness and/or the failure of, or failure to use, proper see-and-avoid techniques. However, the Commission did not find any data or research specific to flying training in New Zealand or in general to support this.

Government funding structure for pilot training

7.16 The Commission found no evidence that the government funding structure for domestic pilot training is affecting flying training safety in New Zealand.

7.17 The Commission found no data or research about the impacts of pilot training funding arrangements on flying training safety. Nor was it able to establish from occurrence data any connection between pilot training funding and flying training safety in New Zealand.

Accessibility of weather information

7.18 The Commission found no evidence to show that free access to MetFlight-GA incrementally improved safety in New Zealand after its introduction in 2004.

7.19 Conversely, the Commission found no evidence to show that the level of flying training safety in New Zealand was adversely affected by MetFlight-GA changing from a free to a user-pays weather information service. Flight training organisations must always access weather information in some form.

Flying training regulatory system

7.20 The Commission did not identify any significant gaps in the design of the regulatory system for flying training in New Zealand. This is not to say that gaps (significant or otherwise) do not exist. It simply means that the Commission did not find any evidence of this.

7.21 Proposed amendments to CA Rules Part 61 and Part 141 are expected to improve safety within the New Zealand flying training system; however, both amendments have been delayed. Every effort should be made to complete both rule change programmes without further significant delay.

Data and research

7.22 There is a lack of data and research examining factors that might or that have contributed to occurrences in flying training operations in New Zealand and overseas. There are also limitations with the CAA's occurrence database, which make it difficult to analyse flight training accident causal factors and safety trends accurately.

7.23 Quantitative research and a causal analysis of flying training-related occurrences held in the CAA's occurrence database are needed to assess fully and identify any potential systemic safety issues, trends and risks so that appropriate safety strategies can be adopted to improve safety performance within the New Zealand flying training system.

8 Recommendations

8.1 On 13 December 2012 the Commission recommended to the Director of Civil Aviation that he:

(a) review the CAA's data systems and processes, particularly regarding flying training data, including the information collected and the way this information is collected, categorised, recorded in the CAA's occurrence database and analysed to ensure that meaningful and complete data on flying training in New Zealand is available; (032/12)

(b) undertake and publish further quantitative research and causal analyses of flying training-related accidents and incidents held in the CAA's occurrence database to assess fully and identify any potential systemic safety issues, trends and risks, so that appropriate safety strategies can be adopted to improve safety performance within the New Zealand flying training system; (033/12)

(c) take all appropriate steps to ensure that information about flight instructor demographics (e.g. qualifications, experience levels, age) and flight instructor performance and competency levels is regularly collected, categorised and recorded in a way that will enable it to be analysed meaningfully; (034/12

(d) complete, as a matter of priority, the tasks that the CAA is required do to progress the proposed amendments to CA Rule Part 141 (Aviation Training Organisations – Certification) and to CA Rule Part 61 (Pilot Licences and Ratings). (035/12)

9 References

Aerosafe Risk Management (2011, August). *Civil Aviation Authority of New Zealand: Flight Training Review.* Retrieved from http://www.caa.govt.nz

Australian Transport Safety Bureau (1991, April). *Research Report: Limitations of the See-and-Avoid Principle.* Retrieved from http://www.atsb.gov.au

Australian Transport Safety Bureau (2004b, May). *Research Report: A review of Midair Collisions Involving General Aviation Aircraft in Australia between 1961 and 2003*. Retrieved from http://www.atsb.gov.au

Australian Transport Safety Bureau (2004a, June). *Aviation Safety Research Paper: Runway Incursions: 1997 to 2003*. Retrieved from http://www.atsb.gov.au

Australian Transport Safety Bureau (2007b, 30 January). *Human Factors Analysis of Australian Aviation Accidents and Comparison with the United States*. (ATSB Transport Safety Investigation Report: Aviation Research and Analysis Report – B2004/0321 Final.) Retrieved from http://www.atsb.gov.au

Australian Transport Safety Bureau (2007a, June). *Radiotelephony Readback Compliance and its Relationship to Surface Movement Control Frequency Congestion. ATSB Transport Safety Report: Aviation Research and Analysis Report 20060053 Final.* Retrieved from http://www.atsb.gov.au

