Report 01-007

Partenavia P68B

ZK-DMA

double engine power loss

North Shore Aerodrome

20 July 2001

Abstract

On Friday 20 July 2001, at around 0450, Partenavia P68B ZK-DMA was abeam North Shore Aerodrome at 5000 feet in darkness and enroute to Whangarei, when it suffered a double engine power loss. The pilot made an emergency landing on runway 21 at North Shore Aerodrome, but the aircraft overran the end of the runway, went through a fence, crossed a road and stopped in another fence. The pilot was the only person on board the aircraft and received face and ankle injuries.

The aircraft encountered meteorological conditions conducive to engine intake icing, and ice, hail or sleet probably blocked the engine air intakes. The pilot had probably developed a mindset that dismissed icing as a cause, and consequently omitted to use alternate engine intake air, which should have restored engine power.

Safety issues identified were the need to amend the aircraft flight manual warning concerning the use of alternate engine intake air, and the need to remind pilots about the Partenavia's in-flight vulnerability to engine air intake blockages by ice, hail, sleet and snow.

Partenavia ZK-DMA after the accident

Contents

List of abbreviations

amsl	above mean sea level
AWS	automatic weather station
CB	cumulonimbus cloud
cm	centimetre(s)
IMC	instrument meteorological conditions
kg	kilogram(s)
m	metre(s)
MSA	minimum safe altitude
SPECI	aviation selected special weather report
TAF	aerodrome forecast
UTC	universal coordinated time

Data Summary

Aircraft registration:	ZK-DMA
Type and serial number:	Partenavia P68B, 68
Number and type of engines:	2 Lycoming IO-360A1B6
Year of manufacture:	1976
Operator:	Great Barrier Airlines Limited
Date and time:	20 July 2001, 0459[1]
Location:	North Shore Aerodrome latitude: 36º 39.4´ south longitude: 174º 39.3´ east
Type of flight:	air transport, freight
Persons on board:	crew: 1 passengers: nil
Injuries:	crew: moderate
Nature of damage:	substantial to the aircraft
Pilot's licence:	Commercial Pilot Licence (Aeroplane)
Pilot's age:	28
Pilot's total flying experience:	706 hours (about 200 on type)
Investigator-in-charge:	K A Mathews

[1] All 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 flight

1.1.1 On Friday 20 July 2001, at around 0430, Partenavia P68B ZK-DMA took off at night from Auckland International Aerodrome for Whangarei. The flight was a scheduled courier run, carrying 73 kg of documents. The pilot was the only person on board the aircraft.

1.1.2 The previous evening a mobile bulk fuel tanker had replenished both aircraft wing fuel tanks with 100 octane avgas, to maximum capacity. A total of 145 litres of fuel was added to the tanks, which gave the aircraft an endurance of around 5 hours. Covers were placed over the wings to prevent water ingress to the fuel tanks.

1.1.3 The pilot had arrived at the aerodrome at around 0340 and completed a pre-flight inspection of ZK-DMA, which included visually checking the fuel quantity and checking for any evidence of water at the fuel tanks and engines drain points. No water or other fuel contamination was detected. The pilot ran both engines and completed engine and other instrument checks. Everything was normal.

1.1.4 The pilot studied the appropriate route and destination weather information, which had been sent to the operator automatically by the Meteorological Service of New Zealand Limited (Metservice). The pilot planned the flight for 5000 feet above mean sea level (amsl) and activated a flight plan. The planned flight time was some 36 minutes.

1.1.5 The aircraft departed and climbed normally to its cruise altitude of 5000 feet amsl. There was some thunderstorm activity and rain showers in the area. The pilot said she completed the top-of-climb and cruise checks, which included checking the outside air temperature and checking for any evidence of ice build-up by shining a torch on the wings and engine air intakes. The pilot said the outside air temperature gauge indicated plus 2° Celsius. There was no evidence of ice build-up.

1.1.6 A short time later the aircraft entered cloud, so the pilot completed further cruise checks and rechecked the wings and engine air intakes for any ice build-up. The pilot said the outside air temperature gauge still read plus 2° Celsius, and the aircraft remained in cloud for around one minute. The pilot encountered some turbulence in the cloud.

