

Adopted: 1/8/91

Log 2269



## National Transportation Safety Board

Washington, D.C. 20594

### Safety Recommendation

DCA 89 MA 076

Date: January 28, 1991

In reply refer to: A-91-11 through -12

Honorable James B. Busey  
Administrator  
Federal Aviation Administration  
Washington, D.C. 20591

On September 27, 1989, Grand Canyon Airlines flight "Canyon 5," a de Havilland DHC-6-300 Twin Otter, N75GC, was operating as a scheduled sightseeing flight under 14 CFR 135 from Grand Canyon National Park Airport, Tusayan, Arizona. The flight was to last about 50 minutes. The airplane carried 19 passengers and 2 flight crewmembers.<sup>1</sup>

The first officer and captain of flight Canyon 5 reported for duty at 0640 and 0715 mountain standard time, respectively. Canyon 5 was to be the first of three aircraft to depart for the 0800 scheduled tour flight; however, the flight was changed to the number two tour position because air had to be added to the airplane's tires. Canyon 3 assumed the number one position. The airplanes also remained in that sequence for the 0900 tour flight. The first tour was uneventful, and Canyon 5 departed on the second tour about 0900. A video tape taken by one of the passengers on the accident flight showed that the takeoff, tour, and approach to the airport were normal.

The flightcrew of America West Airlines flight 1080 in a DHC-8 was holding short of runway 21 waiting for its departure clearance when Canyon 5 made its approach. The crew observed Canyon 5 in a normal attitude, about 5 feet above the runway, as the aircraft "floated" about 1,000 feet down the runway. The first officer observed Canyon 5 touch down and bounce 5 feet into the air. He stated that it "looked as if the pilot was struggling with a cross wind but there was not much wind." He commented that if there was any more than about 10 to 15 knots of wind, they would have felt the effects of it in their aircraft. He expected Canyon 5 to land again and glanced into the cockpit of his airplane. Approximately 5 seconds later, he saw a large cloud of red dust in his peripheral vision, refocused his attention to Canyon 5, and called the captain's attention to Canyon 5. The first officer observed Canyon 5 emerging from the dust cloud in an "unusually" nose-high

<sup>1</sup>For more detailed information read, Aviation Accident Report--"Grand Canyon Airlines, de Havilland DHC-6-300, Twin Otter, Flight Canyon 5, N75GC, Grand Canyon National Park Airport, Tusayan, Arizona, September 27, 1989." (NTSB/AAR-91/01)

attitude and climbing to 150 to 200 feet. The left wing began drop as the airplane drifted to the left and appeared to be "tail walking (oscillating about the vertical axis). Canyon 5 slowly lost altitude as continued to attain a steeper angle of bank, and the nose fell below the horizon in a near vertical left bank.

Survivors of Canyon 5 reported that the takeoff, around landing approach appeared to be normal as the airplane made a right turn lined up with the runway. They stated that the pilot in the right seat, flying the airplane and that the pilot in the left seat had been narrating the tour. During the landing, two passengers noted that the airplane traveled along the runway at a low altitude for what seemed to be a long time, a situation they thought unusual because the airplane should have been landed. Several passengers stated that initially the airplane touched down, then bounced back into the air followed by a hard landing on the right wheel. Two passengers believed that the right wing tip also contacted the ground. One survivor, a private pilot, stated that there was a drop and a hard hit which bounced the airplane about 15 feet. He then felt a "floating" sensation as if there was no response to controls and then "hitting" a second time. He stated that upon hitting the second time, the captain took over the controls applying full throttle power. Several passengers recalled that at this point there was yelling in the cockpit. The passenger who was a private pilot heard one of the crewmembers shouting "come up, come up," which he believed was addressed to the airplane. Several passengers reported that the airplane then went into a steep nose-up attitude and a left bank. Most of survivors reported hearing the buzzing sound or stall warning horn after the airplane left the ground the second time, and a few recalled seeing a red light in the cockpit. Several passengers reported that after the airplane touched down the second time both the captain and first officer had their hands on the controls on the ceiling between the pilot seats. However, they were unable to identify the controls that each pilot was manipulating.

Grand Canyon Airlines' procedure for landing was to leave the engine condition levers<sup>2</sup> in the cruise position until touchdown. At touchdown, the nonflying pilot was to move the condition levers forward to the takeoff/reverse or the high idle thrust position. The airline's procedure was for the flying pilot to control the power levers and the nonflying pilot to control the condition levers during final approach. In the DHC-6, the power levers are located at the front of the overhead panel near the captain's seat, and the condition levers are located to the right of the power levers. When the first officer is flying the airplane, he must reach across the condition levers to grasp the power levers. The captain must then reach behind and around the first officer's arm in order to grasp the condition levers.

An instructor pilot with Grand Canyon Airlines stated that when landing on runway 21, full flaps (37.5° but normally referred to as flaps 40°) were usually selected about 2 miles out at approximately 7,500 mean sea

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<sup>2</sup>The engine condition lever controls the propeller governor, whereas the engine power lever controls the engine fuel control unit.

level (MSL) or about 900 feet above ground level. He said that engine power is usually set to 10 psi of torque and maintained until the airplane enters ground effect. He stated that touchdown ideally occurs at idle power with the first sound of the stall warning horn and the squeak or chirp of the tires occurring simultaneously. He believed that bounces occur in training because of inexperience and that it takes from 10 to 15 knots excess airspeed above the stall airspeed for bounces to occur with full flap landings at idle power settings.

