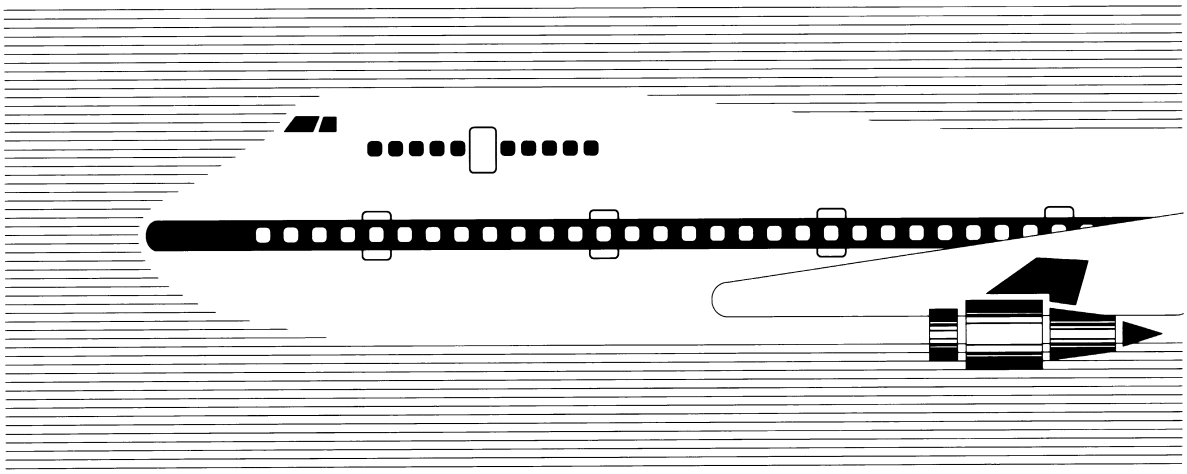
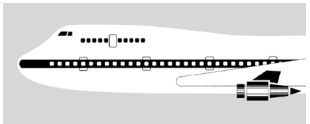
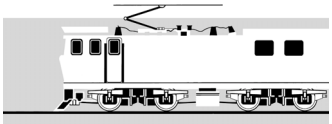


AVIATION OCCURRENCE REPORT

05-010 **Aerospatiale-Alenia ATR 72-212A, ZK-MCJ, runway excursion during landing, Queenstown Aerodrome** **5 October 2005**


TRANSPORT ACCIDENT INVESTIGATION COMMISSION
NEW ZEALAND

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

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

Report 05-010

Aerospatiale-Alenia ATR 72-212A

ZK-MCJ

runway excursion during landing

Queenstown Aerodrome

5 October 2005

Abstract

On Wednesday 5 October 2005, at 1441, ZK-MCJ, an Aerospatiale-Alenia ATR 72-212A, landed at Queenstown Aerodrome, where it inadvertently left the runway. On board were 47 passengers and 2 cabin crew, and 2 pilots and a maintenance engineer on the flight deck. There were no injuries, and no damage to the aeroplane.

Shortly after the captain had landed the aeroplane it was struck by a strong gust, which weathercocked the aeroplane forcefully towards the runway edge. The gust probably exceeded the aeroplane crosswind limit and prevented the captain correcting the weathercock. Consequently, the aeroplane went onto the grass area beside the runway, where it paralleled the runway for about 630 metres before re-entering the runway.

A contributing factor was the reduced effectiveness of the nose wheel steering, because the first officer had not moved the control column far enough forward to ensure there was sufficient weight on the nose wheels.

Safety issues identified were the need for the operator to enhance its ATR 72 training programmes to ensure that pilots were adequately trained for operations in strong crosswind conditions, and for the pilot flying to remind the pilot not flying about the correct landing technique before each landing in strong crosswinds. Two safety recommendations were made to the operator to address these issues.

ATR 72-212A aeroplanes

(Image supplied by the operator)

Contents

Figures

Abbreviations

ATIS	automatic terminal information service
Cb	cumulonimbus cloud
CVR	cockpit voice recorder
DFDR	digital flight data recorder
FCOM	Flight Crew Operating Manual
km	kilometre(s)
kt	knot(s)
m	metre(s)
NZDT	New Zealand Daylight Time
QAR	quick access recorder
UTC	coordinated universal time

Data Summary

Aircraft registration:	ZK-MCJ
Type and serial number:	Aerospatiale-Alenia ATR 72-212A, 624
Number and type of engines:	2 Pratt and Whitney Canada PW127F
Year of manufacture:	1999
Operator:	Mount Cook Airline Limited
Date and time:	5 October 2005, 1441[1]
Location:	Queenstown Aerodrome latitude: 45° 01.27′ south longitude: 168° 44.35′ east
Type of flight:	scheduled air transport
Persons on board:	crew: 5 passengers: 47
Injuries:	nil
Nature of damage	nil
Pilot in command's licence:	Airline Transport Pilot Licence (Aeroplane)
Pilot in command's age:	58
Pilot in command's total flying experience:	19 423 hours (6739 hours on type)
Investigator-in-charge:	K A Mathews

