AVIATION INVESTIGATION REPORT

A99C0281

RUNWAY OVERRUN/COLLISION WITH APPROACH LIGHTS

BEARSKIN LAKE AIR SERVICES

FAIRCHILD METRO SA-227-AC C-FFZN

DRYDEN, ONTARIO

22 NOVEMBER 1999

Aviation Investigation Report

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Fairchild Metro SA-227-AC C-FFZN
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Summary

Bearskin Lake Air Services flight BLS 340, a Fairchild Metro SA-227-AC, C-FFZN, serial number AC-785B, was landing on runway 11 at Dryden, Ontario. The aircraft touched down long, ran off the end of the runway, and collided with approach lights and the instrument landing system localizer antennae. The aircraft came to rest about 300 feet past the end of the runway and the crew shut down the engines. The captain advised Thunder Bay flight service station that the aircraft had run off the end of the runway. The passengers observed a fire in the left engine tail pipe prior to deplaning. After a short delay, the crew and passengers deplaned and walked to the Ontario Government Fire Centre building. The captain then returned to the aircraft and activated the fire bottle for the right engine. There were no injuries, but the aircraft was substantially damaged. Airport staff observed that the passengers had deplaned and could see no fire. Emergency Response Services located in the City of Dryden were not notified and did not respond to the accident scene.

Ce rapport est également disponible en français.

Other Factual Information

On the day before the accident, the crew had flown several legs, arriving in Kenora, Ontario, about 2200 central standard time.[1] After a good night's rest, the crew departed for Dryden at 0755 with six passengers. Prior to departure, the first officer obtained a weather package from the company counter representative. The package contained the Dryden airport surface condition report issued at 0633, which indicated that a 150-foot-wide strip down the centre of the runway had been swept and that the swept area had a Canadian Runway Friction Index (CRFI) of 0.37. The remainder of the runway was described as 100 percent heavy frost covered. The package included the Dryden weather for 0700 which was as follows: wind 260 degrees at two knots, visibility five statute miles (sm), sky condition overcast at 1500 feet above ground level (agl), temperature minus two degrees Celsius, dewpoint minus three degrees Celsius, and altimeter 29.84 inches of mercury. The first officer discussed the weather with the captain; however, the first officer did not consider the CRFI of 0.37 significant and it was not included in the discussion. The crew did not request, or receive, any update on the CRFI from either air traffic control (ATC) or the flight service station (FSS) responsible for Dryden.

The original runway condition report, provided to the Thunder Bay FSS by the Dryden airport maintenance staff, correctly indicated that the centre 100 feet of the runway had been swept. However, the runway surface condition report for Dryden at 0633, issued by the Thunder Bay FSS and subsequently provided to the crew, incorrectly stated that the centre 150 feet of the runway was swept. The runway at Dryden is 150 feet wide.

The weather in Dryden at 0800, some 15 minutes before the accident was as follows: wind 280 degrees at four knots, visibility 1.75 sm in light freezing drizzle and mist, sky condition overcast at 1300 feet agl, temperature minus two degrees Celsius, dewpoint minus three degrees Celsius, altimeter 29.84 inches of mercury. The weather information was passed to the crew prior to their instrument landing system (ILS) approach to runway 11. The runway visual range (RVR) for runway 11 was 5500 feet and the runway lights were on strength three, which is the highest setting at Dryden.

The crew was advised prior to the interception of the final approach course that an aircraft about four minutes ahead of them had descended out of the cloud layer at the approach minimums of 200 feet agl and had completed an ILS approach and landing on runway 11. A special weather observation was made immediately after the accident. In this observation, the sky condition was reported as overcast at 600 feet agl; the other observations remained the same. RVR information is not recorded and is not available for the time of the accident.

The 37-year-old captain had over 5000 hours of total flying time. He held an Airline Transport Pilot Licence (ATPL) issued 20 October 1997 and validated by an aviation medical certificate endorsed on 24 August 1999. His instrument rating was valid until 01 October 2001. The captain had joined the company in mid-1998, completing an initial pilot proficiency check (PPC) as a first officer on the Metro on 28 July 1998. He had upgraded to Metro captain by a PPC on 27 September 1999 and completed his captain line indoctrination on 07 October 1999. The captain had demonstrated normal progress throughout his training with the company.

