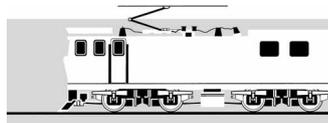
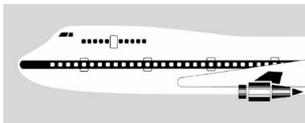


## AVIATION OCCURRENCE REPORT

02-015 Piper PA31-325 Navajo ZK-TZC, loss of control and collision with the ground during a one-engine-inoperative landing approach, near Feilding Aerodrome

17 December 2002



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## **Report 02-015**

**Piper PA31-325 Navajo**

**ZK-TZC**

**loss of control and collision with the ground during a  
one-engine-inoperative landing approach**

**near Feilding Aerodrome**

**17 December 2002**

### **Abstract**

On Tuesday 17 December 2002, at 2036, ZK-TZC, a twin-engine Piper PA31-325 Navajo, took off from Feilding Aerodrome on a visual flight rules flight to Paraparaumu. The pilot and his 2 young sons were on board.

A few minutes later when the aeroplane was level at 1000 feet near Palmerston North Aerodrome some problem, probably with the left engine, occurred and the pilot turned back to Feilding Aerodrome. With the left propeller feathered the pilot flew an irregular low-level circuit in an attempt to land. During a left base turn, with the flaps and undercarriage extended, he lost control of the aeroplane. The aeroplane rotated away from the aerodrome and then struck the ground nose first in a near vertical attitude. The pilot and his 2 sons died in the unsurvivable accident.

No conclusive reason was found to explain why the left propeller was feathered. The pilot's actions in the handling of the emergency and in his attempt to land at Feilding Aerodrome with one engine inoperative are unaccountable.

No new safety deficiencies were identified.

[An erratum was approved by the Commission on 16 August 2004. This report includes the erratum covering paragraphs 1.5.22, 2.7, and 2.8.]



**ZK-TZC after the accident**

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## Abbreviations

amsl	above mean sea level
kg	kilogram(s)
km	kilometre(s)
m	metre(s)
nm	nautical mile(s)
UTC	coordinated universal time

## Data Summary

<b>Aeroplane registration:</b>	ZK-TZC
<b>Type and serial number:</b>	Piper PA31-325 Navajo, 31-7812129
<b>Number and type of engines:</b>	2 Lycoming TIO-540-F2BD (right engine LTIO-540-F2BD)
<b>Year of manufacture:</b>	1978
<b>Operator:</b>	the pilot
<b>Date and time:</b>	17 December 2002, 2041 <sup>1</sup>
<b>Location:</b>	near Feilding Aerodrome latitude: 40° 16' south longitude: 175° 35' east
<b>Type of flight:</b>	private
<b>Persons on board:</b>	crew: 1 passengers: 2
<b>Injuries:</b>	crew: 1 fatal passengers: 2 fatal
<b>Nature of damage:</b>	aeroplane destroyed
<b>Pilot's licence:</b>	Private Pilot Licence
<b>Pilot's age:</b>	44
<b>Pilot's total flying experience:</b>	about 1080 hours (70 hours on type)
<b>Investigator-in-charge:</b>	K A Mathews

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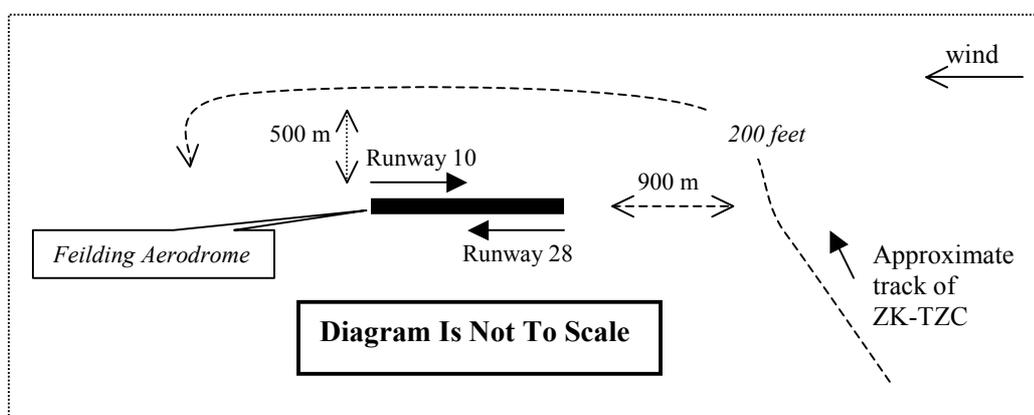
<sup>1</sup> Times in this report are New Zealand Daylight Time (UTC + 13 hours) and are expressed in the 24-hour mode.



