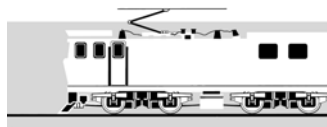
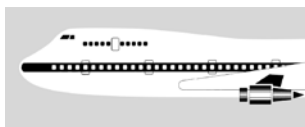


AVIATION OCCURRENCE REPORT

02-007 Piper PA23-250D Aztec and Piper PA34-200T Seneca II, ZK-DIR
and ZK-MSL, near miss, about 25nm southwest of Napier

10 June 2002



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Report 02-007

Piper PA23-250D Aztec and Piper PA34-200T Seneca II

ZK-DIR and ZK-MSL

near miss

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Abstract

On Monday 10 June 2002 at about 1835, Piper PA23-250D Aztec ZK-DIR and Piper PA34-200T Seneca II ZK-MSL were flying the same track from Napier to Paraparaumu and climbing to their respective cruise altitudes when the required vertical separation between them was lost. At one stage the 2 aircraft were possibly at the same altitude, with a lateral separation of less than one km. The pilots were aware of the presence but not the proximity of the other aircraft. The loss of separation was identified only after radar information became available. Positive separation was quickly re-established and the 2 aircraft continued to their destinations as planned.

The loss in separation and following near miss was caused by a combination of the pilots not adhering to the requirements of their air traffic control clearances, local weather influences and a lack of progress information enabling the controller to adequately monitor the separation of the 2 aircraft during their climbs.

The safety issues identified were the need for pilots to ensure they fully complied with their air traffic control clearances and the requirement for air traffic control to increase the monitoring of the vertical separation of aircraft when using a rate of climb-based clearance. A safety recommendation was made to Airways Corporation concerning the latter issue.

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Abbreviations

ATC	air traffic control
CAA	Civil Aviation Authority of New Zealand
DME	distance measuring equipment
fpm	feet per minute
IFR	instrument flight rules
km	kilometre(s)
kts	knots
nm	nautical mile(s)
UTC	coordinated universal time
VHF	very high frequency
VSI	vertical speed indicator

Data Summary

Aircraft types, registrations and callsigns:	Piper PA23-250D Aztec, ZK-DIR, Sunair 20R and Piper PA34-200T Seneca II, ZK-MSL, Napier 67
Operators:	Sunair Aviation Limited and Air Napier Limited
Date and time:	10 June 2002, at about 1835 ¹
Location:	about 25 nautical miles southwest of Napier latitude: 39° 15' south longitude: 176° 28' east
Types of flight:	scheduled air transport, freight
Persons on board:	ZK-DIR, Sunair 20R: 2 ZK-MSL, Napier 67: 1
Injuries:	nil
Nature of damage:	nil
Investigator-in-charge:	I R M ^c Clelland

¹ Times in this report are New Zealand Standard Time (UTC + 12 hours) and are expressed in the 24-hour mode.

