

Turbulence Triggers Roll Upset, Stall

The 737 encountered a mountain wave on approach.

BY MARK LACAGNINA

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

JETS

Thrust Increase Caused Pitch-Up

Boeing 737-300. No damage. No injuries.

A rapid and slightly asymmetric increase in thrust during an encounter with turbulence while the 737 was in a low-speed turn led to a roll upset and a stall on approach to Antalya, Turkey, the morning of May 2, 2009, according to the French Bureau d'Enquêtes et d'Analyses (BEA).

The incident occurred during a flight with 110 passengers and five crewmembers from Marseille, France. The copilot was the pilot flying.

After nearly three hours en route, the flight crew began the descent from cruise altitude at 0655 coordinated universal time (0955 Antalya time). The 737 was over a “broken layer of cumulus with variable development,” the BEA report said. “The cabin manager confirmed to the captain that the cabin was ready for the landing and [that] the cabin crew [had their] seat belts fastened.”

The airplane encountered turbulence while descending through Flight Level 130 (approximately 13,000 ft) with a selected airspeed of 240 kt. During the turbulence encounter, the indicated airspeed “varied between 225 kt and 252 kt, while the vertical accelerations varied between

+0.54 g [i.e., 0.54 times standard gravitational acceleration] and +1.62 g,” the report said.

Shortly after the 737 encountered the turbulence, which the crew apparently did not report to air traffic control (ATC), the approach controller told the crew to reduce airspeed to the minimum for approach. “They selected 210 kt — that’s to say, 10 kt more than the clean-configuration maneuvering speed at the estimated weight,” the report said.

After descending to their assigned altitude, 11,000 ft, the crew observed through the windshield and on their weather radar display “a relatively compact cumulus about 2.5 nm [5 km] in diameter ... about 25 nm [46 km] from the runway threshold” and requested a deviation to the left to avoid it, the report said. “While they asked for a left-side avoidance maneuver where the sky was less cloudy, the controller cleared them for a right-side avoidance maneuver.”

The 737 was about 30 nm (56 km) from the airport at 0713, when the crew began the right turn. They were flying the airplane with the autopilot engaged in the heading- and altitude-hold modes, and with the autothrottle engaged in the speed-hold mode. Seconds after beginning the turn, with a bank angle of 25 degrees selected on the mode control panel, the airplane again encountered turbulence, which caused vertical accelerations between +0.5 g and +1.36 g. The autothrottle reduced thrust in reaction to the disturbance, and indicated airspeed decreased to 199 kt.

Shortly thereafter, while still in the right turn and experiencing a peak vertical acceleration of



+1.45 g, the crew overrode the autothrottle by moving the thrust levers forward. “The speed continued to decay while the engines responded to the throttle advance,” the report said.

The thrust levers apparently were not moved symmetrically, or the engines did not accelerate evenly. Low-pressure rotor speed (N_1) in the left engine reached about 98 percent, while N_1 in the right engine reached about 87 percent. The asymmetric thrust contributed to the initiation of a very high roll rate, with the right bank angle increasing through 57 degrees. The increased thrust produced by the underwing-mounted engines also caused the airplane to pitch 9.5 degrees nose-up.

The enhanced ground-proximity warning system (EGPWS) generated a “BANK ANGLE” warning, and the stick shaker activated. The crew reduced thrust and applied full left aileron and rudder. “The bank reached its maximum of 102 degrees to the right, and the minimum speed of 181 kt was reached,” the report said.

The airplane stalled and descended rapidly. Nose-up elevator control was being held as the right bank angle decreased through 90 degrees and the pitch attitude reached about 25 degrees nose-down. The airplane rolled through wings-level and into a 35-degree left bank. The crew applied nose-down elevator control and full thrust.

The upset lasted about 18 seconds, during which the 737 descended at up to 12,000 fpm in instrument meteorological conditions. After recovering control at 7,576 ft, the crew climbed back to 11,000 ft.

