Cessna 208B Caravan, LN-PBB

AAIB Bulletin No: 5/2000 Ref: EW/C99/09/02 Category: 1.2

Aircraft Type and Registration:	Cessna 208B Caravan, LN-PBB
No & Type of Engines:	1 Pratt & Whitney PT6A-114 turboprop engine
Year of Manufacture:	1992
Date & Time (UTC):	6 September 1999 at 1034 hrs
Location:	Sumburgh Airport
Type of Flight:	Public Transport (Cargo)
Persons on Board:	Crew - 2 - Passengers - Nil
Injuries:	Crew - Nil - Passengers - N/A
Nature of Damage:	Severe damage to the propeller, all three landing gears and the lower and rear fuselage structures
Commander's Licence:	Commercial Pilot's Licence (Norwegian) with Instrument Rating
Commander's Age:	32 years
Commander's Flying Experience:	1,780 hours (of which 500 hours were on type)
	Last 90 days - 90 hours
	Last 28 days - 50 hours
Information Source:	AAIB Field Investigation

History of flight

The operating company were involved in a RoyalMail contract to deliver mail from Aberdeen to Shetland Islands each day. Thecrew involved in the accident had flown LN-PBB from Stauning Airport in Denmarkto Aberdeen in preparation for a two week period of duty delivering the mail;they arrived at Aberdeen at 1700 hrs on 5 September 1999.

The next morning, the crew arrived for dutyat approximately 0540 hrs and completed their normal checks of LN-PBB. Shortlyafter this, the mail arrived and was escorted to the aircraft by the companyground crew. The mail bags were sorted and loaded into the aircraft by theflight and ground crew under the supervision of the commander; the mail hadbeen weighed by Royal Mail

and the commander was given written confirmation ofthe total weight of 1,196 kg. At the completion of the loading, the commanderwas satisfied that the load was secure and correctly distributed. Prior todeparture for Sumburgh Airport, the commander had checked the weather and wasaware that it was 'poor' at Sumburgh but the indications were that it wouldimprove; additionally, the weather at Kirkwall Airport was clear if they neededto divert.

The aircraft appeared fully serviceablduring start, taxi and take off from Aberdeen at 0640 hrs; for the flight toSumburgh, the commander was the handling pilot. Cruise was at Flight Level (FL)90 and, about half way to Sumburgh, ATC advised the crew of the latest weatherat Sumburgh which indicated that they would not be able to land there. However,there was a preceding aircraft heading for the same destination and thecommander elected to continue towards Sumburgh. Then, once the precedingaircraft crew had declared that they were diverting to Aberdeen, the commanderdecided to divert to Kirkwall. The diversion was uneventful and the aircraftlanded at 0807 hrs.

At Kirkwall, the crew uplifted sufficientfuel to bring the total up to the same with which they had left Aberdeen (1,200lb) and waited for a weather improvement at Sumburgh. By approximately 0930hrs, the crew were advised by Kirkwall ATC that the weather had improved atSumburgh and they prepared the aircraft for departure. Take off was at 0950 hrswith the co-pilot as handling pilot. Cruise was at FL 70 and was uneventful upto the approach and landing. The airport was using Runway 27 as that is theonly runway with full ILS. The ATIS information at 1020 hrs was broadcastingthe following information: surface wind 340°/07 kt; 9,000 metres in rain; cloudfew at 300 feet, scattered at 1,000 feet and broken at 1,600 feet;temperature 12°, dew point 12°; tempo cloud broken 1,500 feet with a wetrunway. In accordance with ATC instructions, the crew commenced their descentto 2,000 feet amsl where they were instructed to intercept the ILS from aheading of 300°. Once fully established on the ILS, the commander noted thatthe co-pilot was having a little difficulty maintaining the aircraft on boththe localiser and glide slope. The co-pilot was not sure of the height at whichthey broke cloud but the commander estimated that they were at 500 feet agl. Atthis point, the co-pilot considered that they were slightly high and fast;subsequently, the commander estimated the aircraft airspeed as 140 kt as theybecame visual with the runway. During the final approach, the air trafficcontroller gave three separate wind reports of 010°/11 kt, 010°/11 kt and010°/10 kt; these reports were based on the two minute mean surface winds. Asthe aircraft crossed the runway threshold, the co-pilot called out that he hadtoo much speed and that "it wasn't going to work". With no reply fromthe commander, the co-pilot took this lack of response as an indication thatthe commander was content. For his part, the commander was concentrating on therunway aspect and, although he heard a comment from the co-pilot, did not makeany response. The crew considered that touchdown was approximately halfway downthe runway and the co-pilot was aware of the aircraft bouncing before a secondtouchdown; neither pilot could recall the speed at touchdown. Both pilotsapplied full foot braking but with little apparent result in retardation. Then,as the aircraft approached the end of the runway, the commander took controland applied full power; this was because he was aware of the concrete blockspositioned off the end of the runway as a sea defence and wished to clear them.The aircraft was now yawed slightly left and positioned to the left of therunway centreline. It left the runway surface, travelled across grass and apublic road and came to rest on the concrete blocks.