1 Factual Information

1.1 History of the flights

- 1.1.1 On Monday 10 June 2002, Piper PA23-250D Aztec ZK-DIR, operating as Sunair 20R, and Piper PA34-200T Seneca II ZK-MSL, operating as Napier 67, were both being flown on regular freight services. The 2 aircraft had landed at Napier Aerodrome in the late afternoon, and were scheduled to depart under instrument flight rules (IFR)² at about 1820 for Paraparaumu. On 10 June daylight ended at about 1725.
- 1.1.2 At about 1816, after loading and preparing for the flight, the pilot of Napier 67 called Napier Tower (Tower) and requested airways clearance for the flight to Paraparaumu. Tower cleared Napier 67 to “Paraparaumu via Palmerston, Foxton at 8000 feet”, and approved engine start. A few seconds later the pilot of Sunair 20R asked for start clearance and requested “non-standard 9000 [feet]”³ to Paraparaumu. Tower cleared Sunair 20R to start.
- 1.1.3 At 1818 the pilot of Sunair 20R reported engine start completed and requested taxi instructions. Tower cleared Sunair 20R to taxi and line-up on runway 16. The Tower controller telephoned Ohakea air traffic control (ATC) to coordinate the request for the non-standard altitude. At about this time Tower cleared Napier 67 to taxi to the holding point for runway 16.
- 1.1.4 Tower requested the minimum rate of climb that Sunair 20R would be able to maintain whilst climbing to 9000 feet. The pilot of Sunair 20R advised “500 feet per minute (fpm)”. Tower cleared Sunair 20R to “Paraparaumu, via Palmerston, Foxton, non-standard 9000 feet - 16 Mike departure, climb at 500 fpm minimum”. The pilot correctly read back the clearance.
- 1.1.5 At 1820 the pilot of Sunair 20R reported ready for take-off and advised that he would call when climbing through 2000 feet. Tower acknowledged the pilot’s call and cleared Sunair 20R for take-off. After Sunair 20R had departed, Napier 67 was cleared by Tower to backtrack and line up on runway 16. Tower amended the airways clearance for Napier 67 by limiting its rate of climb to a maximum of 500 fpm. The pilot acknowledged the additional climb requirement.
- 1.1.6 At 1823 the pilot of Sunair 20R reported climbing “through 2000 [feet], established on track at 4 nautical miles (nm)⁴.” At 1824 Tower acknowledged the call from Sunair 20R and cleared Napier 67 for take-off. Napier 67 commenced its take-off roll at this time.
- 1.1.7 At 1825 Tower requested Sunair 20R to “report the level passing”. The pilot advised he was passing through 3000 feet at 7 nm. Tower contacted Napier 67 and removed the rate of climb restriction until passing 2000 feet. The pilot of Napier 67 acknowledged the clearance change.
- 1.1.8 At 1827 the pilot of Napier 67 reported that he was on track at 5 nm, and climbing through 2000 feet. Tower requested Napier 67 to report passing 8 nm from Napier. About 30 seconds later, in response to a call from Tower, the pilot of Sunair 20R reported that he was at 10 nm and climbing through 5000 feet. Tower requested Sunair 20R to report passing 8000 feet and informed Napier 67 that its climb was unrestricted until passing 4000 feet. At 1829 the pilot of Napier 67 reported that he was at 8 nm and climbing through 3400 feet. Tower acknowledged the pilot’s report.

² Flight by reference to instruments and in accordance with prescribed procedures.

³ Unless cleared at a non-standard altitude, aircraft flying west along the Napier – Paraparaumu track were required to fly at even thousands of feet, commencing at 8000 feet. 9000 feet was the lowest non-standard altitude.

⁴ Distances quoted are from the Napier DME site, located about 2 km north of the aerodrome, and are measured in nautical miles.

- 1.1.9 At 1835 Napier 67 appeared on the radar screen at Ohakea Control Centre. The aircraft was observed to be about on track and climbing through 7500 feet. Sunair 20R was not on the radar screen at this time. Within the next minute, in response to a request from Tower, the pilot of Sunair 20R reported that he was at 21 nm and climbing through 7700 feet.
- 1.1.10 At 1836 the pilot of Sunair 20R reported that he was at 22 nm, climbing through 8000 feet and changing to the Ohakea Control frequency. Tower acknowledged the call and over the next 30 seconds made 2 calls to Napier 67 requesting its altitude passing and distance from Napier. About 20 seconds after the second request the pilot of Napier 67 reported at 7800 feet⁵, and within a minute at 8000 feet.
- 1.1.11 At about 1837 Sunair 20R appeared on the radar screen at Ohakea Control Centre. The aircraft was about on track and climbing through 8300 feet. At this time Napier 67 was indicating on radar 8000 feet and both aircraft were observed to be about 25 nm from Napier, with Napier 67 about one km to the south of Sunair 20R and diverging. The Ohakea controller instructed the pilot of Sunair 20R to expedite its climb to 9000 feet and immediately telephoned the Napier controller and requested that Napier 67 be transferred to the Ohakea radio frequency. Both the pilots reported flying in continuous cloud conditions during this time.
- 1.1.12 After the minimum 1000 foot separation was re-established, both aircraft continued onto Paraparaumu without incident.