The investigation sought to determine the factors that might have caused the pilots to lose control of the airplane during the go-around. During the dynamic situation while the airplane was right wing down and heading for the side of the runway, the pilot's reaction might have been to raise the nose and add power for an anticipated go-around. At airspeeds near stall, the downwash on the horizontal stabilizer tends to raise the nose of the airplane, requiring the control yoke to be pushed forward to maintain a normal pitch attitude for the same trim setting. If the pilot pulled back on the control yoke while adding power, this could have resulted in the airplane lifting off in a nose-high, power-on stall or near-stall condition. In addition, the visual reference may have been misleading. According to the operations manual for the DHC-6, with 40° of flaps, the airplane's deck angle is below the flight path angle during a go-around. Therefore, an increase in pitch to a "typical" noseup reference attitude while the flaps were at 40° would increase the possibility of aerodynamic stall and subsequent loss of lift.

The Safety Board believes that during the period after the wing tip strike and the last liftoff in which the tower controllers and the pilots on the ground saw the airplane "tail walking" and moving to the left with the left wing down, the airplane was climbing primarily on the power of the engines, and the airplane wing was in a partially stalled condition. A fully stalled condition probably developed during the final seconds prior to and during the descent to impact. Despite the possibility that only limited or even no aileron roll control authority was available due to damage sustained when the right wing tip struck the ground, the Safety Board could not determine why the flightcrew could not control the roll excursion with rudder input. In addition, the Safety Board could not determine why the flightcrew did not reduce the pitch of the airplane unless the left wing downroll angle was of primary concern in the final moments of flight as the airplane moved to the left toward the crash site.

Without the benefit of a CVR, the investigation could not examine the flightcrew's actions before the bounce or while attempting to recover from the bounced landing. Statements by survivors indicate that the captain took control of the airplane about the time of the second touchdown, that power was added after the wing tip struck, and that yelling took place in the cockpit during the accident sequence. However, it could not be determined exactly when the captain took control of the airplane, or the nature of the communication between the pilots.

It is known that although the captain took control of the airplane, he did not prevent the airplane from landing on the right wing tip and the outside of the right tire. His corrective actions were either too late or improper because control of the airplane was lost at ground contact.

The statements by survivors about crewmembers' yelling may indicate that the pilots were confused about whether they should initiate a go-around or stay on the ground and attempt to regain control of the airplane on the runway. This confusion could have been present after the first bounce when the first officer was having difficulty relanding the airplane, or after the second touchdown and wingtip strike.

Under this scenario, it is possible that one crewmember may have initiated a go-around, while the other's initial reaction could have been to stay on the ground. Such confusion, if it was present, could have prompted the crew to react improperly after initial touchdown when immediate and coordinated action might have resulted in a successful go-around or landing. The Safety Board notes that this type of confusion can only be minimized by close teamwork and adherence to detailed operational procedures.

The Safety Board is concerned that Grand Canyon Airlines' procedure of not moving the condition levers to the maximum RPM position until touchdown may have added to the crew's workload and confusion during the bounced landing. For the captain to take command of the airplane, he would have had to push up the condition levers and then grasp the power levers. This additional action could have delayed the captain's acquisition of control from the first officer. Additionally, because the first officer was grasping the power levers during the approach, both crewmembers could have had their hands on the power levers simultaneously or the captain could have put his hand over the top of the first officer's hand. In the latter situation, the first officer's hand could have been trapped momentarily by the captain. Such a situation could have delayed the first officer's ability to reach the flap lever and reset the flaps.

In summary, the Safety Board concluded that the flightcrew used poor piloting techniques while trying to land the airplane. The captain's supervision of the first officer was inadequate, and his intervention during the attempted landing was untimely or improper. To an unknown extent, confusion and resulting poor crew coordination may have complicated the captain's attempt to intervene and recover the airplane.

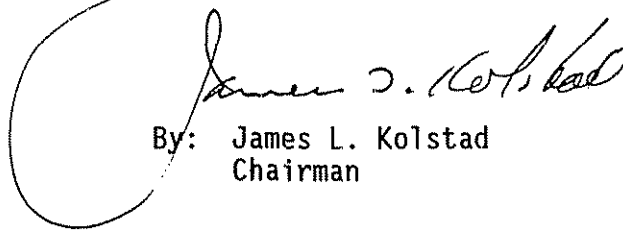
Additionally, the Safety Board concluded that the procedures used by Grand Canyon Airlines of landing with full flaps and not setting the condition levers to maximum RPM position until touchdown may have complicated the pilots' workload. The Safety Board believes that the FAA should require that the procedures used are compatible with the crew coordination training for emergency or unusual situations and that the go-around maneuver from stall or near stall airspeeds can be easily initiated and implemented under the existing conditions, such as at high density altitudes and high gross weights while at maximum flap settings.

Therefore, as a result of its investigation of this accident, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Determine whether airline procedures 1) requiring the pilots to coordinate and set the condition levers to maximum RPM position after touchdown and/or 2) allowing the airplane to operate with full flaps while at high gross weights and high density altitudes, are consistent with a safely initiated and implemented go-around maneuver in a DHC-6-300 from a stall or near-stall condition. (Class II, Priority Action) (A-91-11)

Require that captain upgrade and recurrent training programs include training on techniques for proper supervision of first officers and intervention to correct flying errors during critical phases of flight. (Class II, Priority Action) (A-91-12)

KOLSTAD, Chairman, COUGHLIN, Vice Chairman, LAUBER, BURNETT and HART, Members, concurred in these recommendations.

A large, stylized handwritten signature in black ink, which appears to read "James L. Kolstad". The signature is written over the printed name and title.

By: James L. Kolstad  
Chairman