The response of ATC and the RFFS to theemergency was prompt and effective.

Engineering investigation

Examination of the runway could notestablish the point where the aircraft first touched down or if a bounce andsecond touchdown took place. Also, there was no evidence on the runway

ofaquaplaning having occurred. Approximately 140 metres from the end of therunway and just to the left of the runway centreline, there was visibleevidence of heavy braking from the right main landing gear. There was not thesame evidence from the left main landing gear. The evidence of heavy braking onthe right main landing gear continued along the runway for approximately 110metres during which the aircraft veered well to the left of the centreline. Inthe area of the 09 runway threshold marks, the evidence of heavy brakingdisappeared. The aircraft continued a further 30 metres before it left thetarmac runway surface and entered the grassy overrun area. There was wheel markevidence within this grassy area to indicate that all three landing gear wheelswere in contact with the ground, the aircraft was yawed to the left and therewas no apparent braking taking place. The aircraft then crossed a publichighway and entered a second grassy area. Here, there was no evidence of thenose landing gear wheel being in contact with the ground and no evidence ofbraking taking place. After travelling across the second grassy area, theaircraft crossed approximately 25 metres of tarmac and the concrete sea wall,which was level with the tarmac area. In this area there was good evidence ofall three landing gear tyres being in contact with the ground and aquaplaningoccurring by the two main landing gear tyres. Finally the aircraft departed thesea wall and descended into an area of sea defences which consisted ofapproximately 2 metre square concrete blocks. The impact with the concreteblocks brought the aircraft to a rapid halt which prevented it going into thesea. Because the forward fuselage was below the high water mark the airportauthority removed the wreckage to a safe location on the airport prior to thearrival of the AAIB. The total distance from the first heavy braking mark tothe aircraft's final resting place was approximately 275 metres.

Examination of the wreckage revealed that itimpacted the sea defences at about 50 kt, with high power on the propeller,with the propeller blades in a positive pitch position and with the wing flapsretracted. The forward lower area of the fuselage had been severely damaged bythe impact which had broken and disrupted the flying control systems and thelanding gear hydraulic system. Examination of these systems showed that theyhad all been intact and functioning correctly prior to the impact. Examinationof the main landing gear wheels and brake units showed them to be serviceableand the tyres exhibited damage consistent with the ground marks observed on therunway and in the overrun area.

Eye witnesses

There were numerous eye witnesses to theaccident. The air traffic controller estimated that the aircraft landed at theintersection with Runway 15/33, bounced and then touched down again on thetouchdown zone markings for Runway 09. The intersection is located some 300metres from the threshold of Runway 09 and the touchdown markings are locatedsome 170 metres from the same threshold.

Other eye witnesses were located at thetraffic lights positioned either side of the runway on the public road close tothe threshold of Runway 09. Those positioned to the north of the runway had an uninterruptedview of the latter half of the Runway 27; they considered that the aircraftlanded close to the intersection with Runway 15/33.

A video camera was operating at the southerntraffic lights and this recorded the aircraft passing the threshold; at thatpoint all three landing gears were on the ground.

Weather information

Prior to departure from Aberdeen, the crewhad obtained weather information. The METAR for Aberdeen showed good weatherwith no cloud below 3,500 feet. The METAR for Sumburgh at 0450 hrs showeda surface wind of 180°/11 kt, visibility of 3,000 metres in rain, cloud brokenat 200 feet, temperature of 13° with a dew point of 13°. The METAR forKirkwall at the same time showed a surface wind of 350°/10 kt, visibility of +10km in rain, cloud few at 300 feet and broken at 500 feet, temperature of 13°and a dew point of 12°.

There was no TAF for Sumburgh included onthe TAF Bulletin 3 but the TAF for Kirkwall from 0600 hrs to 1300 hrsindicated the following weather: 270°/10 kt; visibility of +10 km; cloud few at1,500 feet, scattered at 2,500 feet and broken at 4,000 feet; TEMPO 7,000metres in rain; PROB 30 TEMPO 4,000 metres in rain, cloud broken at 700feet; becoming 340°/10 kt between 600 hrs and 0900 hrs.

