Aviation Safety Investigation Report 199502147

Piper Aircraft Corp
Warrior
Canadair Ltd
Challenger

11 July 1995

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Aviation Safety Investigation Report

199502147

Occurrence Number: 199502147 **Occurrence Type:** Accident
Location: Essendon, Aerodrome
State: VIC **Inv Category:** 3
Date: Tuesday 11 July 1995
Time: 1747 hours **Time Zone** EST
Highest Injury Level: None

Aircraft Manufacturer: Canadair Ltd
Aircraft Model: CL600-2B16
Aircraft Registration: VH-BRG **Serial Number:** 5064
Type of Operation: Non-commercial Corporate/Executive
Damage to Aircraft: Substantial
Departure Point: Sydney NSW
Departure Time: 1625 EST
Destination: Essendon VIC

Crew Details:

Role	Class of Licence	Hours on Type	Hours Total
Pilot-In-Command	ATPL	1501.0	5740
Co-Pilot/1st Officer	ATPL	1276.8	11041

Aircraft Manufacturer: Piper Aircraft Corp
Aircraft Model: PA-28-161
Aircraft Registration: VH-BZE **Serial Number:** 28-7916035
Type of Operation: Non-commercial Pleasure/Travel
Damage to Aircraft: Substantial
Departure Point: Moorabbin VIC
Departure Time: 1730 EST
Destination: Essendon VIC

Crew Details:

Role	Class of Licence	Hours on Type	Hours Total
Pilot-In-Command	Private	219.6	220

Approved for Release: Thursday, July 24, 1997

FACTUAL INFORMATION

History of the flight

The PA-28 aircraft was inbound to Essendon using the Essendon Special Aerodrome Procedures. On initial contact with the Essendon aerodrome controller, the PA-28 was cleared to proceed from Point Ormond to Essendon runway 35. As the PA-28 passed west abeam the city, the controller instructed its pilot to maintain best speed and report on short final. Shortly after, the pilot reduced speed to lower flap for the approach. The approach was then made with partial reference to the visual approach slope indicator system (T-VASIS).

The CL600 aircraft was inbound from Sydney via the Plenty locator to Essendon. While the aircraft was on approach frequency, its pilot had accepted an offer from the controller to use runway 26 at Essendon. Twenty-five seconds after the PA-28 had reported abeam the city, the CL600 pilot contacted the aerodrome controller and reported at the Plenty locator.

He was instructed to report on short final, advised of the crosswind and that he was number two in the sequence. The pilot then conducted a practice instrument landing system (ILS) approach, believing that the number-one aircraft was also landing on runway 26.

Approximately 2 minutes after the CL600 had reported at the Plenty locator, the PA-28 was cleared to land. It was then about 2 NM from the threshold of runway 35. At that time, the CL600 was about 4 NM from the threshold of runway 26. The landing clearance given to the PA-28 pilot was not heard by the CL600 crew as the outer marker audio tone came through at that moment and they were conducting final checks.

After a further 1 minute and 40 seconds, the controller advised the CL600 pilot that the number-one aircraft was just crossing the threshold and to expect a late landing clearance. That landing clearance was given 20 seconds later. After a further 35 seconds, the CL600 pilot advised the controller that an aircraft had run into them. The two aircraft had collided at the intersection of runways 26 and 35.

Radar flight profiles

Radar data indicated that the original sequencing of both aircraft was appropriate. However, the situation soon changed and the CL600 maintained a position relative to the PA-28 in both distance and ground speed by a factor of two; that is, the speed of the CL600 was twice that of the PA-28, and its distance from the aerodrome remained constant at about twice that of the PA-28.

Radar data indicated that the aircraft symbols merged at the runway intersection. The PA-28 indicated a ground speed of 50 kts and the CL600 55 kts at the time of impact, 1747 EST. All available data indicates that the flight profiles were normal for both aircraft types.

Damage to aircraft

Damage to the CL600 aircraft was confined to the left wingtip and winglet. The winglet remained intact, but its leading edge was severely delaminated and there were scratches on the wing surfaces.

The left wing of the PA-28 aircraft was destroyed outboard from the wing fuel tank. The wing was partially pulled from the fuselage at the wing root and the fuel tank was damaged. There was some wrinkling of the left fuselage skin surface to the rear of the left wing.