1.1.7 About a minute later, with the aircraft some 10 nautical miles north-east of North Shore Aerodrome, the pilot noticed the left engine fuel flow had dropped. The aircraft was in rain and possibly cloud at the time.

1.1.8 The pilot adjusted the mixture control on the left engine and restored the fuel flow. A short time later the fuel flow dropped again and the engine ran rough and lost power. The pilot completed the engine trouble checks, which included turning the auxiliary fuel pump on and checking the left fuel tank was selected to the left engine. The fuel selection was not altered. The pilot said she did not select the left alternate engine intake air on because there was no evidence of ice.

1.1.9 The pilot advised Auckland Control of the engine failure and requested vectors back to Auckland. Control directed the pilot to turn left or right onto a heading of 135°.

1.1.10 After 23 seconds the pilot had not responded to Auckland Control, so the controller contacted the pilot. The pilot responded saying she was turning left onto a heading of 135°.

1.1.11 About one minute and 20 seconds later the controller advised the pilot "I see you are squawking emergency" [2]. The pilot confirmed she was and said both engines were surging. During the turn onto 135° the pilot noticed the right engine fuel flow drop. The pilot completed trouble checks for the right engine, which included turning the auxiliary fuel pump on, and ensuring the mixture was rich and the right fuel tank was selected. The fuel selection was not altered from the right tank. The pilot said she did not select the right alternate engine intake air on, again because there was no evidence of ice.

1.1.12 The controller advised the pilot that North Shore was the closest aerodrome if she was interested in going there, and that it was on a heading of 150° at 8 miles.

1.1.13 The pilot responded by saying she was in IMC (instrument meteorological conditions). The pilot later said she feathered the left engine at about this time. The controller advised the pilot the aircraft was descending and heading towards the base of the Whangaparaoa Peninsula. He asked the pilot if the aircraft was unable to maintain altitude. The pilot replied saying she was attempting to maintain altitude.

1.1.14 About 20 seconds later the controller told the pilot the North Shore Aerodrome was in her one o'clock position at 5 miles, and that the aircraft had descended to 4000 feet. He advised her the radar terrain was 2000 feet in the area. The pilot responded saying she had shut one engine down, that the aircraft was still descending and she was looking for the aerodrome. The pilot was familiar with the aerodrome and had selected the radio frequency for the North Shore Aerodrome pilot-activated lighting, which turned the runway lighting on by transmitting on the selected frequency. Although runway lighting was available it did not meet all the normal lighting requirements, and was for the private use of the aerodrome operator and other authorised personnel. The aerodrome was, therefore, listed as being unavailable for night operations in the aeronautical information publications, which did not record the pilot-activated lighting frequency.

1.1.15 Forty seconds later the pilot advised the controller that both engines had failed and that she could not see the aerodrome or runway lighting. At that point the controller suggested the pilot could turn left and descend towards the coastline, which was one mile away. The pilot responded by asking the controller to confirm what the radio frequency was for the North Shore Aerodrome pilot-activated lighting. The pilot advised the controller that she was familiar with the aerodrome.

1.1.16 The controller informed the pilot the aerodrome was now in her 3 o'clock position at 3 miles, and that the aircraft had descended through 2500 feet. The pilot advised she was no longer in IMC but still could not see the aerodrome.

1.1.17 At about this time another controller advised the Police the pilot was attempting an emergency landing at North Shore Aerodrome.

1.1.18 The controller advised the pilot the aircraft was in a right turn at 2000 feet and to roll out of the turn onto a heading of 230°. He confirmed the aerodrome was directly ahead of the aircraft at 2.5 miles. The pilot said she still could not see the aerodrome runway lights and asked for confirmation of the runway lighting activation radio frequency. The controller responded saying the aerodrome was in the pilot's 11 o'clock position at 2 miles, and that he was still seeking the lighting information, which was not readily available to him.

1.1.19 The controller advised the pilot when the aerodrome was 210° at 1.5 miles. A few seconds later, the pilot informed the controller she had the runway in sight and would be landing.