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

Factual Information

1.1 History of the flight

1.1.1 On Wednesday 5 October 2005 at about 1350, ZK-MCJ (flight NZ5383), an Aerospatiale-Alenia ATR 72-212A aeroplane, took off from Christchurch Aerodrome on a scheduled flight to Queenstown Aerodrome. On board were 47 passengers and 2 cabin crew, and on the flight deck were a captain, a first officer and a maintenance engineer.

1.1.2 ZK-MCJ proceeded uneventfully to Queenstown, where the pilots carried out an instrument approach with visual circling to land on runway 23. A Boeing 737 had landed normally 5 minutes ahead of ZK-MCJ. The Boeing crew advised the Queenstown aerodrome controller, "… for following aircraft, quite a bit of wind shear about 2 mile final, just coming around Morven [Hill]." The first officer on ZK-MCJ responded and acknowledged the advice.

1.1.3 During the approach to land, the pilots of ZK-MCJ observed that the wind was strong from the southeast. The Queenstown automatic terminal information service (ATIS) issued about 15 minutes earlier, reported the visibility to be 40 km and the wind to be 170° magnetic at 15 kt, gusting to 25 kt. The reported 2000-foot wind was 170° magnetic at 35 kt. Four minutes before ZK-MCJ landed, the aerodrome controller advised the pilots, "… wind increasing at the field, 160 [degrees magnetic] 25 knots."

1.1.4 The captain, who was the flying pilot, briefed the first officer about the possibility of a go around because of the wind conditions, so they configured the aeroplane accordingly. The applicable final approach speed for the aeroplane weight was 115 kt indicated airspeed, but the captain elected to fly the approach at 120 kt to allow for any wind shear encounter. The aeroplane was stabilised by 500 feet above the ground and the pilots were satisfied with the landing approach, so the captain continued for a normal crosswind landing. Full flap was selected for the crosswind landing, in accordance with the Flight Crew Operating Manual (FCOM).

1.1.5 When ZK-MCJ was on final approach, the aerodrome controller advised the pilots, "… wind 170 [degrees magnetic] 25 [knots], max 35 knots, crosswind 20 [knots], max 30 knots, cleared to land."

1.1.6 ZK-MCJ continued normally, and landed at 1441 within the usual touchdown zone and on about the runway centreline. Three air traffic controllers watched the approach and landing, and later commented that the aeroplane appeared to be well controlled and flown normally during the crosswind approach, and that it touched down smoothly and aligned with the runway centreline. The runway was dry at the time. As ZK-MCJ landed, the aerodrome controller advised the pilots, "… wind check 180 [degrees magnetic] 26 knots".

1.1.7 After touchdown, with the nose wheels on the runway and the control column wheel displaced to the left (ailerons into wind), the captain handed over control of the control column to the first officer, in accordance with standard procedures. After relinquishing control of the control column the captain placed his left hand on the nose wheel steering tiller, and kept his right hand on the power levers and his feet on the rudder pedals.

1.1.8 The captain said that at about the time he placed his hand on the steering tiller, a sudden strong wind gust caught the aeroplane and it quickly weathercocked[2] forcefully to the left into wind, and headed toward the left side of the runway. The captain said that the aeroplane weathercocked at about the same time he was preparing to select ground idle, having delayed selecting it until after the aeroplane had settled firmly on the runway. The captain said he noticed the control column was not quite as far forward as he would have expected it to be for the conditions.

[2] Being turned into wind, like a weathervane.

1.1.9 The captain said he tried to recover from the weathercock and to turn the aeroplane to the right, but quickly realised that the weathercock angle had become so large that he could not recover the situation successfully. He therefore allowed the aeroplane to follow its course and to leave the runway and go onto the grassed area just past taxiway C, on the south side of the runway (see Figure 1). He said that he considered using a considerable amount of right braking to try to keep the aeroplane on the runway, but elected not to do so because it could have damaged the aeroplane. He said that as soon as the left gear wheels had run off the runway and sunk into the soft grassed and muddy area, it was impossible to turn the aeroplane back toward the runway.

1.1.10 Both pilots and the engineer commented that it was only a short period of time from when the aeroplane weathercocked until it left the runway, and that the event occurred quickly.