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[1] All times are central standard time (Coordinated Universal Time minus six hours) unless otherwise noted.

Prior to joining the company, the captain had accumulated about 365 hours on multi-engine aircraft. He also held a valid Class 1 instructor rating with about 3160 hours as an instructor pilot. No record was found to indicate whether the captain received crew resource management (CRM) training. At the time, Bearskin Lake Air Services did not provide its pilots with CRM training.

The 30-year-old first officer had approximately 2000 hours of total flying time. He held an ATPL issued on 08 June 1999 with a Group 1 instrument rating valid until 01 May 2001. His licence was validated by an aviation medical certificate endorsed on 09 June 1999. The first officer had started flying in 1995 and had joined the company in September 1999. He completed an initial PPC as a Metro first officer on 13 October 1999 and completed his first officer line indoctrination on 28 October 1999. The first officer had demonstrated normal progress throughout his training with the company. Prior to joining the company, the first officer had accumulated about 450 hours on multi-engine aircraft. He also held a valid Class 3 instructor rating. The first officer had some training in CRM in 1996.

Part of the flight training for both the captain and the first officer was provided by the company and part was completed on a simulator at Flight Safety International.

Runway 11 at Dryden is 6000 feet long with a threshold elevation of 1354 feet above sea level (asl). A paved manoeuvring area, about 200 feet long, is located immediately before the threshold. About 2500 feet from the threshold along the runway is taxiway Alpha, which leads to the apron and terminal building located about 900 feet south of the runway. Runway 11 is served by an ILS approach with a glide slope of three degrees and a decision height (DH) of 200 feet agl, 1554 asl. The glide slope is positioned to place an aircraft at 55 feet agl at the threshold. The recommended visibility for the approach is 0.75 sm or RVR of 4000 feet.

The approach lighting consists of two unidirectional strobe lights positioned before the start of, and on each side of, the manoeuvring area. The threshold and runway end are marked by green and red lights respectively. The lighting system is medium intensity with three settings. A two-bar visual approach slope indicator (VASIS) is positioned to the left of the threshold. Regulation 602.128 of the *Canadian Aviation Regulations* (CARs) specifies that pilots on ILS approaches are prohibited from continuing the descent below DH unless the required visual reference is established and maintained in order to complete a safe landing.

A non-directional beacon is located on the ILS course, 4.1 nautical miles from the runway threshold. An aircraft on the ILS glide path should cross this beacon at 2700 feet asl and reach the threshold of runway 11 in one minute and thirty-eight seconds at a ground speed of 150 knots.

To allow the runway to be re-opened, the right wheel of the aircraft was replaced at the accident site and the aircraft was towed to a hanger on the airport. The aircraft was examined in the hanger by TSB investigators. There was substantial damage to the propellers, landing gear, and aircraft structure from the collision with the localizer antenna and approach lighting. Two propeller blade tips had broken off on the right side and caused puncture damage to the right side of the fuselage and cracked a cabin window. The interior of the cabin was not penetrated by any of the objects that damaged the fuselage. The right engine fire bottle was found to be discharged. The brake system, which does not have an anti-skid feature, was examined and no mechanical failures were found. A firm resistance was felt on toe-brake application. All main wheel tires showed damage from brake application. The airspeed indicators, altimeters, attitude gyros, and horizontal situation indicators (HSI) were removed for testing.

The captain's altimeter was found to be reading 60 feet high and was unserviceable. The first officer's airspeed indicator was serviceable but reading five knots high in the approach speed range. The radar altimeter was unserviceable and did not read accurately. The captain's HSI glide slope indicator was sluggish and had a tendency to stick in the upper half of the scale above the on-glide-slope mark. Tapping the instrument provided a correct reading. All other instruments tested serviceable.

The aircraft flaps were found in the fully-extended position. The condition of the aircraft when examined by TSB precluded activation of the flaps. After other repairs had been completed, the company tested the flap extension, which showed that the extension times and deflection amounts were correct.