“At the request of ATC, the crew described the violent phenomenon they had encountered,” the report said. “After the landing, at 0727, takeoffs were suspended and airplanes on arrival put in holding for about 30 minutes.”

The report said that the airplane had encountered turbulence in the lower layer of a mountain wave. The 737’s optimum speed for penetrating turbulence below 15,000 ft is 250 kt.

According to the manufacturer, the first step in recovering from a stall is to reduce angle-of-attack, the report said. “Nose-down pitch control must be applied and maintained until the wings are unstalled. Under certain conditions,

on an airplane with underwing-mounted engines, it may be necessary to reduce thrust in order to prevent the angle-of-attack from continuing to increase. Once the wing is unstalled, upset recovery actions may be taken and thrust reapplied as needed.”

After the incident, the airplane operator instituted additional pilot training and a “pilot awareness campaign on the suddenness and violence of some environmental phenomena that may exceed the possible responses of the automatic systems and require the flight crew to intervene manually using the flight and thrust controls,” the report said.

Controller Loses Track

British Aerospace Hawker 800A. No damage. No injuries.

A reduced visibility operations plan was in effect at Calgary (Alberta, Canada) International Airport the morning of March 2, 2010. Only Runway 16 was in use, and runway visual range was 2,000 ft (600 m) in light snow and freezing fog, said the report by the Transportation Safety Board of Canada (TSB).

Fifteen aircraft were holding for departure. The Hawker was the first in a line of 12 aircraft holding on a taxiway near the approach threshold of Runway 16; two aircraft were holding on a taxiway farther down the runway; and one, a de Havilland Dash 8, was holding on Taxiway U at midfield.

A shift change had occurred in the airport control tower. After receiving a hand-off briefing, the airport traffic controller advised the flight crews of five aircraft of their sequence for departure. At the time, the Hawker was third in sequence, and the Dash 8 was fourth.

The controller cleared the Hawker crew for takeoff at 0942 local time. Six seconds later, the controller told the Dash 8 crew to line up and wait at the threshold of Runway 16, and to turn right to a heading of 193 degrees after takeoff. The Dash 8 crew “acknowledged the heading change and began to taxi slowly toward the hold line,” the report said. “The crew did not hear the controller’s reference to lining up at the threshold and did not indicate that they were at Taxiway U.”

The 737 descended at up to 12,000 fpm in instrument meteorological conditions.

The report said that the controller had “lost track of the location of [the Dash 8]” and did not check his electronic flight data display, which showed that the aircraft would begin its takeoff from the Taxiway U intersection.

The first officer of the Dash 8 was completing the “Before Takeoff” checklist when the captain “asked about the clearance and expressed concern about the recent takeoff clearance given to an aircraft at the threshold,” the report said. “By this time, [the Hawker] was accelerating through 85 kt.”

At 0944, the first officer “queried the airport controller to confirm that the tower hadn’t authorized anyone’s departure,” the report said. “The airport controller restated the instruction to line up, adding that they should be ready for an immediate departure.”

The Hawker had lifted off the runway about 2,900 ft (884 m) from Taxiway U and passed 400 ft above the intersection of Taxiway U as the Dash 8 crew began to taxi the aircraft onto the runway.

“Visibility was low enough to preclude the airport controller from visually seeing either aircraft or the runway,” the report said. The controller had been monitoring the runway threshold area shown on his airport surface detection equipment (ASDE) primary radar display for movement of the Dash 8. When he noticed a target moving near Taxiway U, he realized that it was the Dash 8 and that the Hawker was passing overhead.

Noting that the controller had complied with ATC requirements by instructing the Hawker crew to line up and wait at the threshold of Runway 16, the report said, “The flight crew was not obligated by regulation to read back the instruction, but to acknowledge it, which they did.”