1.1.11 One cabin crewmember was seated in the front cabin crew seat and facing aft. She said that the flight conditions were quite rough and that although the landing was smooth, the aeroplane was buffeted by the wind after it had landed. A short time later, a passenger near her said they were "off the runway". Seeing that the aeroplane had left the runway, she looked at the passengers and several times yelled, "emergency, grab your ankles", in accordance with the operator's procedures manual for an unprepared emergency.

1.1.12 The other cabin crewmember was seated at the rear of the aeroplane and facing forward, but was unable to see outside. She said that although the flight conditions were quite turbulent, the landing felt smooth. She said that shortly after the aeroplane had landed, she felt a strong swing, like "whip-lash", then realised they had left the runway. When the cabin crewmember at the front instructed the passengers to assume the brace position, she yelled out the same command to the passengers.

1.1.13 As soon as ZK-MCJ left the runway the aerodrome controller activated the crash alarm to alert rescue services, which stood by.

1.1.14 The captain said he considered selecting ground idle and using reverse thrust to slow the aeroplane, but because it had left the runway onto a soft area, and he knew the area ahead was clear, he allowed the inertia of the aeroplane and some power to take it through the soft area.

1.1.15 After the aeroplane had left the runway it paralleled it, crossed grass runway 14 and continued to the main terminal taxiway, by which time it had slowed to normal taxi speed. The captain taxied the aeroplane across the taxiway, applied power and taxied back onto the runway abeam the control tower. He stopped the aeroplane on the runway for about 30 seconds, and using the intercom spoke to the cabin crewmember at the rear of the aeroplane, before taxiing to the terminal. Using the public address system during the taxi, the cabin crewmember reassured the passengers and advised them what had happened.

1.1.16 At the terminal, ground staff implemented the operator's incident recovery procedure and attended to the passengers, of whom some were shaken but otherwise unhurt. The captain attended to the crewmembers and debriefed them on what had happened. The captain also went to the control tower and talked to the controllers about the incident. As a routine procedure, the operator stood the crew down from duty and they returned to Christchurch as passengers on another aeroplane.

1.1.17 The captain later said that the aeroplane required firm forward pressure on the control column to ensure that there was sufficient downward pressure on the 2 nose wheels for effective ground steering. The first officer later said he believed that he had kept the control column forward and the column wheel turned into wind.