[2] Transponder emergency code 7700.

1.1.20 During the descent and approach to land, the pilot manipulated the right engine throttle in an attempt to get some power from the engine, but it only surged erratically. Some residents near the aerodrome were woken by the erratic engine sounds. The pilot selected full flap during the landing approach.

1.1.21 At 0459 ZK-DMA touched down on runway 21 at North Shore Aerodrome, about 300 m into the 760 m long runway. The runway was wet. The pilot said the aircraft touched down at a faster than normal landing speed. Radar plot data showed the aircraft ground speed was some 128 knots on short final approach.

1.1.22 After touching down the pilot raised the aircraft flaps to maximise braking and applied heavy braking. Tyre skid marks were observed from the touchdown point until the end of the runway. The aircraft went through a fence at the end of the runway, across a ditch and road, and across another ditch before coming to rest on its nose in another fence. No fire occurred. The pilot received injuries to her face and one ankle. Some local residents and emergency services arrived at the scene straight away and quickly attended the pilot, but she was trapped in the aircraft for about an hour before she could be removed and transported to hospital.

1.2 Pilot information

1.2.1 The pilot was aged 28. She held a Commercial Pilot Licence (Aeroplane), C category flying instructor rating, instrument rating and a class 1 medical certificate valid until 14 February 2002. She was rated to fly various aircraft including the P68B.

1.2.2 At the time of the accident the pilot had amassed some 706 flying hours and around 200 hours on P68B aircraft.

1.2.3 In the 30-day period before the accident the pilot had been on duty 97.5 hours and flown 39.2 hours. The maximum allowed by the company operations manual was 200 duty hours, and 90 instrument flight rules flying hours in a 30-day period. The normal maximum duty period in one day was 11 hours. The day before the accident the pilot had worked 11 hours and ceased duty at 1800. She had flown 3.8 hours. She had been off duty 4 days earlier.

1.2.4 The pilot's last biennial flight review, annual route check and instrument rating renewal were completed on 27 June 2001 in a Partenavia. A 6-month pilot competency check was completed on 14 July 2001 in a twin-engined Islander BN2 aircraft.

1.2.5 In February 2001 the pilot attended a company refresher course on aircraft icing. Following the accident the pilot displayed knowledge about aircraft icing, including an awareness of the potential for Partenavia engine intake icing to occur. The pilot had previously encountered Partenavia engine intake icing as a co-pilot, and knew that selecting engine alternate air was the corrective action to take.

1.2.6 The pilot had been working for the company for about 2 years. She had been flying from Auckland to Whangarei and Kaitaia as a captain for some 4 months. She had previously flown as a co-pilot on those routes in the Partenavia and BN2 aircraft for some 18 months.

1.3 Aircraft information

1.3.1 ZK-DMA was a Partenavia P68B aircraft, serial number 68, twin-engine all-metal 6-seat aircraft, constructed in Italy in 1976. The aircraft was fitted with Lycoming IO-360A1B6 reciprocating engines.

1.3.2 The aircraft had been issued with a non-terminating Certificate of Airworthiness in the standard category. The aircraft records indicated ZK-DMA had been maintained in accordance with its approved schedule. The aircraft had accumulated 4773.8 hours time in service at the start of the accident flight. The last inspection, a 200-hour check, was completed on 5 July 2001 at 4736.4 airframe hours. The next inspection was due at 4786 hours or 5 January 2001, whichever came first.

1.3.3 The aircraft was approved for the operation. Apart from pitot heat the aircraft was not fitted with any anti-icing or de-icing equipment, and it was not certified for flight in forecast or known icing conditions. Each engine had an alternate air intake, which had to be manually selected. Alternate air selection provided an alternate supply of engine intake air in the event the main ram air intake became blocked by ice, sleet, hail or snow, or by some other means. The alternate air was unfiltered heated air from around the engine, which reduced engine performance slightly.

1.3.4 Each main engine ram air intake was positioned immediately below the propeller spinner. Wire mesh screens covered each air intake, with foam rubber sandwiched between the screens to prevent the engine ingesting dirt and foreign objects. The intake screens were vulnerable to blockage by ice, sleet, hail and snow.

