



AIRCRAFT ACCIDENT REPORT

No. 92-003

Piper PA28-161

ZK-EQU

Alexandra Aerodrome

21 February 1992

**Transport Accident Investigation Commission
Wellington - New Zealand**

TRANSPORT ACCIDENT INVESTIGATION COMMISSION

AIRCRAFT ACCIDENT REPORT No. 92-003

Aircraft Type, Serial Number and Registration:	Piper PA28-161, 28-8116111 ZK-EQU
Number and Type of Engines:	One Lycoming O-320-D3G
Year of Manufacture:	1980
Date and Time:	21 February 1992, 1655 hours NZDT
Location:	Alexandra Aerodrome Latitude: 45°13'S Longitude: 169°22'E
Type of Flight:	Air Transport-Charter
Persons on Board:	Crew: 1 Passengers: 3
Injuries:	Crew: 1 Nil Passengers: 3 Nil
Nature of Damage:	Torn wing leading edge, undercarriage fairings, buckled rear bulkhead, scored lower skins
Pilot in Command's Licence:	Commercial Pilot Licence — (Aeroplane), Category "C" Flight Instructor Rating
Pilot in Command's Age:	29
Pilot in Command's Total Flying Experience:	Approximately 916 hours (130 hours on type)
Information Sources:	Transport Accident Investigation Commission field investigation
Investigator in Charge:	Mr D G Graham

1. NARRATIVE

1.1 On the morning of the accident the pilot in command, who was a part time instructor with the Aero Club, had filed a round-trip flight plan for a charter flight in ZK-EQU from Taieri Aerodrome to Alexandra Aerodrome and return. The flight plan indicated that the aircraft would depart from Alexandra on the return flight at 1700 hours. Fuel endurance was 3.5 hours. The pilot had flown a similar charter in ZK-EQU two weeks earlier.

1.2 The flight, which was carried out on a regular basis, was to enable members of a surgical team from Dunedin Hospital to provide medical services at Clyde Hospital. Three medical personnel were travelling on this occasion. A carton containing patients' records was also carried. One of the surgical team who was a member of the Aero Club, occupied the left front seat of ZK-EQU for familiarisation. He had completed six hours' flight training in Cessna 152 aircraft but had no experience in the Piper series. The aircraft was operated throughout the flight by the pilot in command from the right front seat. The other two passengers occupied the rear seats of the four seater aircraft.

1.3 The pilot had completed a loadsheet for the flight recording a standard weight of 170 pounds (77 kg) for each occupant and 200 pounds (91 kg) fuel on board. No baggage or freight was recorded. The aircraft's take-off weight as computed on the loadsheet exceeded the maximum authorised take-off weight of 1056 kg (2325 pounds) by 26 kg (59 pounds).

1.4 The aircraft's empty weight shown on the load sheet was 2.7 kg (6 pounds) greater than the empty weight recorded on the latest form MOT2173 contained in the aircraft's Flight Manual. This appeared to be an administrative discrepancy as the slightly higher figure was shown on the reference card prepared by the operator to assist pilots when they were completing a load sheet for ZK-EQU.

1.5 The aircraft took off on Vector 23 at Taieri Aerodrome at about 0815 hours. The take-off was accomplished successfully but one of the rear seat occupants later commented on the persistent sounding of the stall warning horn as the take-off progressed.

1.6 The automatic weather recording station located near the aerodrome recorded local conditions at 0800 hours as: wind 120°T/02 knots, temperature +6°C. Conditions at Dunedin Airport 15 km to the south-west were: wind 065°T/07 knots, visibility 80 km, with a QNH of 1003 hPa.

1.7 The flight to Alexandra was uneventful, and the surgical team proceeded by road to Clyde after arrival. During the day the pilot conducted an instructional cross country flight in ZK-EQU from Alexandra to Wanaka and return, with a local student.

1.8 The surgical team returned to Alexandra Aerodrome prior to 1700 hours and the pilot prepared ZK-EQU for departure. The aircraft had not been refuelled since leaving Taieri and the pilot reported that each wingtank contained about 9 gallons of fuel. Items of cargo including the patients' records and four boxes of fruit were stowed in the baggage compartment. The passengers were seated as for the outward flight.

