

Icing Triggers Stall on Takeoff

Challenger crew lacked winter flying experience.

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The following information provides an awareness of problems that can be prevented in the future. The information is based on final reports on aircraft accidents and incidents by official investigative authorities.

JETS

Wings Not Checked for Contamination

Canadair Challenger 600. Destroyed. Three fatalities, three serious injuries.

The flight crew landed the airplane at Montrose (Colorado, U.S.) Regional Airport about 0910 local time Nov. 28, 2004, to refuel during a charter flight from Van Nuys, California, to South Bend, Indiana, (see *Aviation Safety World*, July 2006, page 10). The airplane was being operated by Air Castle Corp. doing business as Global Aviation.

The airplane was on the ramp about 45 minutes in a light snowfall with the auxiliary power unit operating. The first officer, 30, who had 1,586 flight hours, including 30 flight hours in type, remained in the cockpit. The captain, 50, who had 10,851 flight hours, including 913 flight hours in type, observed the refueling. The lineman who conducted the refueling told investigators that the captain examined the underside of the right wing near the right main landing gear but remained near the wing tip and walked away from the airplane when the refueling was completed.

The flight crew did not request deicing services, said the report by the U.S. National

Transportation Safety Board (NTSB). Cockpit voice recorder (CVR) data indicated that about 16 minutes before takeoff, the captain asked the first officer, "How do you see the wings?" The first officer said, "Good," and the captain said, "Looks clear to me." A witness, a pilot, on the ramp said that he did not see either pilot conduct a tactile examination of the wing surfaces.

The captain's logbooks indicated that during winter months from January 2000 to November 2004, he had conducted 18 flights at airports in Canada and the northern United States. "None of the flights were performed in winter weather conditions similar to the conditions that prevailed for the accident flight," the report said. Investigators found no documentation that the first officer previously had operated an airplane in winter weather conditions.

The airport was reporting 1.25 mi (2.01 km) visibility in light snow and mist, a few clouds at 500 ft and an overcast ceiling at 900 ft. Temperature was 1 degree C (34 degrees F), and dew point was minus 2 degrees C (28 degrees F). Airport elevation was 5,759 ft.

At 0949, the crew started the engines, and the first officer radioed on the common traffic advisory frequency that they were taxiing to Runway 35, which was 10,000 ft (3,050 m) long. The airport operations manager radioed that snow-removal operations were being conducted on the runway.

The Challenger was near Runway 31, which was 7,500 ft (2,288 m) long and 150 ft (46 m) wide. The airport operations manager told investigators that a snowplow had cleared a 40-ft



(12-m) swath down the center of the runway along its entire length.

After some discussion, the crew decided that the airplane's runway-length requirement was 7,200 ft (2,196 m) if they did not use engine bleed air for the anti-ice systems during takeoff. "We'll go for three one then. You agree?" the captain said. The first officer replied, "These numbers are always conservative anyway."

The report said that the runway-length requirements discussed by the crew were for a dry runway. "According to the QRH [quick reference handbook] available to the flight crew, the required takeoff runway length for the airplane, given the runway conditions and the use of anti-ice systems, was greater than 11,000 ft [3,355 m]," the report said. Before takeoff, the crew selected the bleed-air anti-ice system for the engine cowlings.

As the airplane was taxied to Runway 31, a passenger recalled seeing "slushy clumps of snow and water" slide across his window.

The crew began the takeoff at 0958. The report said that the airplane accelerated normally to rotation speed. Soon after rotation, however, the CVR recorded the sound of an aural alert that accompanies activation of the airplane's stick-pusher (stall-prevention) system. The report said this indicates that although angle-of-attack (AOA) was high, a positive rate of climb had not been achieved. "An aerodynamically clean airplane at a similar calculated airspeed would have begun establishing a positive climb rate after rotation at an AOA lower than that required for activation of the stick-shaker or stick-pusher," the report said.

The airplane was not equipped with, and was not required to be equipped with, a flight data recorder (FDR). Passengers said that the airplane was about 20 ft to 50 ft above the runway when it abruptly banked left, right and left, and then struck the ground. The initial impact occurred 44 ft (13 m) off the left side of the runway and about 636 ft (194 m) from the departure end. The airplane then slid about 1,390 ft (424 m), and a fire erupted. The captain, flight attendant and a passenger were killed; the

first officer and two passengers received serious injuries.