1.3.5 The Partenavia P68B flight manual contained a warning regarding the use of alternate engine intake air. The manual stated:

> **WARNING**
> WHEN FLYING IN HIGH HUMIDITY ENVIRONMENT AND AT
> FREEZING TEMPERATURE, OPEN THE ENGINE ALTERNATE AIR DOORS.

1.3.6 The Partenavia P68C model had the same engines fitted as the P68B, and its flight manual contained a similar warning to the P68B concerning the use of alternate air. However, the P68C manual required the in-flight use of alternate air at any air temperature in a high-humidity environment.

1.3.7 The flight manual approved maximum take-off weight was 1960 kg. The pilot-completed aircraft load sheet recorded the take-off weight as 1736 kg, and the centre of gravity as within limits. The flight manual showed the aircraft should have maintained at least 5000 feet with one engine inoperative, at its weight at the time the first engine lost power.

1.4 Wreckage and impact information

1.4.1 The nose section, nose undercarriage and cockpit were destroyed in the accident. Some wing buckling was evident inboard of the engines. Both engines were intact and undamaged. The left wing tip struck a fence post. The left propeller was feathered and undamaged. The right propeller was not feathered, and one blade sustained tip damage. The damage was indicative of a low power contact.

1.4.2 The fuel tanks had not ruptured in the accident, but some fuel had leaked out because of the aircraft attitude. The aircraft was levelled and the tank quantity measured with the aircraft dipstick. The left tank contained 175 litres of fuel, and the right tank 145 litres. Fuel samples from the tanks and engine drain points showed the correct green colour, and did not reveal any water or other contamination.

1.4.3 The left fuel tank selector was found selected to the left engine. The right fuel tank selector knob was destroyed. The left auxiliary fuel pump was off, having been selected off by the pilot. The right auxiliary fuel pump position could not be verified. The left and right magnetos for each engine were on.

1.4.4 The master switch was off, having been turned off by another pilot at the scene. The emergency locator transmitter had activated but was turned off by another pilot who assisted the pilot after the accident. All circuit breakers were in. Both throttles were closed. The left propeller lever was in the feathered position. The right propeller lever was selected to full fine. Both mixture levers were at full rich. The engine alternate air selectors were off (under 1 cm out).

1.4.5 There was no obvious damage to either engine. Each engine contained 6 quarts (5.68 litres) of oil.

1.4.6 The flaps were selected up and found in the up position.

1.4.7 The empennage was undamaged.

1.5 Meteorological information

1.5.1 The MetService provided an aftercast of the weather conditions prevailing along the route flown by ZK-DMA, between 0400 and 0500 on the morning of the accident. The information included colour weather radar and satellite images. The conditions were reported as follows:

> Situation. A disturbed west to north-west flow covered the northern part of the North Island. A large complex low covered the remainder of the country.
>
> Weather summary for Auckland Airport to Orewa. At the time of interest, bands of cumulonimbus cloud (CB) embedded in the west to north-west flow were moving eastward across the area. They produced showers and thunderstorms as measured by MetService automatic weather stations [AWS] at Whangarei (WRA) and Whangaparaoa (WHX). Thunderstorms in the vicinity were reported in the Auckland Airport 1500 and 1600 UTC SPECI [aviation selected special weather report] reports with further comments in the remark section of these reports. There [were] no 1600 UTC METAR [aviation routine weather report] or SPECI issued from Auckland Airport. Precipitation was recorded most hours from Auckland Airport AWS (AAA).
>
> Radar images between 1600 [UTC] and 1700 Z [UTC] confirm the presence of strong precipitation echoes between 1630 Z [UTC] and 1700 Z [UTC] and the satellite images indicated the presence of active bands of CB in the area and to the west. The satellite images indicate more extensive cloud than the radar because of the high cloud associated with the tops of CB.
>
> The balloon sounding taken at Whenuapai at 1912 Z [UTC] indicated an unstable airmass and confirms that well developed cumuloform cloud would be likely in the area.

A 1200 UTC Whenuapai Tephigram[3] showed the freezing level at 4334 feet amsl.