1.9 As the pilot taxied ZK-EQU from the terminal area at the aerodrome, which was unattended, he noted the wind to be easterly at about 10 knots. He turned left on entering the runway and backtracked to a position which he estimated as 150 m to 200 m from the threshold of Runway 14. He selected 10° (one notch) of flap and after lining up on Runway 14 increased power to commence the take-off. The rpm indication was between 2300 and 2400 and he recalled estimating the wind again as a 10 knot headwind.

1.10 The aircraft accelerated normally and at 50 knots the pilot raised the nose. The aircraft became airborne momentarily but settled again. The pilot considered that adequate runway length still remained and continued the take-off. He recalled the stall warning horn sounding and lowered the nose slightly in an attempt to obtain more speed.

1.11 It then became apparent to the pilot that ZK-EQU was not going to lift off successfully so he decided to abandon the take-off. He reported sensing a drift to the left during the last few seconds, before he closed the throttle and applied the brakes.

1.12 It was evident that the aircraft could not be stopped in time to avoid colliding with a post and wire fence about one metre high which lay some 80 m beyond the end of the runway. The groundspeed was still high so the pilot veered the aircraft to the left and attempted to minimise the effect of the collision. The aircraft passed through the fence and continued on its wheels over the rough but relatively level ground before descending into a small gully. It came to rest about 280 m from the end of the runway.

1.13 After shutting down the engine and securing the aircraft the pilot and passengers vacated the aircraft. A grass fire had started adjacent to the area where impact with the fence had occurred. The pilot and passengers noted that the smoke from this fire was blowing in the take-off direction and observed the windsock near the threshold of Runway 32 to indicate a 5 to 10 knot wind from a "westerly" quarter. The pilot reported that the windsock close to the terminal still indicated a wind of about 10 knots, favouring take-off towards the south-east.

1.14 Following telephoned advice from the pilot that there was a grass fire off the end of the runway, the Alexandra Fire Service attended and extinguished the fire. They were unaware until after arrival that the fire was associated with an aircraft accident.

1.15 An unsuccessful attempt by Christchurch Flight Information Service to establish whether ZK-EQU had departed from Alexandra for Taieri in accordance with the flight plan led to inquiries through Alexandra Police regarding the whereabouts of the aircraft. Police, Ambulance and Ministry of Transport personnel attended the occurrence when the circumstances became known.

1.16 Damage to ZK-EQU involved the undercarriage fairings, the right wing leading edge, the rear fuselage bulkhead and lower skin. Following inspection and minor repairs, the aircraft was flown back to Taieri Aerodrome two days after the occurrence.

1.17 During the ferry flight there was no indication of any lack of engine power or other abnormality related to the aircraft which might have contributed to a reduction in take-off performance at the time of the accident.

1.18 Calculation of the aircraft's weight and balance, however, based on the actual weights of the passengers and baggage, and the load distribution, determined shortly after the occurrence, indicated that the aircraft's take-off weight exceeded the maximum authorised take-off weight by approximately 52 kg (114 pounds) and the centre of gravity was about 56 mm (2.2 inches) aft of the rearward CG limit at the time of the take-off.

1.19 In an analysis of the conditions prevailing at the time, the Acting General Manager of the New Zealand Meteorological Service reported in part:

“On the 21 February 1992 a depression moved southeast across the southern part of the North Island during the afternoon. At the same time a weak cold front moved northeast across Southland and Otago. The front was weak and it is difficult to trace its passage conclusively but there was a wind change which occurred at 1645 NZDT at Dunedin and it is possible that the front was further north than drawn on the 0600 UTC (1900 NZDT) analysis...

... The front, because of its orientation, would have passed over Alexandra at about the same time as at Dunedin, that is about the time of the accident. It is possible to conjecture the likely wind sequence at Alexandra.

Prior to the approach of the front the winds are likely to have been light and variable mainly from the southerly quarter. As the front approached the winds should have veered west or northwest although still quite light (up to 10 knots). Later with the passage of the front the winds may have freshened briefly from the south or southwest....”.

1.20 Taking into account orographic effects on wind direction due to the orientation of the major valley systems intersecting at Alexandra, the likely sequence of winds accorded with the observations of the pilot and passengers of ZK-EQU at the time of the accident.

1.21 Local temperature was about 19°C and the aerodrome elevation was 750 feet amsl, with a QNH of 1001 hPa. This resulted in a density altitude of approximately 1800 feet amsl at the time of the attempted take-off from Runway 14. The available take-off distance could not be determined with certainty as the aircraft's precise position at the start of its take-off run was not known. The pilot considered, however, that the position to which he had backtracked provided an available length of at least 800 m. The total length of Runway 14/32 at Alexandra was 1200 m. The runway was not provided with “distance markers”.