# 1 Factual Information

## 1.1 History of the flight

- 1.1.1 On Tuesday 17 December 2002, at 2036, ZK-TZC, a Piper PA31-325 Navajo, took off from Feilding Aerodrome on a visual flight rules flight to Paraparaumu. The normal flight time was about 17 minutes. The pilot and his 2 sons, aged 7 years and 5 years, were on board.
- 1.1.2 Earlier that evening the pilot, his wife and 4 children had attended the pilot's farewell work function in Palmerston North. After the function they all went to Feilding Aerodrome where he prepared ZK-TZC for the flight. The pilot's wife saw him carry out a pre-flight inspection of the aeroplane, including checking the fuel. The pilot seemed to her to be his normal self and he gave her no indication that anything was amiss either with himself or ZK-TZC. She did not see the aeroplane taxi but did see it take off on runway 10 and then turn right. She thought the take-off and the departure were normal and saw nothing untoward. She then drove to Paraparaumu with her 2 younger children, the 2 older boys having left in ZK-TZC with their father.
- 1.1.3 An aviation enthusiast, who lived by the aerodrome boundary, watched ZK-TZC taxi and take off, but he did not see or hear the pilot complete a ground run. He saw the aeroplane take off on runway 10 immediately after it taxied and thought the take-off and departure were normal. He did not notice anything untoward with the aeroplane.
- 1.1.4 A radar data plot provided the time, track and altitude details for ZK-TZC. No radio transmissions from the pilot were heard or recorded by Palmerston North or Ohakea air traffic control. Palmerston North Control Tower was unattended from 2030 on the evening of the accident.
- 1.1.5 The radar data plot showed that after take-off ZK-TZC turned right, climbed to 1000 feet above mean sea level (amsl) and headed for Paraparaumu. When the aeroplane was about 2.7 nautical miles (nm) (5 km) from Feilding Aerodrome and tracking approximately 1.3 nm (2.4 km) northwest of Palmerston North Aerodrome it turned to the left, descended and headed back to Feilding Aerodrome. The aeroplane descended at about 500 feet per minute rate of descent to 400 feet amsl. At 400 feet amsl (about 200 feet above the ground) the aeroplane passed about 0.5 nm (900 m) east of the aerodrome and threshold for runway 28, and joined left downwind for runway 10. In the downwind position the aeroplane was spaced about 0.3 nm (500 m) laterally from the runway at an initial height of 400 feet amsl, or about 200 feet above the ground (see Figure 1).



**Figure 1**  
**ZK-TZC approximate approach track**

- 1.1.6 ZK-TZC departed from controlled flight when it was turning left at a low height during an apparent approach to land on runway 10, with its undercarriage and flaps extended. ZK-TZC first rotated to face away from the aerodrome before striking the ground in a nose down attitude. The 3 occupants were killed in the impact.
- 1.1.7 Two witnesses, who were about 3.5 km southeast of Palmerston North Aerodrome and about 6 km from the aeroplane, saw the aeroplane at a normal height shortly before it turned back towards Feilding. They described what they thought was some darkish grey smoke behind the aeroplane shortly before it turned around.
- 1.1.8 A witness near Palmerston North recalled seeing the aeroplane in level flight at about 1000 feet before it rolled quickly into a steep left turn and then headed back toward Feilding Aerodrome. After the steep turn the aeroplane descended. He thought that one or both engines were running unevenly. He did not see any smoke or anything unusual coming from the aeroplane. He lost sight of the aeroplane when it was in the vicinity of Feilding. He remembered that at the time it was getting on toward dark and that there was a high cloud base with gusty winds.
- 1.1.9 Another witness travelling on a road from Feilding Aerodrome to Palmerston North saw the aeroplane fly low over his car. He saw the undercarriage extend then retract and that the left propeller was stationary. He believed the other engine sounded normal. He then saw the aeroplane continue toward Feilding Aerodrome and cross the eastern end of the runway. He thought the aeroplane was trying to turn and said it seemed to be quite low and slow. He did not see any smoke coming from the aeroplane. He was not overly concerned because he thought it was a training aeroplane. He said the weather at the time was clear with a high overcast.
- 1.1.10 The aviation enthusiast saw ZK-TZC return for a landing and fly to a left downwind position for runway 10. He thought the aeroplane was quite low. He said the left propeller was feathered and was not turning and believed the right engine sounded normal. He did not see any smoke coming from the aeroplane. He could not recall the position of the undercarriage or flaps. After a while he became concerned when he had not seen the aeroplane land. He described the weather at the time as being fine with good visibility but that it was getting on toward dark.
- 1.1.11 A further witness living near Feilding Aerodrome by the threshold to runway 10 heard the aeroplane coming and then fly overhead. He said the aeroplane sounded very low and very loud, as though its engine was at maximum speed (power). The engine sounded normal, except that it sounded as though it was under high power. He said there was a slight breeze, clear conditions and a high overcast at the time.
- 1.1.12 A couple living by Feilding Aerodrome on the approach path to runway 10 heard the aeroplane coming from a northerly direction. They thought its engine sounded as though it was under a heavy load and said it was making a very loud noise like a topdressing aeroplane. The engine was making a steady sound and was not intermittent or running rough. The steady loud engine noise continued until they heard a loud thump, when the engine noise stopped abruptly. They said that at the time it was getting on toward dark but the weather was clear with good visibility.
- 1.1.13 An eyewitness to the accident saw the aeroplane at a very low height, about the height of some nearby treetops, when it turned left to land. The aeroplane was turning left when she saw it nose up sharply and then suddenly turn back in the opposite direction, before nosing down and hitting the ground nose first. She said the aeroplane seemed to snap in half after it hit the ground.

## **1.2 Injuries to persons**

- 1.2.1 The pilot and his 2 sons died in the impact.

## **1.3 Other damage**

- 1.3.1 Some oil and fuel spilled into a nearby stream.