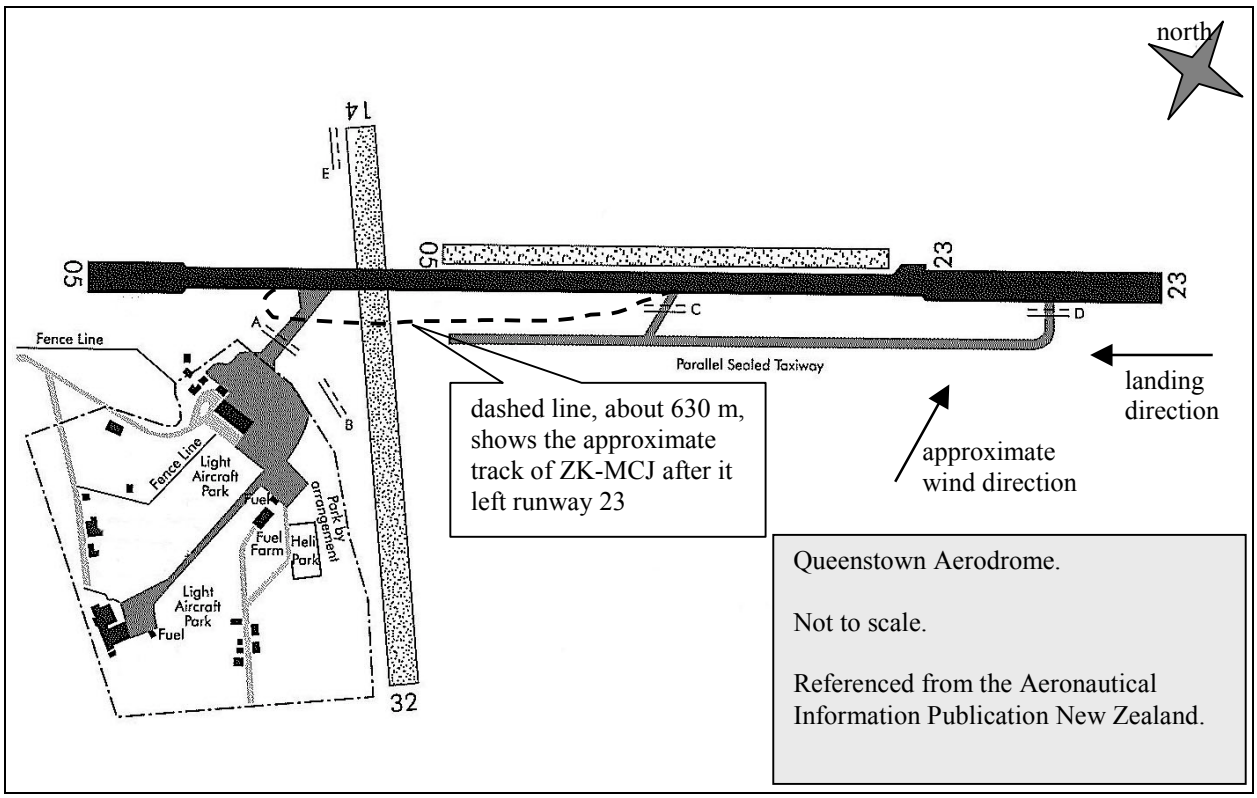


Figure 1
Queenstown Aerodrome showing approximate landing track of ZK-MCJ

1.1.18 The captain had flown with the first officer the previous day. He said that he was aware the first officer had been a captain of De Havilland DHC Dash 8-400 aeroplanes, before joining the operator in February 2005 to train as a first officer on the ATR 72-212A. Although not a requirement, the captain said that he had considered reminding the first officer to keep firm pressure on the nose wheels to assist the rudder for positive steering in strong crosswinds. However, he decided it was not necessary because of the first officer's competence and recent ATR training, and command experience on the Dash 8-400, which the captain said he thought would require similar handling to the ATR 72-212A.

1.1.19 The air traffic controllers later commented that it seemed to them the nose wheels were off the runway longer than normal during the flare and landing, and that there appeared to be little weight on them after they contacted the runway. They said the aeroplane slewed in the mud alongside the runway, and that the nose wheels appeared to be pointed toward the runway. They said there was a lot of mud thrown up, and that the aeroplane had straightened and slowed by the time it crossed grass runway 14.

1.2 Injuries to persons

1.2.1 There were no injuries.

1.3 Damage to aircraft

1.3.1 After shutdown, the maintenance engineer who had been on board ZK-MCJ discussed the situation with the operator's maintenance personnel in Christchurch, where the aeroplane was maintained. After having the aeroplane cleaned of mud he inspected it and, finding no damage, released the aeroplane for a ferry flight back to Christchurch. At Christchurch, the aeroplane was placed on jacks and further inspected. There was no damage found and the aeroplane was released back to service.

1.4 Other damage

1.4.1 Apart from some wheel ruts from ZK-MCJ in the ground beside the runway, there was no other damage.

1.5 Personnel information

1.5.1 The captain was aged 58. He held an Airline Transport Pilot Licence (Aeroplane), and a Class 1 medical certificate valid for multi-crew operations until 4 November 2005. He had flown 19 423 hours, and had 6739 flying hours on the ATR 72 series aeroplane. He was a senior captain with the operator, having gained his captaincy on the ATR in January 1996. He was familiar with Queenstown Aerodrome, having flown there regularly.

1.5.2 His last line check was on 1 July 2005, and his last simulator check was on 1 June 2005. He had flown 156 hours in the previous 90-day period. He had been off-duty for 13 hours before he commenced his flight on the afternoon of the incident. The incident flight was his first flight of the day, and he had been on-duty for about 2 hours at the time of the incident.

1.5.3 In September 2002 at a different aerodrome, the captain had landed an ATR 72-212A in a crosswind that was reported to be at the aeroplane limit, but was later found to have exceeded the maximum demonstrated crosswind by about 6 kt. The captain said that he had no unexpected difficulty in landing the aeroplane on that occasion. The first officer on that particular flight independently confirmed that the landing had been well handled and was without incident.

1.5.4 The first officer was aged 35. He held a Commercial Pilot Licence (Aeroplane), and a Class 1 medical certificate valid until 7 December 2005. He had flown 4174 hours, and had 334 flying hours on the ATR 72 series aeroplane.

1.5.5 He had joined the operator in February 2005 from overseas, where he had been a captain flying De Havilland Dash 8-400 series aeroplanes. The operator had trained him on the ATR 72-212A type, and his last line check was on 15 May 2005. His last simulator check was on 16 September 2005.

1.5.6 He had flown 122 hours in the previous 90-day period. He had been off-duty for 13 hours before he commenced his flight on the afternoon of the incident. He had been on-duty for about 2 hours at the time of the incident.

1.5.7 The first officer said that none of the sessions during the simulator phase of his ATR 72 training had included operations near the maximum demonstrated crosswind limit. During his base and line training, and up until the time of this incident, he had not encountered any strong crosswind conditions for landing or take-off in the ATR 72.