However, the report also noted that the Transport Canada *Aeronautical Information Manual* “advises that, while acknowledging ATC instructions without a full readback is compliant with [Canadian Aviation Regulations], it is good operating practice to read back instructions to enter, cross, backtrack or line up on any runway.”

The ASDE’s runway incursion monitoring and collision avoidance system (RIMCAS) was not in use when the incursion occurred. The report said that because of the complexity of

the airport and its high level of traffic, “multiple RIMCAS alarms per hour” occur during normal operations, and the system is considered more of a nuisance than a safety feature.

The airport’s reduced visibility operations plan did not require RIMCAS to be active, an oversight that the report characterized as “a missed opportunity . . . to provide another layer of defense against collisions in low-visibility conditions.”

Gust Factors in Tail Strike

Boeing 747-400. Minor damage. No injuries.

Shortly after departing from Sydney, Australia, with 229 passengers and 17 crewmembers for a flight to San Francisco the afternoon of May 7, 2010, the flight crew was advised by ATC that the aircraft’s tail had struck the runway on takeoff.

“After completing the appropriate checks and dumping fuel, the crew returned the aircraft to Sydney and landed,” said the report by the Australian Transport Safety Bureau (ATSB). “A subsequent inspection revealed scrape damage to the aircraft’s lower rear fuselage consistent with contact with the runway surface.”

The automatic terminal information service had reported the surface winds as from 300 degrees at 10 kt when the flight crew performed the reduced-thrust takeoff from Runway 34L. The pilot-in-command (PIC) told investigators that during rotation, the aircraft’s response to his elevator control input was “slightly more aggressive than he would have liked and was expecting.”

“None of the crewmembers recalled feeling or hearing anything unusual during this phase, and there were no aircraft system alerts or other indications,” the report said.

Recorded flight data indicated that the 747 had encountered a gust that caused its airspeed to stagnate briefly during rotation. The aircraft lifted off the runway 6 kt below the target rotation speed of 173 kt. The initial rotation rate was about 2.2 degrees per second — or slightly below the nominal rotation rate of 2.5 degrees per second — but had increased to 4 degrees per second at liftoff.

The data also indicated that the PIC’s use of left aileron to counter a left crosswind had

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caused the flight spoilers to deploy, resulting in a slight loss of lift.

The report said that the airspeed loss due to the gust, the increased rotation rate and the lift reduction due to spoiler deployment were primary factors that contributed to the reduction of tail clearance leading to the tail strike.

“Another contributing factor was the reduced-thrust takeoff, which increased the aircraft’s exposure to wind variations during rotation,” the report said.

Damper Leaks Fluid Into APU

Airbus A320-211. No damage. Four minor injuries.

While preparing for a flight from Montreal to Toronto the morning of March 23, 2010, the flight crew noticed no anomalies during their inspection of the aircraft but saw a logbook entry that 6 L (6 qt) of fluid had been added to the “green” hydraulic system. “The entry included an instruction to monitor the quantity levels,” the TSB report said.

The crew detected an odor after starting the auxiliary power unit (APU). “Such odors are not uncommon and are often caused by engine washes or residue in the air conditioning system from the previous flight,” the report said. The odor dissipated after the crew increased the airflow and decreased the temperature in the cabin.

The odor returned shortly after takeoff but dissipated after cabin airflow and temperature again were readjusted.

The A320 was nearing cruise altitude when the crew received an indication of a low fluid level in the reservoir of the green hydraulic system, one of three hydraulic systems aboard the aircraft. They completed the applicable procedures, including disengaging the hydraulic power transfer unit and the engine-driven pump, which isolated the green hydraulic system.

The isolation of the green hydraulic system rendered several systems inoperative, including nosewheel steering, normal wheel brakes, normal landing gear extension and the left engine thrust reverser.

The crew decided to continue the flight to Toronto, which had better weather conditions

than Montreal. “Following an emergency extension of the landing gear, the aircraft made an uneventful landing on Runway 05 and came to a complete stop,” the report said.