## 1.4 Pilot information

- 1.4.1 The pilot was aged 44. He held a Private Pilot Licence (Aeroplane) issued on 18 September 1998 and a Class 2 Medical Certificate valid until 9 July 2004.
- 1.4.2 The pilot had flown about 1080 hours, including some 70 hours in ZK-TZC. His pilot logbook recorded some 210 hours of visual night flying experience. His total multi-engine aeroplane experience amounted to about 78.5 hours.
- 1.4.3 The pilot owned ZK-TZC and used it for both his business and personal use.
- 1.4.4 The pilot also owned a turbo-charged Cessna 210 and his pilot logbook recorded about 550 flying hours in that aeroplane. The pilot had logged about 240 flying hours in a Cessna 182 that he had owned previously.
- 1.4.5 The pilot started his initial multi-engine aeroplane conversion training in a Beechcraft BE76 Duchess at Ardmore on 22 September 2002 and completed it on 25 September 2002. He received 7 hours of conversion flight instruction experience before being issued with his initial multi-engine aeroplane rating. The minimum conversion flight instruction experience requirement was 5 hours. The instructor was a B category flying instructor and an airline training captain. He was also an advisor at a local flying school where he trained instructor pilots for their multi-engine instructor ratings.
- 1.4.6 The instructor sent the Duchess aeroplane manual and a technical data sheet to the pilot for his preparation about 5 days before he began his multi-engine training. The instructor thought the pilot had prepared himself well for the training and had gained a good technical knowledge about the Duchess.
- 1.4.7 The documented multi-engine conversion training programme consisted of 6 separate modules. Each module included a ground briefing, flight preparation, a training flight and an after-flight debriefing. The programme was a specifically designed training course and covered all the areas required for an initial multi-engine aeroplane rating. All pilots who trained for their initial multi-engine aeroplane rating with the flying school followed the same training programme. There was no set flight time and the instructor said that where necessary he would spend more time in a particular area with a student.
- 1.4.8 The instructor said he did a lot of asymmetric (a simulated engine failure) work with the pilot throughout the training programme. He considered that the pilot had achieved a good standard by the completion of the training. His concern was only with engine failures after take-off, where the pilot had tended to allow the aeroplane to get too slow. In the early stages of the training, the pilot was a little slow in carrying out the initial actions during simulated engine failures, but over time he achieved an acceptable standard.
- 1.4.9 The instructor was aware the pilot had purchased ZK-TZC and advised him that the PA31 Navajo was a high performance aeroplane and a step up from the Duchess. Because the instructor was not an experienced Navajo pilot he offered to find an experienced instructor for the pilot's Navajo type rating training, but the pilot declined the offer.
- 1.4.10 The instructor said that on the day of the accident the pilot did not fly ZK-TZC in accordance with the techniques he had taught him during the initial multi-engine aeroplane rating training, for a one-engine-inoperative landing approach.
- 1.4.11 The pilot located a second instructor, who was a C and D category flying instructor, for his Navajo type rating. Additionally, the instructor was familiar with ZK-TZC, having flown it for a previous owner. To be eligible for the PA31 (Navajo) type rating the pilot needed to demonstrate to the instructor a satisfactory technical knowledge of the aeroplane and an ability to perform competently all normal, abnormal and emergency flying procedures. The minimum conversion instruction flight experience necessary for the rating was one hour.

- 1.4.12 For the purpose of insurance coverage on ZK-TZC the pilot had to accrue a total of 25 hours flying experience in the make and model of aeroplane before flying ZK-TZC solo. There was no stipulation on the type of flying to be conducted and the insurance company did not brief the second instructor.
- 1.4.13 On 28 September 2002 the pilot began his Navajo type rating training at Masterton with the second instructor. His pilot logbook recorded 1.5 hours of dual multi-engine aeroplane type conversion flight experience in ZK-TZC that day. His logbook recorded that over the next 10 days he completed a further 25.3 hours flying experience, with the second instructor as pilot in command. On 7 October 2002 he completed an all-up-weight check with the instructor in ZK-TZC, who then issued the pilot a PA31 (Navajo) type rating.
- 1.4.14 The second instructor described the pilot as a willing student. He said the initial conversion instruction flight covered all the normal, abnormal and emergency flying procedures. He said he also demonstrated to the pilot the loss of performance that resulted if the propeller was not feathered after a loss of engine power. The instructor commented that it was the most thorough type conversion he had given a pilot. During the extra 25 hours flying experience, as recorded in both pilots' logbooks, the flying consisted mainly of instrument flight rules training throughout the country. The instructor said he gave the pilot a briefing before and after each flight.
- 1.4.15 The second instructor said that during each flight he gave the pilot some sort of simulated engine failure scenario or other emergency to handle, and discussed various potential emergency situations with him. The instructor believed that by the end of the training the pilot was at a good competent standard overall, and at a very competent standard for visual flight rules flying.
- 1.4.16 The second instructor did not have a documented training syllabus nor did he keep any written records of the training, other than those entries in his own pilot logbook and those recorded by the pilot in his pilot logbook. He had signed the type rating certificate record in the back of the pilot's logbook, certifying that the pilot had met the requirements for a PA31 rating. The instructor was not required to keep any other records.
- 1.4.17 The pilot's and second instructor's pilot logbooks recorded the same flight times for the Navajo type conversion training and the flying completed over the 10 day period in ZK-TZC. These times were greater than those entered in a vehicle logbook carried in the aeroplane, which the pilot used to record the aeroplane's flight time from take-off to landing. This time was taken from a meter in the cockpit.
- 1.4.18 Pilots are entitled to record flight time in their pilot logbooks from the moment an aircraft first moves under its own power for the purpose of taking off until the moment it comes to rest at the end of the flight. This time will be greater than the actual flight time. In this case the flight experience logged by both pilots varied about 26% more than the flight time recorded in the vehicle logbook. The instructor explained that he did not check the entries against the aeroplane's vehicle logbook or technical log entries, but said the differences could be explained by the amount of taxiing time involved during the training.
- 1.4.19 The second instructor said he had advised the pilot not to attempt to land ZK-TZC at Feilding Aerodrome with one engine inoperative, because of the restricted runway length. He said he had told the pilot to use either Palmerston North or Ohakea Aerodromes in such an event. Other options could include Wanganui or Paraparaumu Aerodromes in the unlikely event both Palmerston North and Ohakea were unavailable. The instructor said he could not understand why the pilot had tried to land ZK-TZC at Feilding Aerodrome in this instance. He said the pilot had not flown the aeroplane in accordance with the techniques he had taught for a one-engine-inoperative landing approach.