Flight recorders

The CL600 aircraft was fitted with a Lockheed Aircraft Services flight data recorder (FDR) and a Loral Data Systems cockpit voice recorder (CVR). The PA-28 aircraft was not equipped with a FDR or CVR.

Flight planning

The pilot of the PA-28 aircraft had submitted a valid visual flight rules (VFR) SARTIME flight plan to the Melbourne Regional Briefing Office. The transmitted plan was correct and complete for the proposed flight. The flight plan indicated that the pilot intended to proceed from Moorabbin to Essendon using the Essendon Special Approach Procedures and then return to Moorabbin following orbits over the city area. Correct and completed flight progress strips were prepared and held at the Essendon Tower for the Essendon stages of the flight.

The inbound flight progress strip was held at the aerodrome controller position and the outbound flight progress strip at the surface movement controller position. The pilot of the PA-28 aircraft established contact with the aerodrome controller in accordance with the special aerodrome procedures and was cleared to enter controlled airspace and track to Essendon at 2,000 ft for runway 35.

The CL600 flight crew had submitted a valid instrument flight rules flight plan to the Melbourne Regional Briefing Office. The transmitted plan was correct and complete for the proposed flight. The flight plan indicated the final stage of the flight from Sydney was to track via the Plenty locator to Essendon.

A correct and complete flight progress strip was prepared and held at the Essendon aerodrome controller position for this flight. The CL600 crew had established contact with Melbourne Approach Control and advised they had received Essendon Automatic Terminal Information Service (ATIS) information Hotel, but did not report in-flight conditions. Approach Control advised the crew that Essendon ATIS had changed to information India and that the duty runway was now runway 35. They were also advised that runway 26 was available for landing with a 15-kt crosswind. The crew accepted runway 26 and, as they had not reported visual, were cleared for final and instructed to contact Essendon Tower at the Plenty locator. They established contact with the Essendon aerodrome controller at the Plenty locator and were then cleared to continue descent and track direct to Essendon for runway 26 as the number-two aircraft.

Meteorology

At the time of the occurrence, the wind was 350 degrees at 10-15 kts, the cloud was 2 octas at 2,000 ft and 3 octas at 3,000 ft. Both controllers were aware that there had been strong northerly winds of 30-40 knots at 1,500-2,000 ft. The collision occurred about 2 minutes after last light. Although it was dark on the ground, visibility was good and both aircraft were identified visually on first contact with the aerodrome controller. The ATIS reported visibility as 10 km. There was considerable background illumination along the flight path of the PA-28 between the city area and the runway intersection. It was clear overhead with showers and dark cloud reported to be low on the western skyline.

Orders, regulations and instructions

The Aeronautical Information Publications (AIP) OPS-CTL-18 and the Manual of Air Traffic Services (MATS) 6-3-35 define separation standards required for crossing runway situations.

Essendon Tower local operating instructions (section 4.22) provided directions on the confirmation of the landing clearance under a heading of reduced visibility in which the hours of darkness appear to be considered as constituting reduced visibility. However, these instructions related only to runways 26 and 08 and did not include runway 35.

Personnel

At the time of the accident, the tower was staffed with both an aerodrome controller and a surface movement controller who were both rated as full performance controllers.

The aerodrome controller had held a surface movement controller rating at Essendon since September 1994 and an aerodrome controller full performance rating since 28 May 1995, some 7.5 weeks before the accident.

Prior to September 1994, he had worked for approximately 15 years in the air traffic services training environment at Melbourne. Before this period, he had held a rating for approach/departures radar control at Melbourne which he last exercised in December 1979. The controller had been employed as a contoller for 26 years. Prior to 28 May 1995, he had gained actual experience as an aerodrome controller for 2 years at Melbourne (December 1970 to November 1972) followed by a 9 month term at Essendon.

The pilots of both aircraft held licences and ratings appropriate for the flights undertaken.

Essendon Aerodrome

Essendon Aerodrome is 282 ft above sea level, with runways 08/26 and 17/35 crossing at right angles. Runway 26 is equipped with a localiser, ILS and high-intensity approach lighting. Each of the other three runways is equipped with a T-VASIS.

Essendon Control Tower

The control tower is located about 600 m north of the runway intersection on the west side of runway 35. At night, observation of the thresholds for runways 26 and 35 and the runways' intersection requires the controller to look into the distant lights of Melbourne and the very close lights on surrounding roads. The tower workstation is located such that the operating positions face east. Tower cabin roof stanchions are the only obstructions to visibility, but were not considered to be a factor in this occurrence. Depth of field judgement and the assessment of angular changes of landing aircraft can be difficult under poor ambient light conditions such as at night.