1.5.2 The pilot's weather information received at 0400 included route weather information, appropriate aerodrome forecasts and aerodrome weather reports. CB activity was reported. The temperature at 5000 feet was forecast as plus 1° Celsius from 0500 to 1100. The temperature at 3000 feet was forecast as plus 6° Celsius. A SIGWX (significant weather) forecast valid until 1800 forecast occasional CB tops above 24 000 feet, north of a line from Wanganui to Warkworth, clearing from the west during the morning.

1.5.3 The Auckland International Aerodrome forecast (TAF) for the period forecast the surface wind as 270° true at 15 knots, with gusts up to 25 knots, visibility 25 km in rain showers, few clouds at 2000 feet and scattered clouds at 3500 feet. Temporary deteriorations were forecast to reduce visibility to 6000 m in rain showers with a few CBs at 3000 feet.

1.5.4 A special Auckland International Aerodrome report at 0300 reported temporary deteriorations in visibility to 6000 m in rain showers with thunder and lightning north of the aerodrome.

[3] Aerological diagram in which the principal rectangular axes are temperature (T) and entrophy (Ô): hence TÔ-gram.

1.5.5 The Whangarei TAF forecast visibility at 25 km, rain showers, few clouds at 2000 feet and scattered clouds at 4000 feet. Temporary deteriorations were forecast to reduce visibility to 7000 m in rain showers with a few CBs at 4000 feet. The Whangarei AWS recorded the 0400 temperature at plus 6° Celsius.

1.5.6 Residents living near North Shore Aerodrome reported heavy rain showers from about 0300 until 0600 with some thunderstorm activity. One resident said hailstones had accumulated to a depth of several cm on his front porch that morning. The residents reported the outside air temperature as being around plus 7° Celsius about the time of the accident.

1.6 Tests and research

1.6.1 The aircraft was removed to a maintenance facility for further examination. Fuel was present at each engine fuel distributor manifold, and it flowed freely from each selector valve.

1.6.2 The engine alternate intake air doors were both about two thirds shut. Because of the accident there was considerable disruption to the engine and airframe control linkages. The outside air temperature gauge was not recovered.

1.6.3 Both engines were removed and placed on a test stand for running. A test propeller was fitted to the right engine because of the damage to the original propeller. The right engine was run first, using fuel recovered from its right fuel tank. The engine started normally without any surging or hunting. Engine power was increased to maximum. The engine delivered full power and ran normally throughout its power range. Each magneto worked satisfactorily.

1.6.4 The left engine was run using fuel recovered from its left fuel tank. The feathered propeller remained on the engine for the test. The engine started normally without any surging or hunting, and the propeller came out of its feathered position normally. Engine power was increased to maximum. The engine delivered full power and ran normally throughout its power range. Each magneto worked satisfactorily.

1.6.5 Fuel samples from the bulk fuel supply and mobile tanker were tested. The fuel met all required specifications and was not contaminated.

1.7 Organisational and management information

1.7.1 The company chief pilot advised that aircraft in-flight airframe icing was something of which company pilots were aware, but it was not normally encountered when flying the routes north of Auckland. If icing was encountered the northern routes had low minimum safe altitudes (MSAs), which enabled an aircraft to descend out of icing conditions. The MSA on the Auckland to Whangarei route was 2600 feet. Alternate routes were available should a selected route have conditions conducive to icing or other adverse conditions. There was no mountainous terrain north of Auckland.

1.7.2 The chief pilot said if an aircraft had an engine failure on the Auckland to Whangarei route then the options were to return to Auckland or continue to Whangarei, depending on the nearest location. The P68B should maintain around 4000 feet with one engine inoperative at maximum weight.

1.8 Additional information

1.8.1 Industry sources, including pilots who have flown the P68 aircraft, reported that the Partenavia was vulnerable to ice formation blocking the engine air intakes. The aircraft alternate engine air intake doors did not open automatically in the event the main engine air intakes became blocked, but relied on the crew manually opening them. This was unlike some other aircraft types where the doors opened automatically in the event of an engine intake air blockage.