- 1.4.20 An experienced local Navajo operator at Feilding Aerodrome said that the runway was the minimum length necessary to safely operate the aeroplane normally. He considered the runway was too short for a safe one-engine-inoperative landing and his company policy was to never use the aerodrome in such an event, but to land at either Palmerston North or Ohakea Aerodrome.
- 1.4.21 A maintenance organisation at Feilding Aerodrome carried out the general maintenance on ZK-TZC and the pilot's Cessna 210. The pilot owned a hangar at the aerodrome and both aeroplanes were usually stationed at Feilding Aerodrome, or sometimes at Paraparaumu Aerodrome near where the pilot and his family lived.
- 1.4.22 The maintenance organisation's chief engineer recalled that on 16 October 2002, when the pilot was flying ZK-TZC from Paraparaumu to Feilding, the right engine lost power because of fuel starvation about 9 nm southwest of Feilding Aerodrome. He said the pilot was using the outboard fuel tank at the time (see 1.5.17). The chief engineer and local operator believed the pilot initially said he landed ZK-TZC at Feilding Aerodrome with the right propeller feathered after the incident, but then later advised that he had restored engine power before the landing. Whether the pilot had landed ZK-TZC at Feilding Aerodrome with the right propeller feathered or not could not be confirmed.
- 1.4.23 The local operator said he advised the pilot against trying to land ZK-TZC at Feilding Aerodrome with one engine inoperative because of the restricted runway length, and discussed his own company policy with him. The chief engineer said he had also advised the pilot against attempting to land ZK-TZC at Feilding Aerodrome with one engine inoperative. Both were surprised the pilot had attempted to land ZK-TZC at Feilding Aerodrome in this instance.
- 1.4.24 On the Sunday evening, 2 days before the accident, the pilot flew ZK-TZC to Te Kuiti and stayed with friends. On the Monday he flew the aeroplane to Ardmore and then back to Feilding.
- 1.4.25 A number of people who knew the pilot said he appeared to have a hectic schedule and was often in a hurry. The pilot's wife said he had a high workload and that he was looking forward to a planned family holiday at the end of the week. She said he had a relaxing day with the family on December 15, the Sunday before the accident, and that Sunday and Monday were his days off work. He had returned home about 1800 the day before the accident and had a relaxing evening with his family.
- 1.4.26 The chief engineer had spoken to the pilot at Feilding Aerodrome the evening before the accident. He saw him again about 0815 on the morning of the accident when the pilot went to the aeroplane to remove some personal equipment, but they exchanged only a brief greeting. He said the pilot left in a hurry and appeared to be pre-occupied. He said the pilot had mentioned that he had a very busy schedule that week and consequently did not want the aeroplane to break down. The pilot was scheduled to be in Auckland at 0930 the next morning, December 18, and had to leave Paraparaumu in ZK-TZC early in the morning to make the appointment. The pilot had planned to also fly to Wanganui later the next day, after the Auckland appointment. The chief engineer said the pilot mentioned that he was tired and was looking forward to a family holiday at the end of the week.
- 1.4.27 The pilot had flown ZK-TZC regularly up to the time of the accident. Although his pilot logbook had no entries after 13 October 2002, the aeroplane's vehicle logbook was up to date. In the previous week the pilot had flown the aeroplane 6.3 hours. In the previous month he had flown it 22.9 hours. He had flown the aeroplane 68.3 hours since the first recorded vehicle logbook entry on 28 September 2002.
- 1.4.28 The pilot's last recorded biennial flight review was on 17 September 2000, as certified in his pilot logbook by a flight instructor. A biennial flight review could be combined with any other training or testing, provided the review requirements were fully met and certified in a pilot's logbook by an appropriately qualified flight instructor. The instructor who gave the pilot his

recent multi-engine aeroplane conversion training and rating had not endorsed the pilot's logbook certifying that a biennial flight review had been completed. The instructor mentioned that what was covered during the rating was more than adequate to have met the review requirements, but he could not recall if the pilot had discussed a flight review with him.