The runway in use at Essendon had changed a number of times during the afternoon due to simultaneous runway operations (SIMOPS) changes at Melbourne. Runway 26 had been the runway in use until about 12 minutes before the accident, when runway 35 was designated the runway in use. Runway 35 (1,585 m long), crosses runway 26 (1,921 m long) about 450 m from the runway-35 threshold and 1,000 m from the runway-26 threshold. Both runways had stage-two selections set for their relevant lighting.

Radar facilities

The aerodrome controller had access to a radar display for monitoring and traffic sequencing purposes only. There are no control settings other than range selection, and there are no velocity projections displayed on this equipment. The display was operational and continually monitored by the controller until the PA 28 was about 2 NM from the runway 35-threshold, after which the controller reverted to visual surveillance of both aircraft. The aircraft symbols on the radar display included groundspeed and altitude readouts.

Essendon Tower staffing

Normal staffing configuration during the hours of 0700 - 1700 local, specified that the Essendon Tower be staffed with an aerodrome controller, a surface movement controller, and a coordinator. At the time of the accident, the coordinator was not required to be present in the tower cabin.

Traffic processing

The controller intended the PA-28 to be number one in the landing sequence, as that aircraft was the closest aircraft to the runway in use and was landing into wind. At the time the sequence was formulated, both aircraft were on the radar display, but the CL600 had not passed the Plenty locator and was not on the Essendon Tower frequency.

The controller's strategic traffic processing plan was to maintain the PA-28 as number one and to monitor that aircraft past the intersection of runways 26/35 before issuing a landing clearance to the CL600, the number-two aircraft in the sequence.

The controller informed the investigation he believed he had visually confirmed that the PA-28 had passed through the intersection before he gave the CL600 landing clearance.

The two accident aircraft were the only aircraft inbound to Essendon. There were no other surface movements at Essendon in the vicinity of the runway intersection. At the time of the accident the workload at the aerodrome controller operating position was low and not complex.

ANALYSIS

Aerodrome controller

The controller's strategic traffic processing plan for both aircraft was based on an approach and landing sequence using crossing runways. However, at no stage during this sequence did the controller pass traffic information to the crew of either aircraft, alerting them that both aircraft were being sequenced to land on crossing runways. Furthermore, neither crew was aware of the other's aircraft type, performance capabilities, or relative position.

From the time that the CL600 was at 10 NM, the controller knew that the sequence was likely to result in achieving separation close to the minimum allowable. He had available a number of alternative strategies to ensure separation. When the PA-28 was about 2 NM from the runway-35 threshold, the controller adopted visual surveillance of both aircraft to maintain separation. The controller was unable to recall the visual scanning pattern he adopted in relation to confirming his judgement that separation would be maintained.

As the sequence progressed, the controller incorrectly assessed the position of the PA-28 in relation to the runway intersection as well as its position relative to the CL600. At the time when the controller advised the CL600 crew that the PA-28 was crossing the runway (35) threshold and that they should expect a late landing clearance, radar data shows that the PA-28 was still on approach with 0.41 NM yet to be flown to the runway threshold.

This distance was approximately twice that of the distance from the runway threshold to the runway intersection. The investigation was unable to determine why the controller did not verify the position of the PA-28 in relation to the runway threshold or the CL600. Subsequently, the controller did not use the radar display to check his visual surveillance of the PA-28 position relative to the runway intersection. Furthermore, the controller did not verify his assumption by seeking confirmation from the PA-28 pilot that the aircraft had in fact crossed the runway intersection. The controller was unable to explain to the investigation why he did not avail himself of these options.

CL600 crew

After the crew advised the aerodrome controller that they had passed the Plenty locator, they were instructed by the aerodrome controller to report short final and that they were 'number two'. The crew told the investigation that on receipt of this instruction, they assumed that the number-one aircraft was in the sequence ahead of them on approach to land on runway 26. The crew were making a practice ILS approach in visual meteorological conditions. The investigation was unable to determine whether either of the CL600 pilots conducted an external visual scan to verify their assumption.