NTSB said that the probable cause of the accident was "the flight crew's failure to ensure that the airplane's wings were free of ice or snow contamination that accumulated while the airplane was on the ground, which resulted in an attempted takeoff with upper wing contamination that induced the subsequent stall and collision with the ground." A contributing factor was "the pilots' lack of experience flying during winter weather conditions."

Based on the findings of the investigation, NTSB recommended that the U.S. Federal Aviation Administration "develop visual and tactile training aids to accurately depict small amounts of upper wing surface contamination, [and] require all commercial airplane operators to incorporate these training aids into their initial and recurrent training."

Rapid Rotation Blamed for Tail Strike

Boeing 737-800. Minor damage. No injuries.

Surface winds at the Sydney, Australia, airport were from 030 degrees at 20 kt, gusting to 30 kt, when the flight crew began a takeoff from Runway 34L for a passenger flight to Darwin on Feb. 1, 2005. The pilot-in-command (PIC) and copilot sensed that the tail struck the runway during lift-off. A flight attendant confirmed that an unusual noise was heard during rotation.

The crew conducted the checklist for a tail strike on takeoff and returned to the airport for an uneventful, overweight landing. "An engineering inspection [showed that] a crushable cartridge, fitted to minimize damage during a tail strike, was damaged and required replacement," said the report by the Australian Transport Safety Bureau.

The report said that the PIC had applied an average rotation rate of 3.7 degrees per second and had increased the nose-up pitch attitude to 10.9 degrees during lift-off. FDR data showed that during the 23 previous takeoffs conducted in the airplane, the average rotation rate was 2.2 degrees per second and the average pitch attitude was 5.5 degrees.

The PIC had applied an average rotation rate of 3.7 degrees per second.

“While the PIC needed to react quickly and precisely to manage roll in the gusty crosswind conditions, a more measured input of pitch control was required during the aircraft’s rotation to maintain the allowable tail-clearance margin,” the report said. “The almost doubling of the average pitch rate of rotation during the takeoff indicates that the PIC exceeded the recommended rate. It is possible that the PIC used a similar style of control input for pitch that he was using to manage roll.”

Inexperience Cited in Ground Mishap

Embraer 170. Minor damage. One fatality.

A 5,900-lb (2,676-kg) mobile baggage belt loader was driven beneath the airplane while it was being prepared for a US Airways Express flight from Washington Reagan National Airport on June 6, 2005. The driver was wedged into her seat by the lower fuselage of the airplane and the belt loader’s steering wheel, which had been bent back and down on impact. She died of asphyxiation due to thoracic compression, said the NTSB report.

A witness told investigators that he believed the driver’s foot might have slipped off the brake pedal when she attempted to stop the belt loader. The report said that the driver was wearing leather shoes with hard rubber foam soles. The sky was overcast, but no precipitation was falling on the ramp; temperature was 68 degrees F (20 degrees C).

The driver had not driven a belt loader before being hired by the airline as a fleet service agent about a month before the accident and receiving driver training. NTSB said that the probable cause of the accident was “the inexperience of the driver (fleet service agent) in the operation of a belt loader.”

TURBOPROPS

Engine Shutdown Precedes Control Loss

Mitsubishi MU-2B-60. Destroyed. Two fatalities.

Soon after departing from Runway 35R at Centennial Airport in Englewood, Colorado, U.S., for a cargo flight on Dec. 10, 2004, the pilot told ATC that he needed to return to the

airport. While on left downwind for Runway 35R, the pilot — who had 2,495 flight hours, including 364 flight hours in type — declared an emergency and said that he had shut down one engine.

The controller observed the airplane overshoot the turn from left base to final approach and cleared the pilot to land on Runway 28 at his option. The pilot did not respond. A witness saw the airplane enter a steep left bank and descend to the ground.

Examination of the wreckage indicated that the left propeller had been feathered, but nothing was found that would have precluded normal operation of the left engine, said the NTSB report.