## **1.5 Aeroplane information**

- 1.5.1 ZK-TZC was a Piper PA31-325 Navajo twin-engine aeroplane, serial number 31-7812129, manufactured in the United States in 1978. A Lycoming TIO-540-F2BD engine, serial number L5918-61A, was fitted to the left wing. A Lycoming LTIO-540-F2BD engine, serial number L1469-68A, was fitted to the right wing.
- 1.5.2 A 3-bladed Hartzell constant speed propeller, serial number DJ 9362A, was fitted to the left engine. A 3-bladed Hartzell constant speed propeller, serial number DJ 9322A, was fitted to the right engine.
- 1.5.3 The aircraft records showed ZK-TZC had been maintained in accordance with its approved maintenance requirements. At the time of the accident the aeroplane had amassed 1806.3 hours. The last maintenance check was a 50-hour inspection completed on 13 November 2002 at 1781.9 hours. During this check each engine had its oil and oil filter replaced. A 100-hour check had been completed on 2 April 2002 at 1731.7 hours. The next 100-hour check was due at 1831.7 hours or 2 April 2003, whichever occurred first.
- 1.5.4 Both engines had been overhauled on 12 October 2000. At the time of the accident they had each amassed 140.8 hours since the overhaul.
- 1.5.5 Both propellers had been overhauled on 12 October 2000. At the time of the accident they had each amassed 140.8 hours since the overhaul.
- 1.5.6 The engines and propellers had all amassed 66.2 hours at the last 100-hour check.
- 1.5.7 The aeroplane had an outboard and an inboard fuel tank consisting of rubber bladders in each wing. Each outboard tank had a capacity of 152 litres and each inboard tank 213 litres. The inboard tanks were to be used for take off and landing. The outboard tanks could be used in cruising flight. The aeroplane had a total fuel endurance of about 4.7 hours when the tanks were full.
- 1.5.8 Each engine had one main mechanically-driven fuel pump and 2 auxiliary electrically-driven fuel pumps. One auxiliary fuel pump for each engine could be selected ON or OFF and was normally on for take off and landing. The other auxiliary pump remained on at all times.
- 1.5.9 A low fuel pressure annunciator panel was situated on the instrument panel ahead of the pilot. A light would illuminate to warn of any impending fuel flow interruption, thus indicating the need to change fuel tanks.
- 1.5.10 ZK-TZC had 2 fuel selectors, one for each engine. Each selector lever slid laterally to select INBOARD, OFF or OUTBOARD and notched positively into each selection. The selector lever passed through the OFF position when selecting between OUTBOARD and INBOARD. A control cable connected each fuel selector to its respective fuel valve. A fuel shut-off lever for each engine was located beside each fuel selector.
- 1.5.11 A cross feed selection lever was positioned between the fuel selectors.
- 1.5.12 The second instructor said that if an outboard fuel tank in ZK-TZC was run dry, the engine would catch and continue to run as soon as the inboard tank was selected, without the need to select the second auxiliary fuel pump ON.

- 1.5.13 The second instructor said he had not experienced any problems with the engines or fuel system in ZK-TZC during the time he flew it.
- 1.5.14 On 16 December, the day before the accident, the pilot flew ZK-TZC from Te Kuiti to Ardmore Aerodrome, where he uplifted 472 litres of fuel from a bulk commercial fuel supplier, filling the fuel tanks. The pilot then flew ZK-TZC 1.2 hours to Feilding Aerodrome where he left the aeroplane with the maintenance organisation. The pilot told the chief engineer the right fuel gauge needle was sticking and to investigate and repair it. The pilot did not mention any other concerns with the aeroplane.
- 1.5.15 Before the refuelling on 16 December, the previous known refuelling of ZK-TZC was at Feilding Aerodrome on 11 December from a bulk commercial fuel supply, where 542 litres of fuel were uplifted and the tanks filled. The aeroplane flew about 3.1 hours from that refuelling until its last refuelling at Ardmore.
- 1.5.16 On the day of the accident the maintenance organisation's engineers, as requested by the pilot, examined the right fuel gauge, finding that its indicator needle had stuck at full-scale deflection. They rectified the problem and determined the right fuel indication system was working correctly. No other maintenance was carried out. There was no communication between the pilot and the chief engineer about the fuel gauge repair. A maintenance engineer who worked on the aeroplane recalled seeing the fuel selectors both selected to the inboard fuel tanks after the maintenance and that each fuel gauge read about  $\frac{3}{4}$  full. He also saw a quantity of fuel in all the 4 fuel tanks. A fuel dipstick was not available because the fuel tank arrangement would not allow an effective dipstick measure. If fuel could be seen in the inboard fuel tanks then each tank was at least half full, and if fuel was seen in the outboard tanks then they contained at least 70 litres of fuel each.
- 1.5.17 After the right engine fuel starvation incident on 16 October 2002 the chief engineer examined the fuel bladders. He said that the right outboard fuel tank bladder had partially collapsed because its supporting straps had loosened, thus reducing the fuel tank capacity by around 16 litres. This was repaired and no further problems were experienced.
- 1.5.18 The aeroplane was estimated to have been about 5800 pounds (2631 kg) all-up weight and its centre of gravity within limits at the time of the accident. Because the aeroplane was equipped with vortex generators, its maximum approved take-off weight was 6840 pounds (3103 kg). The maximum approved landing weight was 6500 pounds (2949 kg).
- 1.5.19 The experienced local Navajo operator, the second flight instructor and 2 other pilots experienced on the Navajo said the aeroplane would not maintain altitude at any weight with one engine inoperative and its propeller feathered, if the undercarriage and flaps were extended. They said the aeroplane should have been capable of maintaining its cruising altitude, if its undercarriage and flaps were retracted, even if it was at its maximum approved weight.
- 1.5.20 The performance section of the PA31-325 Navajo flight manual showed that the aeroplane was capable of maintaining about 15 500 feet amsl with one engine inoperative and its propeller feathered, with its undercarriage and flaps retracted, at its weight and the ambient temperature at the time of the accident.
- 1.5.21 The landing distance chart in the PA31-325 Navajo flight manual showed that ZK-TZC needed about 710 m of available landing distance to land at its maximum approved weight with no wind on a paved runway. The aeroplane needed about 660 m of available landing distance at its weight at the time of the accident, or around 630 m with a 10-knot head wind. These landing distances were for an aeroplane that was functioning normally and flown correctly and did not account for any performance loss, or any increased approach speed, because of an inoperative engine.
- 1.5.22 [The emergency procedures section of the PA31-325 Navajo flight manual included the actions to be taken if an engine failed during cruise flight. The initial engine securing actions were to

close the throttle and feather the propeller. Some further actions followed in sequence, such as turning OFF the magnetos, the auxiliary fuel pump (normally off for cruise) and the fuel selector, and pulling the fuel boost pump circuit breaker. Included in the initial required actions was the instruction to, "Land as soon as practical at the nearest suitable airport.]<sup>2</sup>

