AVIATION INVESTIGATION REPORT
A02P0290

GEAR-UP LANDING

CANADA JET CHARTERS LIMITED
CESSNA CITATION 550 C-GYCJ
SANDSPIT AIRPORT, BRITISH COLUMBIA
12 NOVEMBER 2002

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Summary

The Cessna Citation 550 aircraft, C-GYCJ, serial number 5500561, departed Vancouver International Airport, British Columbia, on a medical evacuation flight to the Sandspit Airport in the Queen Charlotte Islands, British Columbia. On board the aircraft were two pilots and a team of two Advanced Life Support Paramedics. When the aircraft arrived at Sandspit, the surface wind was strong, gusty, and across the runway. The crew conducted an instrument approach to Runway 30, and just before touchdown the aircraft's nose pitched down; the captain believed that the nosewheel, and then the main gear, collapsed as the aircraft slid on its belly. The crew carried out an evacuation and proceeded to the airport terminal building. When they returned to the aircraft to retrieve their belongings, the crew discovered that the gear was in the up position, as was the landing gear selector. The accident occurred at 2052 Pacific standard time. There were no injuries. The aircraft was substantially damaged.

Ce rapport est également disponible en français.

Other Factual Information

The captain had been employed by Canada Jet Charters Ltd. as a Cessna Citation 550 pilot for three years. He was the non-flying pilot for this flight and occupied the right seat. He held a valid airline transport pilot licence endorsed for single and multi-engine land aeroplanes, a C550 type rating, and an instrument rating. His last pilot proficiency check had been conducted on a Citation simulator on 05 September 2002. He had accumulated approximately 4550 flying hours on various single and multi-engine aircraft and 1450 hours on the Cessna Citation 550. He was qualified to operate the aircraft as pilot-in-command (PIC) under instrument flight rules (IFR) and was qualified to occupy the right seat while his first officer acted as the flying pilot, from the left seat. He had been off duty for 24 hours before the accident flight.

The first officer had been employed by Canada Jet Charters Ltd. as a Cessna Citation 550 pilot for two years. He was the flying pilot for this flight and occupied the left seat. It is normal company practice for the first officer to occupy the left seat when he is the flying pilot, provided the captain is qualified to occupy the right seat. He held a valid airline transport pilot licence endorsed for single- and multi-engine land aeroplanes, a C550 type rating, and an instrument rating. His last pilot proficiency check had been conducted on a Citation simulator on 10 January 2002. He had accumulated approximately 3300 flying hours on various single- and multi-engine aircraft and 850 hours on the Cessna Citation 550. He had been off duty for 12 hours before the accident flight.

The two pilots checked in at the Canada Jet Charters facility at Vancouver International Airport at 1830 PST[1], where they were met by the two ambulance attendants assigned to the flight. The pilots reviewed weather briefing information and determined that the weather was suitable for the flight in accordance with IFR.

The reported weather at Sandspit Airport at 1800 was as follows: wind 170° true at 6 knots; visibility 20 statute miles; a few clouds at 5200 feet above ground level (agl), a few clouds at 7400 feet agl, and broken clouds at 21 000 feet agl; temperature 11°C; dew point 10°C; altimeter setting 29.03 inches of mercury. The forecast weather for Sandspit Airport for the period from 1800 to 2200 was as follows: wind 160° true at 10 knots gusting to 20; prevailing visibility more than 6 statute miles; scattered clouds based at 500 feet agl, broken clouds based at 2500 feet agl; temporarily between 1800 and 2200, visibility two statute miles in light rain showers and mist; broken clouds at 500 feet agl, overcast clouds at 1500 feet agl.

The aircraft departed Vancouver at 1918. The first officer was the flying pilot. The flight was routine until 2021 when the crew obtained the Sandspit weather observation from the automated weather observation system (AWOS). This observation, taken at 2020, reported the wind to be from 220 degrees magnetic at 30 knots, gusting to 37 knots. The crew carried out a briefing for a VOR/DME approach for Runway 30 and in view of the strong, gusting crosswind at Sandspit, decided to land with flaps at the approach (15°) position, instead of the landing (full) position. Runway 30 is asphalt covered, 5120 feet long and 150 feet wide. They completed the descent checklist and began their descent from flight level (FL) 350 for the approach to

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

Sandspit at 2035. They completed the transition-level checklist through FL180, and the 10 000-foot checklist. At 2045, at an altitude of approximately 10 000 feet, the speed brakes were selected out and remained out for the rest of the flight.

During the approach, the crew received numerous radio transmissions from the AWOS and the Terrace, British Columbia, Flight Service Station (FSS) regarding the Sandspit weather. At the appropriate point in the approach, flaps were selected to the approach position. The landing gear warning horn sounded four times before the aircraft passed EBGAM, the final approach fix (FAF), and was silenced by the crew each time.