1.8.2 At about 0500 on the morning of the accident another company pilot in another Partenavia took off from Auckland International Aerodrome for Tauranga. The pilot climbed the aircraft to 6000 feet. He said the aircraft was in visible moisture throughout the climb, but broke clear of cloud shortly after reaching the top of the climb. Near the top of the climb he noticed the left engine was delivering less manifold pressure than expected. At the top of the climb the left engine delivered less power than the right engine. A short time later the pilot noticed the left engine fuel flow reducing. He turned the fuel pump on, but the fuel flow continued to drop. He selected the fuel mixture to full rich, but the fuel flow continued to drop. He then selected the left engine alternate intake air to on. The engine "coughed and spluttered" somewhat and then resumed normal operation. The pilot said the situation occurred quickly, with the fuel flow dropping from around 14 gallons per hour to 8 gallons per hour in about 10 seconds. He experienced a similar situation again later in the flight when the aircraft descended through a cloud layer. Selecting engine alternate air rectified the problem.

2. Analysis

2.1 The pilot was appropriately qualified, and familiar with the route and the aircraft. The aircraft was serviceable, suitable for the purpose and properly maintained. The aircraft had ample fuel on board to complete the flight.

2.2 The pilot received sufficient route and aerodrome weather information to make an informed decision about the expected weather conditions along the route. Showers and some thunderstorm activity were forecast. The freezing level at the flight planned cruising altitude of 5000 feet was forecast as plus 1° Celsius.

2.3 Some bands of CB embedded in the west to north-west flow were forecast and moved eastward across the area. During the cruise the aircraft occasionally entered IMC and the pilot constantly checked the wings and engine air intakes for any ice formation. No ice was detected. The pilot said the outside air temperature was plus 2° Celsius at 5000 feet, shortly before the left engine lost power. There was some turbulence in IMC, but not substantial enough to indicate to the pilot the presence of significant CB.

2.4 About a minute after the pilot last checked for any ice formation the aircraft entered an area of precipitation. A short time later the left engine faltered, then lost power. What is likely is the engine air intake rapidly became clogged with sleet, hail or ice. This would not necessarily be visible to the pilot, and there was probably no visible ice build-up on the leading edges of the wings or around the air intakes before the power loss. The ambient air temperature could have dropped several degrees as the aircraft entered the area of precipitation, and any venturi effect through the intake will have further lowered the intake temperature. The right engine would have been affected by the same atmospheric conditions, also causing it to lose power.

2.5 Had the pilot selected the engine alternate intake air for each engine, power could have been restored, the situation could have been rectified and the accident averted. The pilot completed normal engine trouble checks but omitted to select engine alternate air on. Because the pilot had been constantly checking for any evidence of icing, and had not detected any, she had not considered icing to be a cause of the power loss.

2.6 Because there were no visual cues to the pilot to suggest icing, and because of the positive outside air temperature noted by the pilot, she probably developed a mindset that dismissed icing as a cause of the engines' power loss. Although pilot fatigue is not considered a factor, the accident did occur at a time of day when circadian rhythms are low and human performance can be reduced. In addition, the pilot would have been busy and preoccupied dealing with the emergency and flying the aircraft. These factors would have made it difficult to break that mindset. The understanding that icing was rarely encountered when flying on the routes north of Auckland could also have exacerbated the situation.

2.7 A double engine failure in a twin-engine aircraft is rare and one that pilots are not normally trained to deal with. The pilot is fortunate a suitable aerodrome was within gliding distance and the aircraft was under radar control at the time. Following the power loss in both engines, in difficult circumstances in darkness, the pilot's presence of mind and skills enabled her to carry out a night emergency landing at North Shore Aerodrome.

2.8 The Partenavia is vulnerable to engine intake icing, and this was common knowledge in the aviation industry. The pilot demonstrated knowledge of the icing vulnerability and had previously experienced Partenavia engine intake icing and knew what action to take. The pilot also had a good general knowledge about aircraft icing. Because of the Partenavia's vulnerability to engine intake icing, and because it was not approved for flight in known or forecast icing conditions, the pilot could have flown at a lower level at 3000 feet where the ambient temperature was warmer, and forecast to be plus 6° Celsius. This would have reduced the likelihood of engine intake icing.