1.2 Personnel information

- 1.2.1 The pilot of ZK-DIR, Sunair 20R, was based in Palmerston North and had regularly flown the Napier to Paraparaumu route over the previous 2 years, firstly with another operator and then with Sunair Aviation Limited. He had 1350 hours total flying experience, of which about 900 hours were on the Piper PA23 Aztec type of aircraft. He held a current Commercial Pilot Licence (Aeroplane) and his last route and instrument checks were on 28 May 2002.
- 1.2.2 Sunair Aviation Limited had taken over the service only on the day of the incident and had retained the pilot from the previous operator but provided a different model of Piper Aztec than the pilot was used to. A second company pilot accompanied the pilot of Sunair 20R for the flights on the day of the incident for familiarisation purposes only.
- 1.2.3 The pilot of ZK-MSL, Napier 67, was based in Napier and had worked for Air Napier Limited since November 1998. He had regularly flown the Napier to Paraparaumu route since 1998. He had 2015 hours total flying experience, of which about 431 hours were on the Piper PA34 Seneca type of aircraft. He held a current Commercial Pilot Licence (Aeroplane) and his last route and instrument checks were on 23 April 2002.
- 1.2.4 The Napier Tower controller had been controlling at Napier since about 1996 and held aerodrome, approach and area ratings. His last proficiency check was on 23 July 2001.

1.3 Aircraft information

- 1.3.1 ZK-DIR was a Piper PA23-250D Aztec, serial number 27-4242. The aircraft was powered by 2 normally-aspirated engines, and so aircraft performance would be expected to progressively degrade during the climb. The pilot estimated the aircraft weight for the flight to be about 200 kg below the maximum allowable limit.
- 1.3.2 Prior to the incident the pilot of ZK-DIR normally flew a later model Piper Aztec, a PA23-250F, registration ZK-EVP. The pilot considered that there was a slight decrease in performance with ZK-DIR, the aircraft cruising about 10 knots (kts) slower than the later F model.

⁵ The distance reported by Napier 67 at this time was not able to be confirmed from the Tower tape recording.

- 1.3.3 ZK-MSL was a Piper PA34-200T Seneca II, serial number 34-7770224. The aircraft had 2 supercharged engines, enabling climb performance to be maintained to cruise altitude. The pilot estimated aircraft weight to be well below the maximum allowable.
- 1.3.4 At comparable aircraft weights, a Piper PA23 Aztec would typically have a greater initial rate of climb performance than a Piper PA34 Seneca type of aircraft. Only at higher altitudes would the climb performance of an Aztec decrease below that of a Seneca.

1.4 Meteorological information

- 1.4.1 On the day of the incident a trough was moving north-east over the North Island. The passage of the trough was associated with north-westerly winds, turning westerly behind the trough. The cloud base was forecast to be about 6000 feet with patches of cloud lower.
- 1.4.2 As the 2 incident aircraft prepared for take-off, the weather at Napier was reported as a surface wind of 210° magnetic at 10 kts, 20 km visibility and a cloud base of about 1800 feet. The reported wind at 2000 feet was 210° magnetic at 30 kts.
- 1.4.3 At about the time of the incident, a significant meteorological notice, SIGMET⁶ 08, was issued and valid for the period 1835 to 2235. The notice advised of isolated severe turbulence forecast below 10 000 feet about and east of the ranges between Whangarei and Palmerston North. The conditions were expected to ease from the north-west.
- 1.4.4 The pilots of Sunair 20R and Napier 67 reported encountering some minor turbulence and possible light wave activity⁷ only during the flights from Napier to Paraparaumu.

1.5 Airspace information

- 1.5.1 The incident occurred on the 206° magnetic track from Napier to Palmerston North, in Napier terminal control airspace. The minimum safe altitude for the route was 7900 feet. The airspace was classified as “D” airspace, meaning that IFR aircraft were required to be separated by at least 1000 feet vertically when in close geographic location to each other. Generally, as on this occasion, no radar information was available for aircraft flying east of the Ruahine Ranges when below about 7000 feet. Separation was, therefore, done procedurally.
- 1.5.2 The responsibility for the control of aircraft flying from Napier to or via Palmerston North normally changed from Napier Tower to Ohakea Control when an aircraft passed 8000 feet in the climb or on reaching 30 nm from Napier, whichever occurred first.

1.6 Additional information

- 1.6.1 In a non-radar environment, the separation of aircraft on departure from an aerodrome could be achieved a number of ways. For example, climbing aircraft on divergent tracks to give lateral separation, or giving intermediate clearances to the following aircraft to ensure that there was always a minimum 1000 foot vertical separation.
- 1.6.2 The separation of 2 aircraft on departure by the use of specified rates of climb was permissible when “confirmation is obtained from the pilot of the second aircraft that the restricted rate of climb is acceptable and that the climb gradient(s) stipulated for the departure being flown will be achieved.” Additionally, the Manual of Air Traffic Services stipulated that rates of climb may only be applied when:

⁶ SIGMET – information concerning en-route weather phenomena, which may affect the safety of aircraft operations.