The first officer did not call for the landing gear to be extended, nor did he call for the before-landing checklist to be completed. The captain did not remind the first officer to extend the landing gear and accomplish the before-landing checks. The before-landing checklist in use called for the speed brakes to be *as required* while the before-landing checklist contained in the Federal Aviation Administration (FAA) approved Aircraft Flight Manual (AFM) called for the speed brakes to be *retracted prior to 50 feet*. After passing the FAF, the landing gear warning horn sounded three more times but was again silenced each time.

At 2051, at about two nautical miles from the runway threshold, the captain remarked that the precision approach path indicator (PAPI) was not visible. He attempted to turn it on remotely by keying his microphone several times, but when that was unsuccessful, he made a radio transmission to the Terrace FSS to determine if the PAPI was working. The Terrace FSS response was to turn the runway lights up to full intensity, and the captain had to ask for the runway lights to be dimmed. By this time the aircraft was about 14 seconds from touch down.

After initial contact with the runway, the aircraft bounced several times with diminishing force as it slid down the runway. It then veered to the right side of the runway, breaking five runway lights with its right wing, veered to the left, and came to a stop on a heading of approximately 280 degrees magnetic, about 500 feet from the end of the runway. The aircraft sustained substantial structural damage.

The design of the Cessna Citation 550 landing gear warning system is such that if the gear is not down and the flaps are selected to the land position, the warning horn sounds and cannot be silenced. With the flaps at the approach position and the gear not down, the warning horn sounds when a thrust lever is retarded below about 70% N1, but the horn can be silenced. If it is silenced, there will be no further aural warning should the gear not be extended, unless either thrust lever is advanced above the reset position and then retarded.

Records show that the aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures. The aircraft was manufactured in 1987 and had flown a total of 8143.5 hours before the accident flight. A review of the journey, airframe, and engine logbooks showed nothing remarkable. The aircraft was being operated within its weight and centre-of-gravity limits. It was equipped with a cockpit voice recorder (CVR) which was removed and shipped to the TSB Engineering Branch laboratory for analysis.

The aircraft was not equipped with a ground proximity warning system (GPWS), nor was it required to be so equipped under Canadian Aviation Regulations (CARs). The GPWS is designed to generate aural and visual warnings if the aircraft enters a flight path toward the ground that would lead to a collision with terrain, or for a landing with an incorrect landing

configuration. Had the aircraft been equipped with GPWS, during the approach to Sandspit, the GPWS mode 4 would have activated at an altitude, measured by the radio altimeter, of 500 feet above the ground, generating warning lights and the aural warning "TOO LOW, GEAR".

Analysis

Canada Jet Charters' standard operating procedures (SOPs) call for the before-landing checklist to be completed prior to the aircraft passing the FAF on a non-precision approach. This was not done despite the landing gear warning horn sounding four times before the FAF, and a further three times between the FAF and touchdown. Each time the horn sounded, it was silenced by the crew.

At two miles from the runway, on final approach, when the captain remarked that he could not see the PAPI, the captain became occupied with getting the PAPI turned on. As a result, the intensity of the runway lights was increased, requiring a further call from the captain. These distractions, and the numerous radio transmissions to the aircraft regarding the Sandspit weather, likely resulted in the crew forgetting that the gear had not been extended and the before-landing checklist not completed.

Findings as to Causes and Contributing Factors

1. The crew did not complete the before-landing checks, ignored aural warnings, and did not lower the landing gear, which resulted in a gear-up landing.

Findings as to Risk

1. The aircraft was not equipped with a GPWS, which could have prevented this accident.

2. The before-landing checklist in use did not reflect the AFM requirement that the speed brakes should be retracted prior to 50 feet.

Safety Action

On 10 January 2003, the TSB issued an Aviation Safety Information Letter to Transport Canada, with a copy to the B. C. Ambulance Service, regarding the design of the Cessna Citation 550 landing gear warning system. The letter also showed that a GPWS would provide defences against the risk of landing with the landing gear retracted.

As a result of the letter, the B. C. Ambulance Service decided to require the fitting of a GPWS system to all fixed wing aircraft operated on their behalf by contracted carriers.

On 14 February 2003, Transport Canada responded, describing a proposed amendment to the Canadian Aviation Regulations regarding implementation of Class "A" and Class "B" Terrain Avoidance Warning Systems (TAWS). The response letter indicated that if the amendments were promulgated, and depending on class, installation and operator, TAWS might provide defences against landing with gear retracted. These proposed amendments have subsequently been accepted in principle. If the proposals become regulations, they will require aircraft such as the Cessna Citation 550 to be equipped with TAWS. A C550 operating under CAR 704 would require, as a minimum, a Class B TAWS if configured with six to nine passenger seats. A Class A

TAWS with a display would be required for an aircraft configured with 10 or more passenger seats. There would be no requirement for an aircraft configured like the occurrence aircraft to be equipped with TAWS.

This report concludes the TSB's investigation into this occurrence. Consequently, the Board authorized the release of this report on 03 July 2003.

Visit the TSB's Web site (www.tsb.gc.ca) for information about the TSB and its products and services. There you will also find links to other safety organizations and related sites.