1.6 Aircraft information

1.6.1 ZK-MCJ was an Aerospatiale-Alenia ATR 72-212A, twin turbo-prop, high-winged passenger aeroplane, serial number 624, which was capable of carrying 66 passengers. The aeroplane was manufactured in France in October 1999. Pratt and Whitney Canada PW127F turbine engines powered the aeroplane, with each engine driving a 6-bladed propeller via a reduction gearbox assembly.

1.6.2 The aeroplane maintenance records showed that it was maintained in accordance with its approved schedules. At the time of the incident there were no known defects.

1.6.3 According to the limitations section in the FCOM, the maximum demonstrated crosswind on a dry runway was 35 kt.

1.6.4 The FCOM stated that the recommended landing flap configuration in strong crosswinds was the same as the standard landing flap setting of flaps 30.

1.6.5 The FCOM advised that during take-off and landing runs in a crosswind, the control column should be deflected towards the wind as appropriate to maintain wings essentially level. A note cautioned that excessive aileron deflections should be avoided because they can affect directional control.

1.6.6 The landing procedure in the FCOM listed the following sequence after the main landing gear was on the ground:

- control the nose wheel lowering
- move both power levers to ground idle
- check that both low pitch lights were illuminated
- use the foot brakes as necessary
- as the speed reduces, and not later than about 40 kt (estimated), captain takes the nose wheel steering control, the first officer was to hold the control column fully forward.

1.6.7 The operator advised that apart from the possibility of an earlier control column handover to use the steering tiller, a landing in a strong crosswind was essentially the same control sequence as for a normal landing.

1.6.8 The FCOM advised that rudder control was normally effective above 40 kt, and the operator said that the rudder normally provided positive directional control above this speed. However, during landings on narrow runways or in strong crosswind conditions, the standard operating procedure was for the captain to be ready to use nose wheel steering as soon as the nose wheel was on the runway, to augment the rudder for positive directional control.

1.6.9 The operator also advised that the control column needed to be positioned appreciably forward to get weight on the nose wheels for effective steering, and that this was further forward than on similar other aeroplanes.

1.7 Meteorological information

1.7.1 The New Zealand Meteorological Service provided an aftercast of the weather conditions, which is summarised as follows:

> Synoptic situation
>
> A low remained slow moving just east of Canterbury Bight during Wednesday 5 October 2005, directing a southerly flow over the lower South Island. This low deepened during the day, increasing the strength of the southerly over Queenstown.
>
> An upper level trough passing over the lower South Island during the early afternoon invigorated Cb [thunderstorm] activity over the Queenstown area. The resultant instability and downward momentum transport allowed stronger southerlies aloft to reach the surface in bursts with the showers.
>
> Summary
>
> The winds during the afternoon of 5 October 2005 at Queenstown were predominantly from 200 degrees true at around 15 knots, but gusting to around 25 knots. It was a particularly gusty afternoon because of the presence of Cb cloud, showers and probably also because of the wind direction in relation to the terrain.
>
> At 1500 NZDT the wind backed to 180 degrees at 23 knots with gusts to 36 kt, which suggests that the crosswind component would have increased significantly, especially with the gusts.

These conditions or something similar may have been prevailing at around [the time of the incident].

The wind changed to 190 degrees at 14 knots gusts 29 knots at 1600 local and significant Cb activity was reported at 1610 NZDT.

1.7.2 At Queenstown Aerodrome, 2 anemometers, each attached to a 6 m mast, were positioned adjacent to the touchdown zone at each end of sealed runways 23 and 05. The anemometers provided wind information to 4 displays in the aerodrome control tower. The control tower had 2 identical displays for an aerodrome controller, and 2 further identical displays for a flight information officer, which separately depicted the wind information for each runway end. Each display showed the wind direction in degrees magnetic and speed in kt. The displays could be selected to show the average wind information over the last 10 or 2 minutes, or the instantaneous wind. The displays also depicted the range of wind direction variation over a period. Aerodrome controllers normally selected the instantaneous wind display, whereas flight information officers normally selected an average wind position display. Each display was visible to both the controller and flight information officer, and had separate power on and alarm indicators. The wind information was not recorded.

1.7.3 An automatic weather station was positioned at Queenstown Aerodrome, adjacent to the touchdown zone for runway 05. The information it provided included wind information that was presented on a further display in the control tower. The controller or the flight information officer could refer to the information, which complemented their primary wind displays. The wind information was recorded for the Meteorological Service.

1.7.4 The following wind observations from the Queenstown automatic weather station were noted:

At 1400 the wind was 200° true at 15 kt, gusting to 26 kt.

At 1500 the wind was 180° true at 23 kt, gusting to 36 kt.

1.7.5 At 1510 a special weather report showed the wind at 180° true at 18 kt, gusting to 35 kt. Visibility was 15 km in rain showers, with thunderstorm activity.