⁷ Up draughts and down draughts associated with the passage of wind over hilly or mountainous terrain.

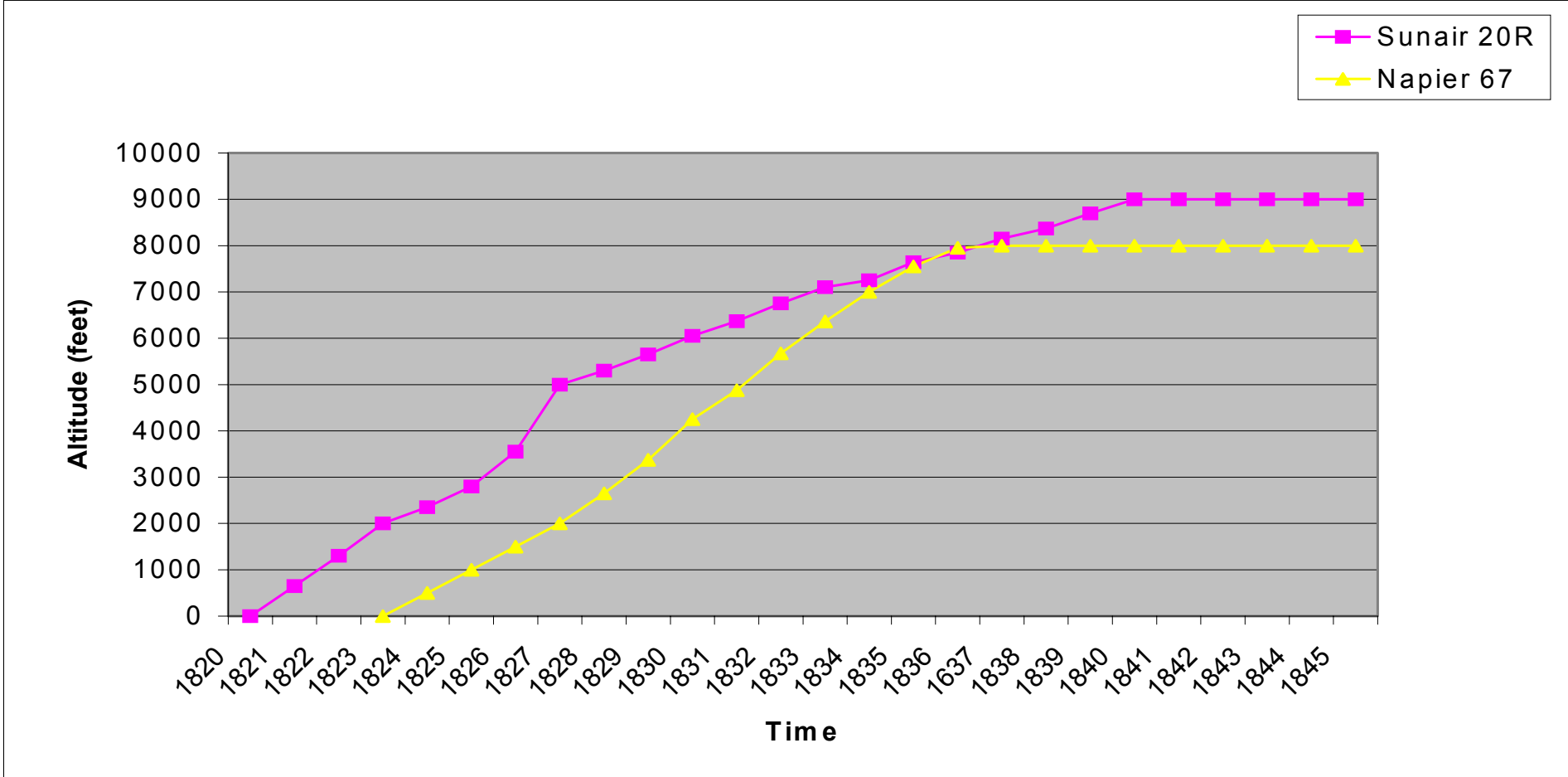
- at least 2000 feet exists between the aircraft at the commencement of the application;
 - the specified rates will not allow separation to decrease below the minimum (1000 feet);
 - separation is checked at intervals of not more than 5000 feet;
 - forecast/observed/reported mountain wave activity that would adversely affect aircraft performance, or severe turbulence is not present;
 - the aircraft are at or below FL290^{8,9}
- 1.6.3 The pilot of Sunair 20R reported after the incident that during the climb to 9000 feet, he was able to maintain a rate of climb in excess of 500 fpm, up to about 700 fpm, but this decreased to about 500 fpm as the aircraft approached cruise altitude.
- 1.6.4 The pilot of Napier 67 reported after the incident that his rate of climb occasionally exceeded 500 fpm, and “might have bumped up to momentarily to 600 or 700 feet”, but that he compensated by climbing with reduced power or flattening the climb and “even maintaining level flight”, the aircraft airspeed increasing as a result.
- 1.6.5 A pilot can measure the climb or descent performance of an aircraft using a vertical speed indicator (VSI). The VSI is a sensitive differential pressure gauge that compares changes in static pressure and is normally calibrated in 100 fpm intervals. Instrument faults are uncommon and would normally be obvious to a pilot. However, a common error is that of lag, where sudden changes in static pressure may not be immediately or accurately detected on the instrument, for example when encountering turbulence. However, general trend information is considered to be reliable. No instrument faults were reported for ZK-DIR or ZK-MSL.
- 1.6.6 Radar data for the climbs indicated that Sunair 20R was climbing at a groundspeed of about 85 kts, reducing to about 75 kts approaching 9000 feet, and Napier 67 was climbing at a steady groundspeed of 102 kts.