## **1.6 Meteorological information**

- 1.6.1 On the day of the accident, a Palmerston North Aerodrome automatic weather station report at 2000 recorded the following: wind 120° true at 9 knots gusting to 17 knots, visibility 30 km and scattered cloud at 7000 feet.
- 1.6.2 A manual Palmerston North Aerodrome weather observation at 2000 reported the following: wind 130° true at 10 knots, visibility 30 km, few clouds at 2500 feet, scattered cloud at 4000 feet and broken cloud at 5000 feet.
- 1.6.3 A Palmerston North Aerodrome automatic weather station report at 2100 recorded the following: wind 120° true at 11 knots gusting to 16 knots, visibility 30 km, few clouds at 1600 feet, scattered cloud at 5000 feet and broken cloud at 8000 feet.
- 1.6.4 Evening civil twilight, the end of daylight, on 17 December 2002 for the Feilding and Palmerston North areas was 2110.

## **1.7 Communication**

- 1.7.1 The aeroplane was fitted with transceivers for normal air-to-ground and air-to-air communications.
- 1.7.2 The Palmerston North Control Tower provided an aerodrome control service to meet operational requirements. The tower was unattended from 2030 on 17 December 2002, but continued to record any radio transmissions made on the local frequencies. No radio transmission from ZK-TZC was recorded.

## **1.8 Aerodrome information**

- 1.8.1 Feilding Aerodrome had a bitumen main runway 705 m long and was at an elevation of 214 feet amsl. The available take-off and landing distances were also 705 m. Runway lighting was available for night operations.
- 1.8.2 Palmerston North Aerodrome, situated 4 nm (7.4 km) south of Feilding Aerodrome, had a bitumen main runway 1902 m long. The available landing distances were 1763 m for runway 07 and 1822 m for runway 25. The aerodrome was equipped for night operations.
- 1.8.3 Ohakea Military Aerodrome was situated 10 nm (18.6 km) northwest of Feilding Aerodrome. The landing distance available on its main bitumen runway was 2447 m. Lighting was available for night operations.
- 1.8.4 Paraparaumu Aerodrome had 2 bitumen runways. The available landing distances on the longest runway was 1222 m for runway 16 and 1141 m for runway 34. The available landing distance on runway 11 was 1087 m and 1149 m for runway 29. Runway lighting was available for night operations.

## **1.9 Flight recorders**

- 1.9.1 The aeroplane was not equipped with any flight recorders, nor was it required to be.

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<sup>2</sup> 1.5.22 – Erratum approved on 16 August 2004 for publication.

## 1.10 Wreckage and impact information

- 1.10.1 ZK-TZC struck the ground on the edge of a stream that ran through a grass paddock, about 400 m northwest of the threshold for runway 10 at Feilding Aerodrome. The impact signature showed the aeroplane struck the ground nose-first in a near vertical attitude, facing away from the aerodrome and towards the direction from which it had come.
- 1.10.2 The entire aeroplane was accounted for at the accident site, which was contained within a small area. There was no evidence of any in-flight structural failure or component separation, or any evidence the aeroplane had struck an obstacle, such as trees, wires or birds. The aeroplane broke up extensively during the impact sequence. The empennage was the only intact section of the aeroplane.
- 1.10.3 Control continuity was established as far as possible given the disruption that had occurred. The flaps were fully extended and the undercarriage was in the down locked position. The rudder trim was neutral and the elevator was trimmed nose up.
- 1.10.4 The 2 left fuel tanks were destroyed in the impact. No fuel remained in the left tanks but there was a significant amount of fuel spilled around the area of the tanks, along with a strong fuel smell. Both left fuel caps were in place. The 2 right fuel tanks were ruptured but still contained some fuel. A significant amount of fuel was present around the area of the tanks as well as there being a strong fuel smell. Both right fuel caps were in place. A fuel sample taken from the right inboard fuel tank showed the fuel was the correct grade and that there was no evidence of any contamination. There was some fuel present in the lines to each engine with no evidence of water or other contamination. The left engine fuel bowl and filter contained a small amount of uncontaminated fuel. The right engine fuel bowl and filter contained uncontaminated fuel.
- 1.10.5 The right fuel selector was found selected to the inboard fuel tank, although its corresponding fuel valve was in the OFF position. The left fuel selector was found selected OFF, although its corresponding fuel valve was in the inboard fuel tank position. The fuel selector levers notched positively into detents when selected to the chosen setting. The fuel valves operated correctly, were free to move and were unobstructed. Significant fuel valve control cable stretch and cable disruption occurred during the accident sequence. Both fuel shut-off levers, beside each fuel selector, were in the ON position. Fuel crossfeed was not selected. The left fuel gauge on the overhead panel showed a near full indication and the right fuel gauge showed a half full indication. Both auxiliary fuel pumps on the overhead panel were selected OFF.
- 1.10.6 Although little reliable information could be gained from the cockpit instruments and control settings, the following additional information was noted:
- both throttle levers were fully open
  - both mixture levers were rich
  - both propeller pitch control levers were set to full fine (maximum speed)
  - the altimeter QNH was set at 1014 hPa (hectopascals)
  - the 4 magnetos (2 for each engine) were selected ON
  - the 2 additional auxiliary electric-driven fuel pumps' circuit breakers were in.
- 1.10.7 The left propeller appeared to be in the feathered position with no rotational damage evident on any of its blades. The propeller had separated from the left engine crankshaft because of overload, and lay adjacent to the engine. The right propeller remained attached to its engine crankshaft and was not feathered. One propeller blade tip showed evidence of being driven under power when it struck the ground.
- 1.10.8 There was no cargo on board the aeroplane apart from some personal effects and medical equipment. Two operable firearms and about 500 rounds of live ammunition were found in a bag in the position of the destroyed nose locker. The firearms had not discharged and were clean. The ammunition had not discharged. No other dangerous goods were found among the wreckage.