1.7.6 A Queenstown area forecast issued at 0948 local time, and valid from 0900 until 2400, included the following:

Wind 200° true at 18 kt gusting to 30 kt, becoming 200° true at 8 kt from 2000 to 2200. Visibility 25 km in rain showers, with broken cloud at 4000 feet. The 2000-foot wind was forecast as 190° true at 35 kt, becoming 200° true at 25 kt from 2000 to 2200.

1.8 Communication

1.8.1 Communications were by very high frequency transceivers.

1.9 Aerodrome information

1.9.1 Queenstown Aerodrome was an international airport with the corresponding facilities, including an air traffic control service during normal hours of operation. The aerodrome had one main sealed runway 1891 m long and 30 m wide, orientated 234° and 054° magnetic, which comprised runways 23 and 05 (see Figure 1). A 60 m wide predominantly grass area surrounded each side of the runway. The landing distance available for either runway direction was 1779 m.

1.9.2 The Aeronautical Information Publication New Zealand noted that mountainous terrain surrounded the aerodrome, and that turbulence was experienced in most wind conditions. In strong southwest airstreams, frequent turbulence and wind shear occur on approach.

1.9.3 The aerodrome wind recording system met the International Civil Aviation Organisation standards. Because of the runway length, the aerodrome was not required to have an anemometer positioned near the mid-point of the runway. Calibration and routine maintenance of the anemometers were carried out annually.

1.10 Flight recorders

1.10.1 ZK-MCJ was equipped with a cockpit voice recorder (CVR), a digital flight data recorder (DFDR) and a quick access recorder (QAR) that captured 188 individual items of flight data.

1.10.2 The CVR and DFDR data were not retrieved. The QAR data was retrieved for analysis.

1.10.3 The QAR information that was reviewed revealed no aeroplane deficiencies. The following observations were taken from the QAR data.

1.10.4 Fifty feet before ZK-MCJ touched down, there was a 42-kt gust from 191° true. Allowing for 24° of magnetic variation at Queenstown, this equated to 167° magnetic. Because runway 23 at Queenstown was aligned 234° magnetic, this gave a 67° crosswind of 38.7 kt at that point. There was a 31-kt gust immediately before the 42-kt gust, and a 21-kt gust immediately afterwards, both from 200° true. Wind data was no longer calculated once the aeroplane touched down.

1.10.5 Just before the 42-kt gust the indicated airspeed increased from 120 kt to 128 kt, then reduced to 120 kt with a groundspeed of 105 kt. The indicated airspeed then steadily decreased to 113 kt, before increasing to 119 kt 5 feet before touchdown. One foot before touchdown the indicated airspeed was 87 kt, and at touchdown it was 100 kt.

1.10.6 Just before touchdown the right rudder deflection was about half of the available angle, and then reduced and fluctuated to no more than about one sixth of the available angle until the aeroplane left the runway.

1.10.7 Shortly after landing, the indicated airspeed was at 82 kt and the ground speed at 81 kt, which reduced steadily to 55 kt and 50 kt respectively at the time the aeroplane left the runway.

1.10.8 Shortly after ZK-MCJ touched down, the left aileron was deflected into wind to about 2° from its maximum deflection, and the aeroplane was essentially wings level.

1.10.9 The elevator deflection reached almost half its available downwards travel immediately after ZK-MCJ touched down, then rarely exceeded a third of its available downwards deflection until after the aeroplane left the runway. The control column pitch displacement was in a similar range.

1.10.10 About 3 seconds after landing the aeroplane swung to the left. The recorded lateral and vertical acceleration suggested that the aircraft left the runway about 2 seconds later. The ailerons were deflected fully in the left wing down position at that stage. The aeroplane turned about 25° off runway heading before it turned back to parallel the runway.

1.11 Organisational and management information

1.11.1 The operator's ATR 72-212A pilot type conversion training consisted of a ground phase, full-flight simulator phase, base training and line training.

1.11.2 The only reference to crosswind landings in the simulator training manual was in the session plan for the first simulator flight, which called for a departure crosswind greater than 10 kt. The operator advised that in practice the landing crosswind for all simulator sessions was at the instructor's discretion. The operator's Pilot Training and Standards Manual had no requirement to instruct pilots in landing under maximum demonstrated crosswind conditions.

1.11.3 The crosswind experienced during the base and line training phases of a pilot's ATR 72-212A training was entirely dependent upon the conditions encountered on each training flight.

1.11.4 The wind limitations section of the operator's Pilot's Procedures Manual gave some instructions for operating the ATR 72 in high winds and crosswinds. For landing, the manual said that progressive into-wind application of the ailerons must be made to assist in keeping the wings level and the aeroplane straight. After touchdown, the manual said that the control column was to be held forward to provide positive pressure on the nose wheels. The manual said that the ATR 72 was not normally to be operated on the ground when the reported wind strength, including gusts, exceeded 55 kt.