Because of the inoperative systems, the aircraft had to be towed to the gate. While waiting for a tow vehicle to arrive, the crew started the APU and shut down the engines. Company procedure called for all doors to be closed during towing. After conferring with maintenance personnel, the crew re-engaged the green hydraulic system to close the landing gear doors.

“Almost immediately, smoke began to enter the cabin and cockpit,” the report said. The captain ordered an evacuation. The flight attendants told the passengers to leave everything behind, but several passengers took baggage and personal items with them.

Evacuation of the 98 passengers was completed in about two minutes. However, the slides had become damp in the light rain, and two passengers who exited with their baggage received minor injuries, including scraped knuckles and sore backs. Two crewmembers, who were the last to evacuate and were required to bring emergency equipment with them, sustained similar injuries.

Examination of the A320 revealed that fluid from the green hydraulic system had leaked through worn piston rod seals in a yaw damper actuator. The fluid had flowed down the aft fuselage and into the APU intake. “The APU had compressed and heated the fluid, which was then sent through the bleed air system to the air conditioning pack, through the filters and eventually into the cabin,” the report said.

TURBOPROPS

CFIT in a Mountain Gap

de Havilland DHC-6. Destroyed. 13 fatalities.

The Twin Otter was on a scheduled flight from Port Moresby to Kokoda, both in Papua New Guinea, the morning of Aug. 11, 2009, when it crashed in a mountain gap about 11 km (6 nm) southeast of Kokoda Airstrip. All 11 passengers and the two pilots were killed.



The accident site was in jungle on the eastern slope of the Kokoda Gap, at an elevation of 5,780 ft, said the report by the Accident Investigation Commission of Papua New Guinea (AIC).

The flight crew made no radio transmissions indicating that they were experiencing any difficulties. The aircraft was not equipped with, and was not required to be equipped with, a cockpit voice recorder (CVR).

The crew was operating on an instrument flight rules (IFR) flight plan but likely were attempting to descend visually through the mountain gap, the report said. “There were no navigation aids at Kokoda to assist crews during their arrival or departure from the airstrip.”

“At about the time of the accident, there was a solid bank of cloud situated at the junction of the Kokoda Gap and Kokoda valley,” the report said. “Witnesses at [a local village] stated that they observed an aircraft fly low over the village and that cloud obscured the eastern ridge of the gap at that time.” Witnesses at another local village said that they heard an aircraft flying low overhead but could not see it through the clouds.

The Twin Otter was banked 25 degrees right on impact. The accident likely occurred as the crew was maneuvering in an attempt to maintain or reacquire visual contact with the terrain, the report said. “The investigation concluded that the accident was probably the result of controlled flight into terrain [CFIT] — that is, an otherwise airworthy aircraft was unintentionally flown into terrain, with little or no awareness by the crew of the impending collision.”

In a response to an AIC recommendation generated by the findings of the accident investigation, the Civil Aviation Safety Authority of Papua New Guinea intends to require the installation of CVRs in turbine-powered aircraft with more than nine passenger seats.

Starved on Crossfeed

Beech King Air C90A. Substantial damage. No injuries.

Four days before the King Air departed from Key Largo, Florida, U.S., for a charter flight to Orlando on May 25, 2009, the pilot reported that the left fuel boost pump was

operating intermittently. “Maintenance [personnel] checked the pump but could not duplicate the intermittent discrepancy, and the airplane was approved for return to service,” said the report by the U.S. National Transportation Safety Board (NTSB).

Shortly after the airplane departed from Key Largo, the left boost pump failed, and the crossfeed valve automatically opened to enable the right boost pump to feed the left engine, as well as the right engine, with fuel from the right wing and nacelle tanks.

The PIC told investigators that he “looked at the emergency procedures checklist for boost pump failure but did not comply with the checklist and did not change the fuel control configuration,” the report said. “The PIC reported he did not see any urgency and elected to continue the flight [with the crossfeed system engaged], though he did not monitor the fuel quantity gauges.”