2 Analysis

- 2.1 The analysis of the incident was based on a combination of witness interviews, ATC communication recordings, supporting flight documentation and limited radar data. The lead-up to the incident and the initial loss of required separation occurred outside radar coverage.
- 2.2 The 2 flights were regular, routine freight runs from Napier to Paraparaumu, via overhead Palmerston North. The controller and both pilots had controlled or flown the flights numerous times in the past and were very familiar with the operation and each other.
- 2.3 The 2 aircraft departed from Napier at night in accordance with prescribed IFR clearances. The controller elected to use specified rates of climb for the 2 aircraft to ensure the required separation criteria were maintained – Sunair 20R to climb at a minimum of 500 fpm, and Napier 67 at a maximum of 500 fpm. Both pilots were aware of their respective requirements.
- 2.4 The 2000 foot separation applied for the initiation of the climb procedure only. This provided an additional safety margin for the climb and especially for the take-off phase for the following aircraft, where arguably performance was most critical. After initiation of the procedure, vertical separation was permitted to reduce to a minimum of 1000 feet.

⁸ Flight level 290, or 29 000 feet

⁹ Manual of Air Traffic Services, RAC 3-25, dated 16 May 2002



**Approximation of Aircraft Climb Profiles
(based on radar and pilot reports)**

- 2.5 With Sunair 20R having already reported through 2000 feet when Napier 67 took off, the specified rates of climb would have maintained the required separation had they been adhered to.
- 2.6 From experience, ATC and aircrew knew that the Aztec, Sunair 20R, would typically out-climb the Seneca, Napier 67. Therefore, once the initial separation was established, all parties considered there was little requirement to constantly monitor the separation of the 2 aircraft during the progress of the flights. Regulations required the controller to check separation at least once every 5000 feet of climb. Nevertheless, the controller twice compared the separation between the 2 aircraft, and on each occasion removed the rate of climb restriction for Napier 67, albeit on a temporary basis.
- 2.7 By removing the restriction on Napier 67 as Sunair 20R passed 3000 feet, any excess energy held by Napier 67 could be converted to increasing its climb rate until reaching the next limit altitude, which potentially reduced the vertical separation between the 2 aircraft to the 1000 foot minimum. However, when the pilot of Napier 67 reported passing 2000 feet at 1827, the vertical separation between the 2 aircraft had possibly increased as the pilot of Sunair 20R reported passing 5000 feet shortly after. The climb restriction on Napier 67 was then removed for the second time. The possible increase in separation probably reinforced the perception by the pilots and controller that adequate separation existed for the remainder of the climbs.
- 2.8 Some 8 minutes elapsed from when the pilot of Sunair 20R reported passing 5000 feet at about 1827, and next reported “through 7700” at 1835. Another 2 minutes elapsed before a check of Napier 67’s progress was obtained. To close a 2000 foot separation over 8 minutes, a rate of 250 fpm would have been required. This rate could have been achieved by Sunair 20R reducing its climb rate by 250 fpm or Napier 67 increasing its rate by 250 fpm, but was probably a combination of smaller amounts by both aircraft.
- 2.9 Analysis of the ATC tapes and radar data clearly indicated that after Sunair 20R passed 5000 feet and Napier 67 was cleared unrestricted to 4000 feet, neither pilot adhered to their clearance requirements for the remainder of their climbs (refer to figure at page 5). The rate of climb for Sunair 20R slowed to an average of about 330 fpm, while Napier 67’s average rate of climb increased to about 680 fpm after passing 4000 feet. As a result the vertical separation steadily reduced until the 1000 foot minimum was infringed at about the time Sunair 20R passed 7500 feet and Napier 67 passed 6500 feet. The 2 aircraft were possibly climbing through 7500 feet to 8000 feet at about the same time.