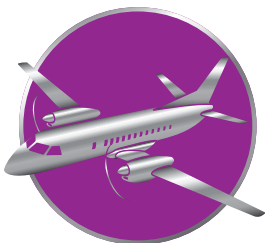
NTSB said that the probable cause of the accident was “the pilot’s failure to maintain minimum controllable airspeed during the night visual approach, resulting in a loss of control and uncontrolled descent into terrain.” A contributing factor was “the precautionary shutdown of the left engine for undetermined reasons.”

Ice Accumulation Forces Descent

Beech King Air 200. Substantial damage. No injuries.

Two pilots and two paramedics were aboard the airplane when it departed from Prince George, British Columbia, Canada, on Jan. 19, 2005, to pick up two patients in Cranbrook. Icing conditions were encountered during cruise at 15,000 ft. “The aircraft’s ice-protection equipment dealt effectively with the icing conditions until about 45 minutes after takeoff, when the aircraft began to accumulate ice at a rate that exceeded the capabilities of the ice-protection equipment,” said the report by the Transportation Safety Board of Canada (TSB).

Airspeed decreased from 230 kt to 150 kt, and the crew had to conduct a descent with maximum available engine power to avoid a stall. ATC cleared the crew to descend to 13,900 ft, the minimum safe altitude for the area, but the crew said that they were unable to maintain altitude. When the airplane descended below 10,800 ft, the minimum obstacle clearance altitude for the area, ATC provided radar vectors away from high terrain and toward Kelowna, which had visual meteorological conditions (VMC). The report



said that the airplane descended at 1,500–2,000 fpm in a power-on stall condition.

“Several minutes later, the pilots advised that they were clear of cloud and proceeding to Kelowna,” the report said. “Accumulated ice, up to six inches [15 cm] thick, was shed during the approach to Kelowna, where an uneventful landing was made.”

The report said that none of the weather information the pilot had reviewed on an Internet site before the flight had indicated forecast or actual icing conditions along the route. However, the pilot had not reviewed the graphical area forecast, which called for mixed moderate icing conditions along the route between the freezing level and 16,000 ft.

The airplane operator removed the King Air’s engines from service after the incident because they had been operated in excess of maximum inter-turbine temperature and torque limits for about seven minutes during the flight.

Refueling Postponed, Then Omitted

Embraer EMB-110P1. Substantial damage. One serious injury.

After landing at Savannah (Georgia, U.S.) International Airport on the morning of Dec. 9, 2005, the pilot radioed a fuel order. While exiting the airplane, she was told by another pilot that he had heard a “popping noise” from an engine. The pilot, who had 2,250 flight hours, including 195 flight hours in type, was conducting an engine run-up when the fuel truck arrived. “The pilot elected not to refuel the airplane at that time and continued the run-up,” said the NTSB report. “No anomalies were noted during the run-up, and the airplane was taxied back to the ramp and parked.”

The pilot returned to the airport that night to conduct a positioning flight to pick up cargo in Columbia, South Carolina. “[She] did not reorder fuel for the airplane, nor did she recall checking the fuel tanks during the preflight inspection,” the report said.

The airplane departed from Savannah at 2100 local time and was in cruise flight when the “FUEL” annunciator light illuminated. The fuel-quantity indicators showed less than 200

lb (91 kg) of fuel remaining. The pilot told ATC that the airplane had minimum fuel and requested radar vectors to the nearest airport. Both engines lost power on final approach to Orangeburg (South Carolina) Municipal Airport, and the airplane struck trees about 0.25 nm (0.46 km) from the runway at 2240.

NTSB said that the probable causes of the accident were “the pilot’s inadequate preflight inspection and her failure to refuel the airplane, which resulted in total loss of engine power due to fuel exhaustion.”

PISTON AIRPLANES

Stress Causes Landing Gear Failure

Beech Queen Air. Substantial damage. No injuries.

The airplane was on a cargo flight from Coventry, England, to Knock, Ireland, on Dec. 20, 2005. Because of adverse weather conditions at Knock, the commander diverted the flight to Sligo, Ireland, which had “benign” weather conditions with surface winds from 170 degrees at 12 kt, said the report by the Irish Air Accident Investigation Unit.