The report said that, in accordance with the checklist, the pilots could have disengaged the crossfeed system, so that the left engine-driven pump could suction-feed fuel from the left tanks, which contained a sufficient quantity of fuel.

During the descent to Orlando, both fuel pressure warning lights illuminated. Shortly thereafter, both engines lost power due to fuel starvation when the fuel from the right tanks was exhausted. The pilot turned toward a nearby airport but, realizing that the airport was out of glide range, extended the landing gear and landed the King Air in an open field near Yeehaw Junction, Florida. The airplane touched down hard and skidded, and the right main landing gear wheel assembly separated and struck the right horizontal stabilizer. The two passengers, the pilot and the copilot escaped injury.

“Postaccident inspection of the airplane revealed internal components of the left boost pump were worn ... and that the right no-fuel-transfer time delay relay was inoperative due to a broken terminal on the relay,” the report said.

‘The PIC did not comply with the checklist [and] did not monitor the fuel quantity gauges.’

The failure of the relay precluded illumination of a warning light indicating that fuel no longer was being transferred from the right wing tanks to the 60-gal (227-L) right nacelle tank. Had the warning light illuminated, “it is likely that the flight crew would have diverted earlier for an uneventful landing at a suitable airport,” the report said.

Fuel Leak Traced to O-Rings

Cessna 208 Caravan. No damage. No injuries.

Shortly after taking off from Runway 02 at Nelson (New Zealand) Aerodrome for a scheduled flight with four passengers to Wellington the morning of Feb. 20, 2010, the flight crew noticed an uncommanded reduction in torque and moved the power lever forward. Then, they detected a strong odor of fuel and saw a higher-than-normal fuel flow indication.

The PIC reduced power and told the airport traffic controller that he was returning to land on Runway 20. “He did this without declaring an urgency or distress situation,” said the report by the New Zealand Transport Accident Investigation Commission.

Another aircraft had been cleared to line up for takeoff on Runway 20, so the pilot landed the Caravan on an adjacent grass runway and taxied it to the apron.

Investigators found that the loss of torque had been caused by fuel leaking past O-ring seals that had been damaged by movement of the fuel-transfer tubes. The tubes “had been reduced in size [by 0.2 to 0.5 mm, or 0.008 to 0.020 in] at some time during maintenance by a chemical milling process that had removed the anodic protective coating,” the report said. The chemical milling, which had been done to clean the tubes, is not an approved cleaning method and is “contrary to good engineering practice,” the report said.

The report also said that the pilots should have declared an urgency or distress situation so that they would receive priority handling by ATC and ensure that emergency services would be readily available on arrival. “A fuel leak, especially near a hot engine, could have been serious,” the report said. “Fire could have broken out at any time.”

PISTON AIRPLANES

Loss of Control in Fog

Britten-Norman Islander. Destroyed. One fatality.

Visual meteorological conditions prevailed at Forteau, Newfoundland and Labrador, Canada, the morning of June 7, 2009, when the pilot departed on an emergency medical services (EMS) flight to pick up a patient at Port Hope Simpson Airport for delivery to St. Anthony. The airport did not have an approved weather-reporting system, but a local contact had told the pilot that fog was “down over the trees,” the TSB report said.

“It is common on the east coast of Labrador to have localized fog patches that clear up quickly after the sun heats the surface,” the report said.

The pilot had told the St. Anthony hospital dispatcher that he would turn back to Forteau if he could not maintain visual flight rules conditions. The Islander did not have an autopilot; thus, single-pilot operation in IFR conditions was prohibited. Moreover, the only instrument approaches available at the destination were global positioning system (GPS) approaches; although the aircraft had GPS equipment, the company was not authorized to conduct GPS approaches.