1.10.9 The engines and propellers were removed to an independent overhaul organisation for further examination under the Commission's supervision. The airframe wreckage was removed to a different secure location.

### **1.11 Medical and pathological information**

1.11.1 Post-mortem toxicological tests did not reveal any substance that could have impaired the pilot's ability to control the aeroplane. Post-mortem examination findings did not reveal sudden pilot incapacitation or impairment of flying ability.

1.11.2 The 3 aeroplane occupants were restrained by normal lap and shoulder harnesses, but died from multiple injuries received during the accident.

### **1.12 Fire**

1.12.1 No fire occurred.

### **1.13 Survival aspects**

1.13.1 The accident was not survivable.

### **1.14 Tests and research**

1.14.1 Under the Commission's supervision an independent engine overhaul facility disassembled and subjected both engines to a detailed examination, including various component testing.

1.14.2 Nothing was found with either engine or their related systems to indicate that they were not capable of operating normally before the accident. The examination and testing included the oil, turbocharger, ignition, fuel and induction systems. Fuel found in the fuel system was not contaminated.

1.14.3 The engines were in good condition and reflected their low hours and proper maintenance since overhaul.

1.14.4 The left propeller and governor were sent to an independent propeller overhaul facility for examination. Nothing was found to indicate that the propeller or its governor had malfunctioned before the accident, nor was any evidence found suggesting that they had not operated normally up until the accident. From the examination, the propeller appeared to have been in the feathered position when it struck the ground.

1.14.5 Daily fuel checks were carried out on the bulk fuel supply last used to refuel ZK-TZC. A fuel check showed the fuel was not contaminated and there were no reports of problems with other aircraft that had used the same fuel supply.

## **2 Analysis**

2.1 No conclusive reason could be found to explain why the left propeller was feathered. The aeroplane had been properly maintained and there was no evidence of any malfunction or problem with any system in the aeroplane. There was sufficient fuel in each fuel tank, and the aeroplane had about 3.5 hours fuel endurance when it took off on the accident flight. Tests did not indicate any fuel contamination.

2.2 The pilot was inexperienced on multi-engine aeroplanes but was familiar with multi-engine operations and the Navajo, having only recently completed his initial multi-engine aeroplane conversion training and Navajo type rating in ZK-TZC. Because of insurance requirements he received considerably more dual instruction in the Navajo than the minimum required for a type rating, and he had flown the aeroplane consistently up until the accident. The performance and

emergency considerations of operating a multi-engine aeroplane should, therefore, have been fresh in his mind.

- 2.3 The aeroplane took off normally from Feilding Aerodrome and climbed successfully to 1000 feet amsl for the flight to Paraparaumu. As it neared Palmerston North Aerodrome some problem occurred and the pilot abruptly turned ZK-TZC left, then descended and returned towards Feilding. What appears likely is that the left engine lost power or failed for some reason.
- 2.4 Although there was no record that the pilot made a distress call, which suggests he did not sense serious or imminent danger nor need any assistance, radio failure could not be ruled out.
- 2.5 The left fuel selector lever was found in the OFF position, but its corresponding fuel valve was found selected to the inboard fuel tank. The right fuel selector lever was in the inboard fuel tank position but its corresponding fuel valve was found selected OFF. Because the fuel selector levers moved laterally and had a positive locking action to retain them in each selected position, they are unlikely to have moved because of disruption during the accident. On the other hand, the fuel valves had no such locking and relied on control cable tension between the selectors and valves to position each valve correctly. Significant control cable stretch and disruption occurred during the accident, which would explain why the fuel valves were in positions different from their selectors.
- 2.6 The pilot probably selected the fuel selector levers to the positions found. There is, therefore, a possibility the pilot inadvertently selected the left fuel selector to the OFF position when attempting to select the left outboard fuel tank for cruise flight. The pilot normally used the outboard fuel tanks during cruise flight and the fuel selectors had to be first moved past their OFF positions to select the outboard fuel tanks.
- 2.7 [The pilot might have intentionally selected the left fuel selector lever to the OFF position after he secured the engine, in accordance with the flight manual procedures. Had he followed the full sequence of procedures, then the magnetos should also have been selected OFF and the fuel boost pump circuit breaker pulled, which they were not. If fuel was to be shut off at the engine firewall, the fuel shut-off lever beside the fuel selector should be used. Both fuel shut-off levers were found in the ON position.]<sup>3</sup>
- 2.8 [From witness accounts the pilot might have been tired the day of the accident. He also left Feilding late in the evening and had a busy schedule planned the next day, which required an early morning departure from Paraparaumu in ZK-TZC. He was also supervising his 2 young sons. These factors could have distracted the pilot from the normal operation of the aeroplane. Had he consequently mistakenly selected the left fuel selector to OFF when intending to select the outboard fuel tank, he might then have simply believed he had an engine failure without first checking the fuel selection.]<sup>3</sup>
- 2.9 Why the pilot elected to return to Feilding Aerodrome rather than land ZK-TZC at Palmerston North Aerodrome is unaccountable. The runway at Palmerston North Aerodrome was 2.7 times longer than the runway at Feilding Aerodrome. The pilot was also aware that Feilding Aerodrome was not recommended for landing the aeroplane with one engine inoperative, having recently been advised accordingly by several people. When ZK-TZC made an abrupt left turn it was at 1000 feet amsl and about one nautical mile from the threshold of runway 07 at Palmerston North Aerodrome. The aeroplane was already positioned on about a left base for the runway and was ideally placed to carry out an immediate landing. Alternatively, the pilot could have flown the aeroplane to Ohakea or even continued to Paraparaumu.
- 2.10 The pilot's decision-making might have been influenced by the inconvenience of an unexpected problem and the potential disruption of an unplanned landing at Palmerston North, or by a perceived need to return to Feilding where his second aeroplane and maintenance provider were