The airplane veered left after touchdown on Runway 11 and departed the runway onto grass. Neither pilot was injured. The commander, 62, who had 10,208 flight hours, including 83 flight hours in type, told investigators that he taxied the airplane slowly back onto the runway and to the apron.

The airport manager told investigators that he was concerned that the landing gear might collapse, causing the airplane to block the runway, and he instructed the commander to stop taxiing. “The aircraft was manhandled to the parking area, with one individual keeping the port [left] wheel in line,” the report said.

Examination of the airplane showed that the left main landing gear torque link had fractured at both its lower and upper attachment points. The report said the fractures were caused by a “single-event overload” that occurred because the airplane was landed with the left wing low and either with the wheel brakes applied or with significant lateral drift and a tail-low attitude.



No Forecast of Mountain Wave Activity

Cessna P210N. Destroyed. Two fatalities.

About 2030 local time on Feb. 10, 2005, the airplane was cruising at 9,000 ft over mountainous terrain during a charter flight from Fresno, California, U.S., to Santa Monica when the pilot reported extreme turbulence and requested a lower altitude. “The aircraft then dropped off [ATC] radar, and no further radio transmissions were received,” the NTSB report said.

The wreckage of the airplane was found near Lebec, California, two days later. The pilot and his passenger had been killed.

The report said that no advisories for turbulence at 9,000 ft were in effect when the accident occurred. An automated weather observation system near the accident site was reporting wind gusts to 45 kt.

NTSB said that the probable cause of the accident was “the pilot’s in-flight loss of control due to the flight’s encounter with unforecasted localized mountain wave activity with severe to potentially extreme turbulence, downdrafts and rotors.”

HELICOPTERS

Vortex Ring State Cited in Loss of Control

Agusta–Bell 412HP. Substantial damage. One fatality, two minor injuries.

The air ambulance crew were conducting their ninth approach during an air-sea rescue training flight for the Swedish army on March 25, 2003. Weather was clear, and winds were light. During the approach, the flight crew followed an exercise plan in which, after bringing the helicopter to a hover about 100 ft above the water, the commander operates the cyclic control and anti-torque pedals to maneuver the helicopter laterally while the copilot operates the collective control to maneuver the helicopter vertically.

The final approach was conducted to a hole in the ice on a lake near Karlsborg with one medical orderly inside the cabin and another medical orderly on the right landing

skid. The helicopter was about 65 ft above the water when a high descent rate developed. The copilot’s attempts to reduce the descent rate failed, and the helicopter struck the ice, said the Swedish Accident Investigation Board’s report. The helicopter rolled over on impact, and the ice broke.

The pilots and the medical orderly inside the cabin exited the helicopter as it began to sink. “Outside the helicopter, the commander tried to help [the other] medical orderly ... by holding his head above the surface,” the report said. “However, he was finally obliged to let go as the helicopter sank deeper.” The commander had not been able to release the orderly’s safety harness because the orderly had donned his life vest over the harness.

The report said that the flight crew had used increasingly higher airspeeds and tighter flight paths during the approaches, and that the helicopter’s pitch attitude was unusually high during the last approach. The high descent rate had developed when the helicopter, with a high power setting and zero airspeed, sank into the main rotor downwash and entered a vortex ring state, also called settling with power, in which airflow through the rotor is disturbed.

A contributing factor was the “simultaneous maneuvering by both pilots, [which] allowed small or no chance of discovering in time that they were approaching the helicopter’s limit for safe flight,” the report said.

Glassy Water Cited in Roll-Over

Bell 206B. Substantial damage. One fatality, two minor injuries.

The float-equipped helicopter was engaged in water-sampling operations at several lakes north of Vancouver, British Columbia, Canada, on Oct. 26, 2005. Aboard the helicopter were the pilot and two Environment Canada employees, all of whom wore life vests. The TSB report said that the pilot had extensive experience flying helicopters and the passengers recently had received underwater emergency escape training.

After landing on eight lakes, the pilot attempted to land on Devil’s Lake. The winds



were calm, “and the water was quite glassy and shaded from the sun by hills,” the report said. “When glassy water conditions exist, humans are not able to judge with accuracy the distance to the surface of the water by looking at it.” The helicopter was not equipped with a radio altimeter.