2.9 Local residents near North Shore Aerodrome reported the early morning air temperature as being about 7° Celsius. If this was the case, the ambient temperature at 5000 feet may have been lower than zero, although the pilot reported it as plus 2° Celsius. The aircraft outside air temperature gauge was not recovered for testing. The gauge indications could have been slightly inaccurate and, combined with any ram heating effect, may have been in error by 2° Celsius.

2.10 The weather conditions on the morning of the accident were especially conducive to the formation of engine intake ice. Another company pilot in another Partenavia also encountered engine intake blockages, probably because of sleet or ice build-up, on a route south of Auckland. The pilot took the appropriate action and corrected the situation. He may have been more attentive to the potential for ice formation because he was flying on a colder southern route.

2.11 The aircraft flight manual contained a clear warning about the use of alternate engine intake air. The warning, however, only mentioned at "freezing temperature" in a high-humidity environment as being the time to apply alternate air. The later model P68C aircraft flight manual required alternate air to be used in any air temperature when flying in a high-humidity environment. Some venturi effect through the engine air intakes probably existed, which would tend to lower the intake temperature below the ambient temperature. The foam rubber in the intakes would also absorb moisture and have potential to freeze. This would not be visible to the pilot. Accordingly, the P68B flight manual warning should be amended to align itself with the P68C flight manual warning and pilots instructed to heed the warning.

3. Findings

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

3.1 The pilot was suitably qualified and authorised to conduct the flight.

3.2 The aircraft was airworthy and its records indicated it had been maintained correctly.

3.3 The aircraft encountered weather conditions conducive to the formation of engine intake icing.

3.4 The engine air intakes probably became blocked by sleet, ice or hail, which caused both engines to lose power.

3.5 The pilot probably developed a mindset that dismissed engine intake icing as a cause of the double engine power loss and omitted to apply the necessary corrective action.

3.6 Had the pilot selected each engine's alternate engine intake air on, engine power should have been restored.

3.7 The Partenavia P68B flight manual warning concerning the use of alternate engine intake air should be amended to require the in-flight use of alternate air at ambient temperatures above freezing, in a high-humidity environment.

4. Safety Recommendations

4.1 On 5 October 2001 the Commission recommended to the director of civil aviation that he:

4.1.1 Amend the Partenavia P68B flight manual warning concerning the use of alternate engine intake air to reflect the warning contained in the P68C manual, which is, "when flying in high humidity at any air temperature, open the engine alternate air doors". (062/01)

4.2 On 17 October 2001 the director of civil aviation replied:

4.2.1I will publish an amendment to the Partenavia P68B flight manual as recommended and I expect this to be completely implemented by 17 December 2001.

The covering letter to operators will require them to brief their pilots on the content of the amendment.

4.3 On 5 October 2001 the Commission recommended to the chief executive of Great Barrier Airlines Limited that she:

4.3.1 Remind company pilots about the Partenavia's in-flight vulnerability to engine air intake blockages by sleet, ice or hail, the symptoms of any blockage, and the corrective action necessary should a blockage occur. (063/01)

4.4 On 27 November 2001 the chief executive of Great Barrier Airlines Limited replied:

4.4.1 Great Barrier Airlines supports your recommendation, and would like to suggest the following addition to your proposal.

"It is advisable that companies should implement as a standard operating procedure (P68) that if temperatures of below 5 degrees C and/or visible moisture are encountered, then engine alternate air systems should be activated."

Discussion has been held with CAA with regards to incorporating the above (or similar) into a supplement to the Partenavia manual, or to advise all operators.

Since the occurrence of ZK-DMA all pilots were involved in a flight safety meeting [in] which this incident was discussed. Engineering staff were involved, a working model of an alternate air box was displayed and manual operation shown. The flight standards and training manager reinforced the dangers of not completing all trouble checks from 100% recall, [and] more emphasis has been put on this in training.

Approved for publication 13 December 2001

Hon. W P Jeffries
Chief Commissioner