1.12 Additional information

1.12.1 Following the incident, some of the operator's training captains and pilots explored landing the ATR 72 in crosswinds up to 40 kt in the flight simulator, with variable success. At the maximum demonstrated crosswind of 35 kt, the aeroplane could be regularly landed without undue difficulty.

2 Analysis

2.1 The flight was a regular public transport flight that was uneventful until the landing at Queenstown, where the aeroplane inadvertently left the runway.

2.2 At Queenstown there was a strong southerly wind flow. Because of thunderstorm activity and the wind direction in relation to the terrain, the flow resulted in particularly gusty crosswind conditions for landing that were near the maximum demonstrated limit for the aeroplane.

2.3 The captain was the pilot flying and was experienced on the ATR 72-212A, and had experience in landing the aeroplane during maximum crosswind conditions. The first officer, although new to the aeroplane type, was an experienced pilot with command experience on similar twin turbo-prop aeroplanes. He had not had any training or actual experience in landing the ATR 72-212A in strong crosswinds.

2.4 Up to the time the aeroplane touched down, the pilots had been provided with reliable, up-to-date wind information from the ATIS, the crew from a preceding aeroplane and the aerodrome controller. This information never indicated that the crosswind and associated gusts exceeded the demonstrated crosswind limitation for landing, or that a landing may be unsafe, so the captain's decision to land was reasonable. Nonetheless, the pilots prudently prepared for a potential go around, in the event the conditions either precluded a landing or made an attempted landing unwise. However, had the captain reminded the first officer to position the control column positively forward after landing for effective nose wheel steering, the incident might have been avoided.

2.5 The QAR airspeed data showed that the conditions were gusty during the approach and landing. From all accounts, the captain's approach and touchdown were well handled with no undue difficulties being experienced. This was in spite of the QAR recording a 42-kt gust that exceeded the aeroplane crosswind limit, immediately before it touched down.

2.6 After the main landing gear was on the runway, the captain deflected the ailerons almost fully into wind to reduce the potential for any wing lifting. During landing, the amount of aileron deflection a pilot used was dependent entirely upon the crosswind conditions at the time. Although the FCOM contained a caution that excessive aileron deflections could affect directional control, there was no roll evidence from the QAR data suggesting that this had occurred.

2.7 Once the captain had landed the aeroplane and deflected the control column forward and into wind, he relinquished control of the control column to the first officer before he moved the

power levers to ground idle. Although there was provision for the captain to hand over the control column sooner than normal to use the steering tiller, his actions were out of sequence with the landing procedures listed in the FCOM. The captain's desire to get positive steering as soon as possible in the gusty conditions, by using a combination of nose wheel steering and rudder, probably led him to get out of sequence with the landing actions. However, because the aeroplane airspeed was sufficiently above the minimum for positive rudder control, there should have been enough time for the captain to have selected ground idle and slowed the aeroplane further before having to use nose wheel steering. In the circumstances, it is unlikely that this out of sequence action contributed to the incident.

2.8 From touchdown until the aeroplane left the runway, the QAR data showed that less than half the available rudder deflection was used. Although more rudder control was available to the captain, the speed and degree of the weathercocking were such that he decided not to use rudder aggressively to counter the swing, but to rely on nose wheel steering assistance.

2.9 Although the first officer believed that he had positioned the control column forward, the QAR data, the captain's observation and witness accounts suggested that up until the time the aeroplane left the runway, there was insufficient down elevator deflection and thus not enough weight on the nose wheels for effective nose wheel steering. The amount of forward control column deflection a pilot applied was judged according to the airspeed, and increased progressively as the speed reduced. However, with the ATR 72-212A this was considered by the operator's experienced pilots to be further forward than on most aircraft types. In this case, the first officer's action in not getting the control column as far forward as he should was a result of his ATR 72-212A training and experience, and the captain's decision not to remind him to do so. The first officer also probably applied the amount of forward deflection that he had been accustomed to when flying the Dash 8-400 aeroplane.

2.10 The primary cause of the incident was that a sudden gust, which most probably exceeded the aeroplane limit, struck the vertical stabiliser and weathercocked the aeroplane forcefully to the left. This loss of control was exacerbated by the gust occurring during a critical phase of the landing, before the captain had completed the normal landing sequence actions and before effective nose wheel steering was available. This determination was based upon the crew accounts, the QAR data and the wind reports, and because the gusts were steadily increasing in strength to near the aeroplane maximum limit.