The crew were subsequently advised that the 'number one' aircraft was crossing the threshold and that they should expect a late landing clearance. Twenty seconds later, they were given clearance to land. On receipt of the advice to expect late landing clearance, the pilot in command apparently felt some concern and was considering a go-around but did not discuss this with the other crew member. The co-pilot also had some concerns which he did not communicate to the pilot in command. Their concerns, although unshared, represented a potential cue for the crew to resolve with the controller, any doubts they may have had that the number-one aircraft in the sequence was in fact preceding the CL600 to land on runway 26. Before the crew could speak to each other, the controller cleared them to land.

After receiving this clearance, the crew would have concluded that, as they were operating under positive control, the runway was clear, and they would have confirmed this by visual observation.

Pilot in command PA-28

A number of factors would have influenced the pilot's ability to maintain a complete awareness of his environment. He was occupied with the process of flying the aircraft to ensure a smooth landing for the comfort of his passengers. Furthermore, due to his low level of experience in night flying, he was also concentrating on the T-VASIS approach and for the correct taxiway on which to exit.

SIGNIFICANT FACTORS

1. The controller adopted and maintained a traffic sequence, which as it progressed, was unlikely to result in achieving the required separation.

2. The controller misjudged the position of the PA-28 in relation to the runway-35 threshold and the position of the CL600.

3. The controller did not seek verification from the PA-28 pilot that his aircraft had crossed the runway intersection.

4. The controller did not provide the required separation.

SAFETY ACTION

The Bureau of Air Safety Investigation issued interim recommendation IR950209 to Airservices Australia on 23 November 1995. It stated:

"The Bureau of Air Safety Investigation recommends that Airservices Australia revise the standard operating procedures in relation to runway separation standards applicable to intersecting runway operations at locations where azimuth resolution is difficult to assess or not available.

"The procedure should ensure that under such conditions, whenever runway separation is based on an assurance that an aircraft is clear of a runway intersection, corroborative evidence is obtained to confirm that separation will be achieved."

Airservices Australia replied on 11 December 1995 as follows:

"BASI IR 950209 recommends that "Procedures should ensure ... whenever separation is based on an assurance that an aircraft is clear of a runway intersection, corroborative evidence is obtained to confirm that separation will be achieved."

"The current procedure described in MATS 6-3-6 is clear -

"B shall not be permitted to cross the runway threshold until preceding .. landing aircraft A has crossed the relevant runway intersection or has stopped short of the intersection."

"How this procedure is achieved and ensured at specific locations is a matter of technique, and should therefore be an issue of local training and rating, with possible incorporation in Local Instructions (LIs).

"Discussions have been held with the manager ATS Training regarding ATC responsibilities for ensuring the procedure and for specific inclusion of the issue into the training syllabus.

"No change to current national procedures is proposed."

The Bureau assessed this response as OPEN and further correspondence was entered into. A letter was sent to Airservices Australia on 12 August 1996. It stated, in part:

"Thank you for your response to Interim recommendation 950209 regarding azimuth resolution for intersecting runway operations. While I am pleased to read that you intend to modify the training syllabus so that it will include specific instruction related to achieving a standard, I feel that the main point of the recommendation may have been missed.

"While I agree that the procedure in MATS 6-3-6 is clear, I would wish to see some corroborative evidence available to the controller in situations where azimuth resolution is either difficult to assess or not available at all.

"The application of any such device/procedure may vary from location to location and even from runway to runway at the same location. It may also be deemed to only apply on certain runways at certain times, for instance, night operations."

Airservices Australia further replied on 18 September 1996 as follows:

"I refer to your letter dated 12 August 1996, regarding Airservices' initial response to BASI Interim Recommendation 950209. In that letter, you highlighted concerns that our proposals regarding azimuth resolution for intersecting runways, did not provide any corroborative evidence to a controller that the requirements of MATS 6-3-6 Para 35 had been met.

"While still of the opinion that the issue remains one that should be incorporated as part of local training and rating requirements, we propose to include additional guidance in MATS by amending the relevant paragraph as follows:

"Aircraft B shall not be permitted to cross the runway threshold until preceding departing or landing Aircraft A has crossed the relevant runway intersection or has stopped short of the intersection. Azimuth resolution, particularly at night or in reduced visibility, can affect the ability to visually determine an aircraft position on a runway. When visual determination is limited by azimuth resolution, the pilot shall be instructed to report when either of the above requirements has been met."

The Bureau assessed this subsequent response as CLOSED-ACCEPTED.