The aircraft was equipped with a flight data recorder (FDR) and a cockpit voice recorder (CVR). The approach flown by the aircraft was tracked by an air traffic control (ATC) radar and the information was recorded. Communications between the crew, ATC, and the FSS serving Dryden were also recorded. All recordings were analysed at the TSB Engineering Laboratory in Ottawa and a detailed profile of the approach and landing was developed. Information provided by ground observers and the crew was correlated with the profile.

The company Metro Standard Operating Procedures (SOPs) specify that all approaches shall be monitored by the pilot-not-flying (PNF), whether in visual or instrument conditions, and specify the procedures to be followed. SOPs state that an airspeed of 140 knots shall be maintained when established on the final approach segment, reducing to a reference speed (V_{Ref}) over the threshold. V_{Ref} is based on a chart provided in the aircraft flight manual (AFM) and provides a landing distance for a threshold crossing height of 50 feet. The V_{Ref} calculated for the aircraft's landing weight was 109 knots indicated airspeed(IAS). The AFM indicates that the aircraft's weight and the ambient temperature would require a landing distance of about 2500 feet, including a ground roll of 1675 feet. Using tables contained in the *Canada Flight Supplement*, the application of the CRFI of 0.37 would result in an estimated landing distance of 4700 feet using reverse thrust based on a threshold crossing height of 50 feet. The resulting ground roll would be about 3875 feet.

On the occurrence flight, the captain was the pilot flying (PF) and the first officer was the PNF. The FDR indicated that the aircraft was established on the glide path, with compensation for the tail wind. The approach was stable, with the aircraft configured properly and at an IAS of 140 knots as required by SOPs, until about 2.5 nm from the runway threshold. At this point, engine power was increased by about five pounds of torque, the aircraft descent rate slowed to about half the descent rate that had been maintaining the glide slope, and the aircraft became high on the glide slope. At about 1 nm, a gradual power reduction was made and the rate of descent increased; however, the aircraft remained high on the glide slope and the IAS increased to 150 knots. From a point over two miles back from the threshold, the aircraft was 50 to 100 feet above the glide path; at the threshold, the aircraft was about 90 feet above the glide slope; and at the runway/glide slope intercept point, it was about 100 feet above the glide slope. Cockpit indications of altitude and glide path deviations were consistent with FDR information. No glide slope deviation calls or airspeed calls were made during the approach, except that, just as the aircraft was landing, there were some airspeed calls. Visual conditions were encountered about 100 feet above DH (200 feet agl), and the PF called the runway in sight about 180 feet above the runway elevation at a distance of 0.17 nm. The only runway lighting visible to the crew were the runway edge lights.

The aircraft crossed the runway threshold at an IAS of 150 knots. Full flaps were lowered and power reduced at this time. The aircraft touched down with about 2000 feet remaining at an IAS of 109 knots. Visual cues that could have revealed the aircraft's position were taxiway Alpha and the terminal building. After touchdown, maximum braking and reverse thrust were applied; however, the aircraft could not be stopped on the runway.

The engines were shut down by the crew immediately after the aircraft stopped. About 30 seconds after engine shutdown, the first officer confirmed that the passengers had no injuries. Electrical power to the CVR was cut about two minutes after engine shutdown, and the first officer did not leave his seat to open the main cabin door before this time.

In the passengers' opinion, the crew did not evacuate the aircraft quickly after engine shutdown. Two of the passengers saw a fire in the tail pipe of the left engine and attempted, to no avail, to attract the crew's attention by shouting. Finally, one passenger walked forward and insisted that the main door be opened. The first officer then left his seat and evacuated the passengers through the main door.

Emergency Response Service (ERS) is provided by the City of Dryden volunteer fire department. The response vehicle is located in the town and response is initiated by radio from airport vehicles or by telephone. The crew made no request for ERS. In the radio transmission to the FSS, the crew indicated only that the aircraft had slid off the end of a slippery runway. No damage to the aircraft was reported. Airport staff were contacted by the FSS and the first airport vehicle reached the aircraft in about three minutes. The vehicle was equiped with both telephone and radio, and the airport manager was able to talk directly to the aircraft captain and establish that ERS was not required. The runway braking action on the runway was checked as the airport vehicle responded to the call. The breaking action check did not delay the response.