The pilot conducted a shallow approach to the middle of the lake, using visual cues from the shoreline 200–400 m (656–1,312 ft) away and small ripples on the water. “Before the pilot anticipated touching down, the helicopter struck the surface of the lake and flipped onto its back,”

the report said. “It remained afloat supported by the floats, but the cabin was submerged.”

A main rotor blade had fractured on contact with the water and had penetrated the front of the helicopter. The pilot and front-seat passenger had been struck by debris. The report said that the pilot’s helmet had protected him from serious head injuries, but the front-seat passenger had received critical head injuries and was unconscious. The front-seat passenger was rescued from the helicopter by the rear-seat passenger, but she died about six days later from her injuries. ●

Preliminary Reports				
Date	Location	Aircraft Type	Aircraft Damage	Injuries
May 24, 2006	Georgetown, Bahamas	Israel Aircraft Industries Westwind	substantial	5 minor, 3 none
The airplane was on an air-ambulance flight from San Juan, Puerto Rico, to Norfolk, Virginia, U.S., in nighttime visual meteorological conditions (VMC) when the left generator failed. The crew diverted the flight to Florida but then encountered additional electrical system problems, including low battery voltage. They declared an emergency and diverted to Exuma International Airport. A total electrical system failure apparently occurred during approach. The right main landing gear tire burst after touchdown, and the airplane veered off the right side of the runway about 0055 local time.				
May 28, 2006	Narita, Japan	Boeing 767-300	none	none
The flight crew were distracted during climb and did not set their altimeters to 29.92 in Hg. While leveling at their assigned flight level, 260, they received a terrain awareness and warning system resolution advisory.				
May 29, 2006	Dortmund, Germany	Saab 340	NA	none
Soon after departing from Dortmund for a scheduled passenger flight to Poland, the airplane was struck by lightning, which caused a loss of some flight instruments. The crew returned to Dortmund and landed without further incident.				
May 30, 2006	Juarez, Mexico	Schweizer 269D	destroyed	3 fatal
The helicopter, operated by the Mexican government, was on a local flight in VMC when it struck terrain.				
May 30, 2006	Chantilly, Virginia, U.S.	Embraer 170	substantial	1 serious, 60 none
The crew were not able to raise the landing gear handle after departing from Houston for a scheduled United Express flight to Washington Dulles International Airport. They conducted the abnormal checklist, and the landing gear retracted. During a visual approach to Runway 19R at Dulles, the crew observed a “LG LEVER DISAG” message and conducted a go-around. The crew found that the main landing gear had extended but the nose landing gear had not extended. After briefing the flight attendants and passengers of the problem, the crew conducted an emergency landing on Runway 19L. After stopping the airplane on the runway, an evacuation was conducted using the slides at the two rear doors. One passenger suffered a broken ankle during the evacuation.				
May 30, 2006	Washington	Eurocopter EC-135P1	substantial	1 fatal, 3 serious
The helicopter was on an emergency medical services flight between two hospitals in Washington. The pilot, who had 15,613 flight hours, including 914 flight hours in type, said that the helicopter began to “shuffle” and no. 1 engine speed increased during the first approach to the helipad. He reduced power from the no. 1 engine and conducted a go-around. The pilot said that he was maneuvering the helicopter for another approach when it began to vibrate and then entered a spin. The helicopter struck a tree and the ground at a golf course. The preliminary report said that the patient, who was critically ill, later died in the hospital for reasons not yet determined.				
May 31, 2006	Juneau, Alaska, U.S.	Bell 206L-1	substantial	3 minor, 4 none
The preliminary report said that flat lighting and whiteout conditions existed as the pilot maneuvered the helicopter above a glacier during a charter sightseeing flight. The main rotor blades struck the ice, and the helicopter descended onto the glacier.				
June 1, 2006	Bocas del Toro, Panama	British Aerospace Jetstream 31	substantial	18 NA
Rain was falling at the airport when the Air Panama flight overran the runway on landing and came to a stop in a marsh.				