Australian Transport Safety Bureau (2010a). *Aviation Occurrence Statistics 1999 to 2009.* (ATSB Transport Safety Report: Aviation Research and Analysis Report – AR-2009-016(3) Final.) Retrieved from http://www.atsb.gov.au

Australian Transport Safety Bureau (2010c, 23 June). *Improving the Odds: Trends in Fatal and Non-fatal Accidents in Private Flying Operations*. (ATSB Transport Safety Report: Aviation Research and Analysis Report – AR-2008-045 Final.) Retrieved from http://www.atsb.gov.au

Australian Transport Safety Bureau (2010b, 10 November). *Safety in the Vicinity of Non-towered Aerodromes*. (ATSB Transport Safety Report: Aviation Research and Analysis Report AR-2008-044(2) Final.) Retrieved from http://www.atsb.gov.au

Australian Transport Safety Bureau (2012, 29 May). *Aviation Occurrence Statistics 2002 to 2011.* (ATSB Transport Safety Report: Aviation Research and Analysis Report AR-2012-025 Final.) Retrieved from http://www.atsb.gov.au

Aviation Services Limited (n.d.). *Quarterly Flight Test Pass Rates.* Retrieved March 2012 from http://www.aviation.co.nz

Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile (n.d.). *Mid-Air Collisions 1989-1999: Safety Study*. Retrieved from http://www.bea.aero

Bureau of Air Safety Investigation (1996, 21 January). *Flying Training in Australia*. (Research Paper SAB/RP/91/09.) Retrieved from http://www.atsb.gov.au

Civil Aviation Authority (n.d.). *CAA Actions in Response to Aerosafe Report*. Retrieved March 2012 from http://www.caa.govt.nz

Civil Aviation Authority (2005). *New Zealand Fixed Wing Aviation Accidents. A Review of All Reported New Zealand Registered Aeroplane Accidents from 1995 to 2004*. Retrieved from http://www.caa.govt.nz

Civil Aviation Authority (2007, September/October, p. 8-9). English Language Proficiency. *Vector*. Retrieved from http://www.caa.govt.nz

Civil Aviation Authority (2008, September/October, p. 10-11). Flight Training Growing Pains. *Vector*. Retrieved from http://www.caa.govt.nz

Civil Aviation Authority (2010, 12 October). *Review of CAA Funding: Consultation Supporting Document B General Information*. Retrieved from http://www.caa.govt.nz

Civil Aviation Authority (2011a, 29 November). *Aviation Safety Summary Report, 1 July to 30 September 2011*. Retrieved from http://www.caa.govt.nz

Civil Aviation Authority (2011d, 5 May, p. 3-4.). *Civil Aviation Rules Register Information Leaflet (CARRIL)*. Retrieved from http://www.caa.govt.nz

Civil Aviation Authority (2011c, 20 September). *Radiotelephony Manual. Advisory Circular 91-9 & Advisory Circular 172-1*. Retrieved from http://www.caa.govt.nz

Civil Aviation Authority (2011b, 3 November). *Pilot Licences and Ratings – General. Advisory Circular 61-1*. Retrieved from http://www.caa.govt.nz

Civil Aviation Authority (2012a, February). *Plane Talking, A Guide to Good Radio Use, Good Aviation Practice*. Retrieved from http://www.caa.govt.nz

Civil Aviation Authority (2012b, 28 February). *AvKiwi Safety Seminars for Pilots* [press release]. Retrieved from http://www.caa.govt.nz

Civil Aviation Safety Authority (2010). *Submission to the Senate Standing Committee on Rural Affairs and Transport: Pilot Training and Airline Safety Consideration of the Transport Safety Investigation Amendment (Incident Reports) Bill 2010*. Retrieved from http://www.aph.gov.au

Civil Aviation Safety Authority (2011*). Annual Report 2010-11*. Retrieved from http://www.casa.gov.au

Cushing, S. (1994). *Fatal Words: Communication Clashes and Aircraft Clashes*. Chicago: University of Chicago Press.