The following laboratory report was prepared: LP 123/99—Recorder Data Analysis.

Analysis

The analysis of the accident will discuss the effect of the unserviceable instruments found during testing, the final portion of the ILS approach, crew decision making during the visual landing, the lack of crew coordination during the approach, passenger evacuation, and ERS response.

The glide slope indicator's lack of responsiveness found during testing was probably overcome in the air by aircraft vibration, since the captain's instrument was performing adequately in flight. In addition, during the latter part of the approach, the aircraft was above the glide slope, in which range the instrument was not sticking. Since the crew indicated that they became visual at 300 feet above runway elevation, the unserviceability of either the captain's altimeter or the radar altimeter had no adverse effect on the approach. The error in the first officer's
airspeed indicator would have caused him to call out airspeed deviations with a five-knot error; however, because the aircraft's speed remained above V_{Ref} until touchdown, a five-knot error in his calls would have been of no consequence.

An excessive power setting by the PF caused the aircraft to become high on the glide slope as the range to the runway decreased from 2.5 to 1 nm. When the runway environment became visible to the crew, the aircraft rate

of descent again decreased and the aircraft flew further above the glide slope. This latter deviation from the glide slope probably occurred because both crew members diverted their attention outside the cockpit to concentrate on visual references to the runway. While both crew members were aware that the aircraft was high and badly positioned for landing, neither crew member voiced concern about the progress of the approach.

During the approach, there was no discussion between the crew members and there was a lack of calls by the first officer regarding glide slope and airspeed deviations, which likely contributed to the poorly-flown approach. A crew practising good CRM techniques would have ensured that each pilot was aware of how well the approach was progressing and how effective the approach was in positioning the aircraft properly for the landing.

A landing at Dryden was possible for the accident aircraft under the ambient conditions because an estimated landing distance of 4700 feet was required and a landing distance of 6000 feet was available. However, this distance is based on a threshold crossing height of 50 feet and a threshold crossing speed of 109 knots. Because both of these parameters were exceeded, the likelihood of a successful landing was reduced. A decision to execute a missed approach or to continue to land depended on the captain's judgement of the aircraft's position and amount of runway remaining to land from the approach he had flown. The captain's decision to land was not altered during the approach; his predisposition or mind-set negated the visual cues that should have shown the ILS had not been accurately flown and that the aircraft was badly positioned for landing.

A review of appropriate literature indicates that when one makes a series of sequential, related decisions, there is a tendency not to change or modify the preceding decision as readily as the available information would otherwise suggest as prudent. This apparent reluctance to change a decision may, in part, be the result of a state of expectancy or predisposition (mind-set) which can distort what is perceived.

It is not known why the crew did not move quickly to evacuate the aircraft after engine shutdown. Two of the passengers who saw a fire in the tail pipe of the left engine were unable to attract the crew's attention, and one passenger walked forward and insisted that the main door be opened. After at least two minutes following engine shutdown, a crew member, the first officer, left his seat to assist in the evacuation of the passengers. The decision by the crew to not request ERS was not an informed decision. The aircraft had collided with lighting structures and propeller blade tips had broken off and damaged the aircraft structure. The possibility of a fire caused by fuel leaking on the hot brakes could not be immediately ruled out.

Findings as to Causes and Contributing Factors

1. The approach was flown such that the aircraft was about 90 feet too high and about 40 knots too fast at the threshold.

2. The captain landed the aircraft with about 2000 feet of runway remaining; about 3875 feet of runway was required to stop the aircraft after landing.

3. Crew coordination during the approach and landing was minimal and ineffective, which likely contributed to the poorly-flown approach.

Findings as to Risk

1. The crew did not assess the condition of the aircraft and communicate clearly to the FSS whether ERS should be activated.

2. The crew did not take action to evacuate the aircraft in a timely manner.

Other Findings

1. Airport staff arrived at the aircraft in about three minutes and promptly established communications between the aircraft captain and the airport manager.

2. Several cockpit instruments were defective, but this did not contribute to the accident.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 01 November 2000.