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<sup>3</sup> 2.7 and 2.8 – Erratum approved on 16 August 2004 for publication.

located. He might have also been anxious about getting to Auckland the next morning. Although the maintenance facility was at Feilding, the chief engineer lived in Palmerston North and would have travelled at short notice to the aeroplane as soon as he knew it had a problem.

- 2.11 The pilot might have also been influenced to land ZK-TZC as soon as possible at Feilding Aerodrome by a desire to leave Feilding again in his other aeroplane, or to get to Paraparaumu, before it was dark. This, however, should not have unduly concerned him because aerodrome lighting was available at Feilding and Paraparaumu, and he was familiar with visual night flying.
- 2.12 If, as some suspected, the pilot had previously landed ZK-TZC at Feilding Aerodrome with a propeller feathered, he might have had the confidence to attempt it again. However, he had been advised afterwards that it was a potentially dangerous feat to attempt.
- 2.13 Having elected to return to Feilding Aerodrome, the pilot should have kept ZK-TZC at 1000 feet and flown a standard one-engine-inoperative circuit and approach in accordance with his recent training. The circuit and approach that he flew were illogical and inconsistent with his training.
- 2.14 Because the pilot descended ZK-TZC quickly to 200 feet above the ground and extended the undercarriage on left base for runway 28, then retracted it and continued around for runway 10, this suggests he initially planned landing downwind on runway 28. The radar plot also suggests that this was the case. However, because he had recently taken off on runway 10 and knew the wind strength it seems inconceivable that he would attempt a downwind landing on such a short runway (for a Navajo).
- 2.15 If the pilot had first attempted to land on runway 28 it could help explain why ZK-TZC was at such a low height and so close laterally to the runway when it was downwind for runway 10. If he had extended the flaps and undercarriage again when approaching runway 28, or when ZK-TZC first entered downwind for runway 10, the aeroplane would not have been able to maintain height because of the increased drag, even with maximum power applied on the right engine and with the left propeller feathered.
- 2.16 When the pilot feathered the left propeller and extended the undercarriage and flaps is unclear. Witnesses saw that the propeller was feathered when the aeroplane approached Feilding Aerodrome, so the pilot probably feathered it soon after he turned ZK-TZC back towards Feilding.
- 2.17 With ZK-TZC at such a low circuit height and so close to runway 10 in the downwind position, the aeroplane, even with both engines operating normally, was unlikely to complete a successful landing. However, turning left toward a secured engine with the flaps and undercarriage extended exacerbated the situation, making a successful landing even less likely.
- 2.18 The right engine was heard to be under high power, so the pilot had probably selected maximum power in an attempt to retrieve a worsening situation. If he had discontinued the circuit and retracted the undercarriage and flaps, he might have been able to gain airspeed and height and place the aeroplane in a better position to attempt a landing. What is evident though is the pilot continued with his improbable circuit, and allowed the aeroplane's air speed to decay to such a point that he lost control at a height from which recovery was impossible.
- 2.19 The control loss occurred because the pilot probably let the aeroplane's airspeed fall below the minimum single-engine control speed, which brought about an uncontrollable yaw and rapid roll towards the inoperative left engine.
- 2.20 An engine power loss in a multi-engine aeroplane such as the Piper PA31 Navajo, especially in the cruise, should not lead to an accident if standard procedures are followed. Most multi-engine aeroplanes are designed for this possibility and there are well-established standard procedures to follow for a safe outcome.

- 2.21 ZK-TZC was a relatively high performance twin-engine aeroplane that was more than capable of safe flight on one engine at 1000 feet, and there were a number of “suitable” aerodromes to which the pilot could have flown the aeroplane and landed safely. Why the pilot took the actions that he did is puzzling, especially when a number of safer and more logical options were readily available to him.

### **3 Findings**

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

- 3.1 The aircraft records showed ZK-TZC had been properly maintained and was airworthy before the accident.
- 3.2 No conclusive reason could be found to explain why the left propeller was feathered.
- 3.3 The pilot chose an improper course of action and flew an improbable circuit in attempting to land ZK-TZC back at the departure aerodrome with one engine inoperative, which led to the accident.
- 3.4 The pilot’s handling of the emergency was unaccountable.
- 3.5 There was no indication that the training the 2 instructors gave the pilot was anything other than of a proper standard and above the minimum requirements.
- 3.6 Had the pilot applied the techniques that both instructors said they taught him for a one-engine-inoperative approach and landing, and chosen any of a number of safer options readily available to him, the accident would probably not have occurred.

Approved for publication 30 July 2003

Hon W P Jeffries  
Chief Commissioner





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Transport Accident Investigation Commission  
P O Box 10-323, Wellington, New Zealand  
Phone +64 4 473 3112 Fax +64 4 499 1510  
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