2.11 Insufficient weight on the nose wheels was a contributing factor to the incident, because the captain was relying upon positive nose wheel steering control to augment the rudder control. Initially, rudder control alone should have been sufficient to keep the aeroplane straight up to the maximum crosswind limit, until the airspeed had decayed to above the point that nose wheel steering became prudent in the conditions. The QAR data showed that the airspeed was at 100 kt when the aeroplane touched down, and that it had reduced to 55 kt when the aeroplane left the runway.

2.12 There was no wind data available from near the middle of the runway to show the wind strength at that point, because it was not necessary at Queenstown. Therefore, the possibility exists that before the aeroplane landed, the crosswind was stronger near the middle of the runway than at each end, and that it exceeded the aeroplane limit. However, the critical wind information for landing was that existing at the touchdown zone.

2.13 The event occurred quickly, and its swiftness and the degree of weathercocking along with the reduced effectiveness of the nose wheel steering caught the captain by surprise and prevented him regaining immediate control. The captain quickly realised that the aeroplane was heading toward the runway edge and that he could not safely prevent it. His actions, in leaving the power levers at flight idle and allowing the aeroplane momentum and some power to take it through a soft area alongside the runway, and to then parallel the runway before re-entering it, led to a successful recovery, without any aeroplane damage.

2.14 The 2 cabin crewmembers reacted quickly to what had happened and issued the appropriate instructions to the passengers. Their actions would have reassured the passengers, and could have helped prevent any injuries.

2.15 The operator's incident recovery procedure was utilised to good effect and demonstrated the value of having such procedures in place.

2.16 Queenstown was not the only airport in New Zealand where gusty strong wind conditions could be encountered. Despite this, the operator's training programme did not ensure that pilots had the necessary knowledge and skills to operate the ATR 72-212A in strong crosswind conditions. Consequently, this contributed to the first officer not positioning the control column sufficiently forward during the landing so that the captain would have effective nose wheel steering, and the subsequent runway excursion.

2.17 The operator's transition training and recurrent programmes for the ATR 72-212A should reflect the New Zealand conditions, and be enhanced to ensure that all the operator's pilots are familiar with the peculiarities of the aeroplane and the appropriate techniques for landing and take-off in crosswinds at the maximum demonstrated limit. To help prevent similar occurrences, the operator should also establish procedures so that the pilot flying always reminds the pilot not flying about the required technique prior to each landing in a strong crosswind.

3 Findings

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

3.1 The records for the aeroplane showed that it was serviceable and suitable for the flight.

3.2 The crew was qualified and authorised for the flight.

3.3 The weather and wind reports were suitable for the flight to proceed and for the pilots to attempt the landing.

3.4 A strong gust that probably exceeded the aeroplane crosswind limit caught the aeroplane at a critical moment during the landing roll, and caused it to weathercock forcefully to the left and toward the runway edge.

3.5 The nose wheel steering was ineffective, because the first officer had not positioned the control column forward as far as necessary to put sufficient weight on the nose wheels.

3.6 Without effective nose wheel steering the captain could not regain directional control, and the aeroplane inadvertently left the runway.

3.7 The captain relinquishing control of the control column early to the first officer, probably contributed to the first officer's lack of control input.

3.8 The operator's training programme had not ensured that the first officer was trained adequately for ATR 72-212A operations in strong crosswind conditions.

3.9 The captain could have put a defence in place and potentially helped prevent the incident, if he had reminded the first officer about the peculiarities of the aeroplane and the need for positive forward pressure on the control column for the crosswind landing.

4 Safety Recommendations

Safety recommendations are listed in order of development and not in order of priority.

4.1 On 23 February 2006 the Commission recommended to the General Manager of Mount Cook Airline that he:

4.1.1 ensure the ATR 72-212A transition and recurrent training programmes prepare pilots for crosswind operations up to the aeroplane demonstrated limit. (001/06)

4.1.2 establish procedures so that the pilot flying always reminds the pilot not flying about the appropriate technique for landing in a strong crosswind, each time such a landing is to be attempted. (002/06)

4.2 On 6 March 2006, the Flight Operations Manager of Mount Cook Airline responded for the General Manager, in part:

4.2.1 The Flight Operations Department of the Airline fully supports the recommendations included in your letter of 23 February, and has been asked to implement them.

The implementation will be done in two stages; the first via the process that provides pilots with urgent or short duration material that is "must know", our Operational Notices. That information will then be incorporated into the permanent manuals that document procedures; the Pilot Training and Standards Manual for the first recommendation, and the Standard Operating Procedures for the second.

I will forward you a copy of the relevant Operational Notice by the 31st March 2006, and the relevant manual pages by 30th June 2006. The manuals have a three-month amendment cycle.

Approved on 20 March 2006 for publication

Hon W P Jeffries
Chief Commissioner

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Price $22.00 ISSN 0112-6962