Etem, K., & Patten, M. (1998, December). Communications-related Incidents in General Aviation Dual Flight Training. *ASRS Directline, Issue No. 10*. Retrieved from http://asrs.arc.nasa.gov

Federal Aviation Administration (1999). *General Aviation and Air Taxi Activity (GAATA) Survey CY1999*. Retrieved from http://www.faa.gov

Federal Aviation Administration (2008, October). *Pilot English Language Proficiency and the Prevalence of Communication Problems at Five U.S. Air Route Traffic Control Centers (DOT/FAA/AM-08/21)*. Retrieved from http://www.faa.gov

Federal Aviation Administration (2009, May). *The ICAO English Language Proficiency Rating Scale Applied to Enroute Voice Communications of U.S. and Foreign Pilots (DOT/FAA/AM-09/10)*. Retrieved from http://www.faa.gov

Federal Aviation Administration (2010, September). *Causes of General Aviation Weather-Related, Non-Fatal Incidents: Analysis September 2010 Using NASA Aviation Safety Reporting System (ASRS) Data*. (Final Report DOT/FAA/AM-10/13.) Retrieved from http://www.faa.gov

International Civil Aviation Organization (2010). *Manual on the Implementation of ICAO Language Proficiency Requirements (Doc 9835 AN/453)*. Retrieved from http://www.icao.int

Knotridge Limited (2010, 15 June). *New Horizons: A Report on New Zealand's Aviation Industry*. Retrieved from http://www.aviationnz.co.nz

Machol, R.E. (1979, February). Effectiveness of the Air Traffic Control System. *Journal of the Operational Research Society*, *30*, 111-119. doi:10.1057/jors.1979.24

National Air Traffic Services Limited (2006). *Communication Error* [DVD]

National Transportation Safety Board (n.d.). Aviation Accident Database. Retrieved from http://www.ntsb.gov

New Zealand Air Line Pilots' Association (n.d., p. 18). Tertiary Funding Cuts Have Potential to Impact Pilot Supply and Training. *Pacific Wings*

The Ambidji Group Pty Ltd. (2009, 30 June). *Utility of General Aviation Aerodrome Procedures to Australian-Administered Airspace: Report to the Civil Aviation Safety Authority Office of Airspace Regulation*. Retrieved from http://www.casa.gov.au

Transport Accident Investigation Commission (a) (n.d.). Boeing 777, HL 7497, landed short of displaced threshold, Auckland International Airport, 16 November 2004. *Aviation Occurrence Report* no. 04-006. Wellington: Transport Accident Investigation Commission

Transport Accident Investigation Commission (b) (n.d.). Raytheon 1900D, ZK-EAN and Saab-Scania SF340A, ZK-FXA, critical runway incursion, Auckland International Airport, 29 May 2007. *Occurrence Report* no. 07-005 INCORPORATING Raytheon 1900D, ZK-EAH and Raytheon 1900D, ZK-EAG, critical runway incursion, Auckland International Airport, 1 August 2007. *Occurrence Report* no. 07-009. Wellington: Transport Accident Investigation Commission

Transport Accident Investigation Commission (2010, September). Interim Factual Report: Cessna C152 ZK-JGB and Cessna C152 ZK-TOD, mid-air collision, near Feilding, Manawatu, 26 July 2010. *Aviation Inquiry Report* no. 10-008. Wellington: Transport Accident Investigation Commission

Transport Accident Investigation Commission (2011b, February). Final Report: Cessna C208 Caravan, ZK-TZR, engine fuel leak and forced landing, Nelson, 10 February 2010. *Aviation Inquiry Report* no. 10-003. Wellington: Transport Accident Investigation Commission

Transport Accident Investigation Commission (2011a, October). Final Report: Cessna A152, ZK-NPL and Robinson R22 Beta, ZK-HIE near-collision, New Plymouth Aerodrome, 10 May 2010. *Aviation Inquiry Report* no. 10-005. Wellington: Transport Accident Investigation Commission

Transport Accident Investigation Commission (2012, October). Final Report: Cessna C152 ZK-JGB and Cessna C152 ZK-TOD, mid-air collision, near Feilding, Manawatu, 26 July 2010. *Aviation Inquiry Report* no. 10-008. Wellington: Transport Accident Investigation Commission

Transport Canada (2000, 14 September). *National Civil Aviation Safety Committee: Sub-Committee on Runway Incursions Final Report*. Retrieved from http://www.tc.gc.ca

United States General Accounting Office (1989, 30 June). *Air Traffic Control FAA's Interim Actions to Reduce Near Mid-Air Collisions: Report to the Chairman, Subcommittee on Transportation and Related Agencies, Committee on Appropriations, U.S. Senate*. GAO/RCED-89-149. Retrieved from http://www.gao.gov

(n.d. = no date)

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