At Kirkwall, the crew received furtherweather information about Sumburgh. The METAR for 0920 hrs showed asurface wind of 330°/10 kt, visibility of 4,000 metres in rain, cloud few at300 feet, scattered at 1,200 feet and broken at 2,000 feet. The TAF issuedat 0845 hrs and valid between 1000 hrs and 1900 hrs indicated the followingweather: 350°/10 kt; visibility of 7,000 metres in rain; cloud scattered 300feet and broken at 500 feet; TEMPO visibility of 1,000 metres, cloud few at 100feet and broken at 200 feet; PROB 30 TEMPO visibility +10 km, cloud scatteredat 700 feet and broken at 1,500 feet.

The air traffic services assistant locatedin the Sumburgh Tower took a weather observation immediately after theaccident. This was similar to the ATIS at 1020 hrs and was as follows: surfacewind 340°/7 kt; visibility of 9,000 metres in moderate rain; cloud few at 300feet, scattered at 1,000 feet and broken at 1,400 feet; air temperatureand dew point of 12°; QNH of 1016 Mb.

Airport information

Runway 27 at Sumburgh has a Landing DistanceAvailable of 1093 metres (3,586 feet). A flight inspection of the ILS had beencarried out on 17 and 18 June 1999 and the system conformed to the requiredstandards. Following the accident, a ground inspection of the facilityindicated that it was fully serviceable.

There are 3° PAPIs located 198 metres fromthe displaced threshold of Runway 27. All the runway lights including the PAPIswere on at the time of the accident. Subsequently, the PAPI angles were checkedand confirmed as accurate; the crew of LN-PBB could not recall seeing the PAPIsduring their approach and landing.

The runway condition had been formallychecked on 2 February 1999. At that time, the Mu readings varied between 0.81and 0.90. Following the accident a further inspection of the runway surface wascarried out. This occurred on 8 September 1999 with moisture conditions similarto those existing on the day of the accident; this revealed average readingsbetween 0.68 and 0.75. All these readings indicate good braking action. Additionallyduring heavy rain, a visual check by AAIB investigators of the last third ofthe left side of Runway 27 revealed no standing water.

Radar information

Subsequent to the accident, a radarrecording of LN-PBB was obtained from Sumburgh Radar. Calculations indicatethat the average groundspeed of the aircraft from 2,000 feet agl to touchdownwas approximately 170 kt; touchdown appeared to be at least 1/2 along therunway. A

further calculation indicated that the average groundspeed from 500feet agl (height at which the crew became visual with the runway) to touchdownwas approximately 140 kt. This last calculation confirmed the crew'srecollection of speed as they became visual with the runway.

Company information

The aircraft operating company provided thefollowing information from their operating manuals:

1. The threshold speed for the aircraft was 90 kt.
2. Both the commander and the co-pilot had completed courses in Crew Resource Management although there was no specific national or company requirement to do so.
3. The weather limitations for operating the aircraft in UK was a minimum visibility of 1 nm and a minimum cloud base of 1,000 feet ceiling. Note: Cloud ceiling, as defined in the UK Air Navigation Order (ANO), in relation to an aerodrome means the vertical distance from the elevation of the aerodrome to the lowest part of any cloud visible from the aerodrome which is sufficient to obscure more than one-half of the sky so visible.
4. There was no specific information included within the manuals to require a crew to be stabilised at a specific height during the approach.

Air Navigation Order (ANO)

The aircraft were operating under Article32A of the UK ANO. This states that:

'An aeroplane which is not registered in theUnited Kingdom and is powered by one engine only shall not fly for the purposeof public transport at night or when the cloud ceiling or visibility prevailingat the aerodrome of departure and forecast for the estimated time of landing atthe aerodrome at which it is intended to land and at any alternative aerodromeare less than 1,000 feet and 1 nautical mile respectively.'

Analysis

The aircraft overran the end of Runway 27 atSumburgh following a touchdown which was too fast and well down the runway.There was insufficient runway remaining for the aircraft to stop. The landingresulted from a poor approach and no apparent co-operation between the crew. Apositive decision from the co-pilot, or better monitoring and an active inputfrom the commander, should have resulted in a go-around and a further approachor a diversion. While this crew may be unusual, it would be appropriate for theoperating company to review their procedures to ensure that their crews areoperating in a safe manner.

The investigation also reviewed the rulesunder which the flight was conducted. Examination of the weather informationavailable to the crew indicate doubts as to whether the flight could have beencompleted within the limitations contained within company manuals.Additionally, Article 32A of the UK ANO is not clear; it could be interpretedas only prohibiting flights when the weather conditions are not met at allof the relevant aerodromes. It would be appropriate for the CAA to review thecontent of Article 32A to ensure that the intent is clear.

Safety recommendations

It is recommended that:

Recommendation No 2000-20

The Norwegian Authorities require theoperating company of LN-PBB to review their operating procedures.

Recommendation No 2000-21

The CAA review the content of Article 32A ofthe Air Navigation Order and clarify it.