1.22 The take-off distance required for air transport operations from a paved runway (to achieve a 50 foot screen height in accordance with the provisions of CASO [Civil Aviation Safety Order] 4) was calculated with respect to the existing conditions using the take-off performance graph approved for the Piper PA28-161 aircraft type.

1.23 For the aircraft at maximum all-up weight, 0° flap and a take-off speed of 60 knots, the following representative distances applied:

10 knot headwind	800 m
Zero wind	900 m
5 knot tailwind	1060 m

1.24 The Pilot's Operating Handbook for ZK-EQU included the following information in Section 6 (Weight and Balance) reproduced in part:-

"In order to achieve the performance and flying characteristics which are designed into the airplane, it must be flown with the weight and centre of gravity (C.G.) position within the approved operating range (envelope). Although the airplane offers flexibility of loading, it cannot be flown with the maximum number of adult passengers, full fuel tanks and maximum baggage. With the flexibility comes responsibility. The pilot must ensure that the airplane is loaded within the loading envelope before he makes a take-off.

Misloading carries consequences for any aircraft. An overloaded airplane will not take off, climb or cruise as well as a properly loaded one. The heavier the airplane is loaded, the less climb performance it will have.

Centre of gravity is a determining factor in flight characteristics. If the C.G. is too far forward in any airplane, it may be difficult to rotate for take-off or landing. If the C.G. is too far aft, the airplane may rotate prematurely on take-off or tend to pitch up during climb. Longitudinal stability will be reduced. This can lead to inadvertent stalls and even spins; and spin recovery becomes more difficult as the centre of gravity moves aft of the approved limit.

A properly loaded airplane, however, will perform as intended ...".

1.25 The performance calculations suggested that the position on Runway 14 from which the pilot elected to commence take-off was likely to have satisfied the take-off distance requirements for ZK-EQU in a headwind, or calm conditions, had the aircraft been loaded at or below its maximum all-up weight. However, the accident circumstances demonstrated the cumulative adverse effect of an unexpected tailwind component and an overload, on the aircraft's take-off performance. It was evident that in the prevailing conditions these factors, compounded by the aft centre of gravity, were sufficient to preclude a successful take-off.

1.26 The approved Flight Manual for ZK-EQU, which included certain sections of the Pilot's Operating Handbook, contained the following caution in Section 4.23 Take-off:

"...Premature raising of the nose or raising it to an excessive angle will result in a delayed take-off."....

1.27 A number of previous accidents had occurred in New Zealand in which PA28 series aircraft failed to become airborne or did not achieve adequate height to clear obstacles in the take-off path.

1.28 In addition to the adverse effect of a tailwind, or overload, as evidenced in the accident to ZK-EQU, variation in technique with regard to the extent of nose-up pitch applied and maintained during the take-off had contributed to an extended ground roll and/or subsequent failure of the aircraft to achieve an effective rate of climb. Rotation at too low an airspeed (dependent on the aircraft's weight) could result in the aircraft becoming airborne in ground effect but with a high drag attitude and consequent failure to accelerate.

2. FINDINGS

2.1 The pilot in command held a valid Commercial Pilot Licence (Aeroplane), and a Type Rating Certificate for Group A aircraft which included the PA28-161.

2.2 The aircraft's Certificate of Airworthiness and Maintenance Release were valid.

2.3 The pilot, who was operating the aircraft from the right front seat, abandoned an attempted take-off from Alexandra Aerodrome when the aircraft failed to become airborne properly.

2.4 The aircraft over-ran the runway, passed through a fence and came to rest in a gully.

2.5 At the time of the accident the aircraft's weight exceeded the maximum permitted take-off weight and the centre of gravity was located aft of the rearward limit.

2.6 At the time of the accident an unexpected change in wind strength and direction, combined with the adverse weight and balance configuration, was likely to have increased the distance required for the aircraft to become airborne.

2.7 The technique employed may have adversely affected the aircraft's take-off performance.

2.8 The pilot did not utilise the full extent of the available runway for the attempted take-off.

2.9 The probable causes of this accident were that the pilot did not ensure the aircraft was correctly loaded and did not use the full length of runway available for the take-off. Contributory factors were a non-standard take-off technique and a change in the wind strength and direction.

7 August 1992

M F Dunphy
Chief Commissioner