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Preliminary Reports				
Date	Location	Aircraft Type	Aircraft Damage	Injuries
June 2, 2006	Groton, Connecticut, U.S.	Learjet 35A	destroyed	2 fatal, 3 minor
Weather conditions at the airport included 2.0 mi (3.2 km) visibility in mist and a 600-ft broken ceiling when the airplane struck approach lights and water near the approach end of Runway 05. Both pilots were killed.				
June 3, 2006	Manassas, Virginia, U.S.	Dornier 328-300	substantial	2 minor, 6 none
The crew rejected a takeoff from Runway 34R because of an "altitude miscompare." The airplane overran the runway and was brought to a stop on a road.				
June 5, 2006	Bangalore, India	Bell 407	substantial	2 none
A hard landing occurred after rotor speed decreased during a training flight.				
June 5, 2006	Bandanaira, Indonesia	CASA 212	substantial	18 NA
There was heavy rainfall at the airport when the airplane veered off the runway on landing.				
June 6, 2006	Wuyishan, China	Boeing 737	NA	none
The runway reportedly was contaminated with water when the China Eastern Airways flight veered off the runway on landing.				
June 6, 2006	Gulf of Mexico	Bell 206L-1	none	1 serious, 3 none
A passenger was struck by the tail rotor while boarding the helicopter at an offshore platform.				
June 7, 2006	Medellín, Colombia	Boeing 747-200F	substantial	5 none
The Tradewinds International Airlines positioning flight overran the wet, 3,500-m (11,484-ft) runway after the crew rejected the takeoff because of an engine failure.				
June 9, 2006	Anyang, South Korea	Airbus A321	substantial	none
The Asiana Airlines flight encountered a hailstorm that destroyed the radome and weather radar equipment, and cracked the windshields, obstructing the flight crew's vision. An emergency landing was conducted without further incident in Seoul.				
June 15, 2006	East Midlands, England	Boeing 737-300	substantial	2 none
The airplane was on a cargo flight from Belgium to London Stansted Airport. Because of low visibility at Stansted, the crew diverted to East Midlands Airport and were conducting a Category III approach when the airplane touched down short of the runway, damaging the right main landing gear. The crew conducted a go-around, diverted to Birmingham and landed without further incident.				
June 15, 2006	Catania, Sicily	Boeing 737-400	NA	NA
The left nosewheel separated on takeoff from Catania. The flight, operated by Air One of Ireland, landed in Rome without further incident.				
June 17, 2006	San Juan, Puerto Rico, U.S.	Boeing 757	minor	177 none
The right engine failed during a US Airways flight from Saint Thomas, Virgin Islands, to Charlotte, North Carolina, U.S. The crew diverted the flight to San Juan and landed without further incident.				
June 20, 2006	Chicago	McDonnell Douglas MD-83	substantial	136 none
The crew of the American Airlines flight, inbound from Los Angeles, conducted a go-around during its first approach to O'Hare International Airport because of an apparent malfunction of the nose landing gear. The airplane circled the airport for about 45 minutes. The flight crew briefed the flight attendants and passengers about the problem and their intentions, and reportedly conducted a zero-g maneuver in an unsuccessful attempt to jar the nose gear loose. The crew then landed the airplane safely with the nose gear retracted.				
June 21, 2006	Jumla, Nepal	de Havilland Canada DHC-6	destroyed	9 fatal
The Twin Otter, operated by Yeti Airlines, struck a mountain during a go-around. Elevation of Jumla Airport is 9,400 ft.				
June 22, 2006	Colorado Springs, Colorado, U.S.	Excel-Jet Sport-Jet	substantial	2 minor
The experimental single-engine very light jet struck terrain during takeoff for a flight test.				
June 24, 2006	Upland, California, U.S.	Cessna Citation Ultra	destroyed	3 serious
Witness reports indicated that the airplane, inbound from San Diego, might have been on a go-around after touching down on the 3,865-ft (1,179-m) runway when it struck terrain and burned about 600 ft (183 m) from the departure end of the runway about 2225.				
NA = not available				
This information, gathered from various government and media sources, is subject to change as the investigations of the accidents and incidents are completed.				
Sources: Australian Transport Safety Bureau, Aviation Safety Network, <i>Flight International</i> , Flight Safety Foundation-Taiwan, <i>Flight Safety Information</i> , U.S. Federal Aviation Administration, U.S. National Transportation Safety Board				