- 2.10 Groundspeeds recorded by Ohakea Radar confirm that both aircraft had a steady headwind component of about 20 kts. The wind velocity, however, was not strong enough to generate severe turbulence or strong wave activity, but the light to moderate turbulence and the probably gentle wave activity were, nevertheless, sufficient to have some effect on their climb performance.
- 2.11 The higher groundspeed of Napier 67 supports the observation that some excess climb energy was converted into forward speed, and resulted in it steadily gaining on Sunair 20R as both aircraft approached 25 nm.
- 2.12 The lower groundspeed of Sunair 20R in the climb, 85 kts reducing to 75 kts, would indicate that aircraft performance was decreasing significantly as it approached cruise altitude. The 10 kt reduction in groundspeed coincided with the pilot being instructed by Ohakea Control to expedite the climb to 9000 feet.
- 2.13 The pilot of Sunair 20R was familiar with the performance capabilities of the Aztec model of aircraft and should have been able to correctly assess its climb performance capabilities. The pilot had flown the aircraft earlier in the day and should have noticed any significant degradation in performance when compared to the previous aircraft he had flown.

- 2.14 Despite the light turbulence encountered by both aircraft, the VSIs would still have provided the pilots with reliable climb information on which they could monitor their adherence to their IFR clearances for the climbs.
- 2.15 At a rate of climb of 500 fpm, a period of 10 minutes could elapse before a separation check was completed if the 5000 foot interval requirement was adhered to. With a minimum vertical separation of 1000 feet a rate of 100 fpm, or 50 fpm each for 2 aircraft, would be required to close the gap. This is approaching the accuracy limitations of the VSI.

3 Findings

Findings are listed in order of development and not in order of priority.

- 3.1 Both pilots and the controller were qualified, experienced and current in their respective positions.
- 3.2 The 2 aircraft departed Napier in accordance with standard clearance requirements and separations.
- 3.3 The weather, though suitable for the flights, affected the performance of the 2 aircraft to a minor degree.
- 3.4 The changes made by the controller to the IFR climb clearances were in accordance with procedures.
- 3.5 The controller, in spite of correctly applying the required procedures, did not continue to monitor the progress of the 2 aircraft as they approached their respective cruise altitudes and was, therefore, unable to identify that the aircrafts' climb rates had altered to the extent that a loss of separation was likely.
- 3.6 The minimum 1000 foot vertical separation requirement was infringed because neither pilot complied with their respective IFR clearances during the climb, and did not advise ATC accordingly.
- 3.7 Neither the pilots, nor the controller, were aware that a loss of vertical separation had occurred until advised by Ohakea Control.
- 3.8 The 2 aircraft passed in close proximity to each other, and only tolerances in navigation prevented a possible mid-air collision.
- 3.9 Rate of climb or descent requirements and instrument tolerances do not provide sufficient buffer for low performance aircraft to ensure separation minima are maintained.

4 Safety Recommendations

- 4.1 On 12 February 2003 it was recommended to the Chief Executive, Airways Corporation of New Zealand that he:
- 4.1.1 Amend the requirements for vertical separation when specified rates of climb or descent are used, especially for low performance aircraft, to ensure that there is either an increase in the level of monitoring, or a greater buffer is applied for the procedure. (053/02)

4.2 On 19 February 2003 the Manager System Safety for Airways Corporation of New Zealand replied in part:

Airways will amend its operating manual (Manual of Air Traffic Services) to mandate more frequent monitoring of separation for low performance aircraft. The amendment will be published to be effective on 12 June 2003.

Approved for publication 29 January 2003

Hon. W P Jeffries
Chief Commissioner



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