Nearing the destination, the pilot radioed an airport attendant who estimated that visibility was between 1/4 and 1/2 mi (400 and 800 m), and the ceiling was at about 200 ft. Shortly thereafter, witnesses heard the sounds of a sudden increase in power and an impact. The wreckage was found on a hill about 4 nm (7 km) from the airport.

The investigation concluded that the Islander had “departed from controlled flight, likely in an aerodynamic stall.” The report noted that the fog cleared about 30 minutes after the crash.

Takeoff on Fumes

Aero Commander 500S. Substantial damage. One fatality, one serious injury.

Shortly after taking off from Runway 07R at Daytona Beach (Florida, U.S.) International Airport the morning of May 25, 2009, the



pilot reported “an engine failure” and that he was returning to land on Runway 25R. The pilot was seriously injured and his passenger was killed when the airplane struck terrain short of the runway.

The pilot told investigators that he had conducted a “full” preflight and that the fuel quantity indicator showed 110 gal (416 L). However, maintenance records showed that the gauge had been replaced about a month earlier in an unsuccessful attempt to solve a fuel quantity indication problem known to the pilot. The maintenance technician had determined that the fuel system would have to be drained to enable further troubleshooting of the problem, and the pilot had decided to continue flying the airplane to reduce the fuel load before this was done.

The pilot said that both engines began “surging from full throttle to idle” on takeoff from Daytona Beach, and, after turning back to the airport, he “dropped the gear and gave it full flaps when I felt I had the runway made.” He said that he had “no recollection of the airplane stalling or the impact.”

The report said that only trace amounts of fuel were found in the two tanks, and 1.0 qt (0.9 L) of fuel was drained from the sump.

The Aero Commander was built in 1973 and was modified in 1978 with twin-turbocharged, eight-cylinder Lycoming IO-720 engines replacing the original six-cylinder IO-540s. Each of the 720s consumed about 40 gal (151 L) per hour at rated power. The airplane’s fuel capacity was 226 gal (855 L).

HELICOPTERS

Fan Fracture Affects Control

Bell 47G-2A-1. Substantial damage. One minor injury.

The helicopter had climbed about 200 ft on departure from Rolleston, Queensland, Australia, the morning of May 3, 2009, when the pilot heard a very loud bang and felt a jolt. “The helicopter immediately started descending, and the pilot noted that the forward/aft cyclic control was unresponsive,” said the ATSB report.

The pilot was able to use lateral cyclic control to turn away from trees as the 47 continued to descend with violent pitch changes. Nearing the ground, he raised the collective control to cushion the touchdown. However, the helicopter landed hard, causing the tail rotor to sever the tail boom. The pilot sustained a minor back injury.

Examination of the helicopter showed that three of the 16 engine cooling fan blades had fractured due to fatigue cracking and had struck the fan cowling. The cowling then separated and jammed the flight control linkages.

Investigators found that the cooling fan had not been reassembled correctly after maintenance. An imbalance resulting from the incorrect installation likely affected the fan’s vibration and resonance characteristics, and increased its susceptibility to fatigue failure, the report said.

Manual Dropped on Jettison Lever

Eurocopter AS 365-N3. Minor damage. No injuries.

The EMS helicopter was en route to the site of an automobile accident near Huber Heights, Ohio, U.S., at about 0300 local time on July 4, 2010, when the pilot accidentally dropped a flight manual onto the right-front passenger door jettison handle.

The NTSB report said that maintenance personnel had neglected to reinstall a plastic guard over the handle after a required inspection of the door. The dropped manual caused the handle to rotate, break its safety wiring and disengage the door’s upper hinge pin. The door’s middle and lower hinge pins did not disengage.

The passenger door remained in place, but its window bent outward, separated from its frame and struck the horizontal stabilizer.

When the pilot heard the loud bang, he was told by the flight nurse that the window had blown out. The pilot diverted to Moraine, Ohio, and landed the helicopter without further incident. ➤



Preliminary Reports, March 2011

Date	Location	Aircraft Type	Loss Type	Injuries
March 1	Hanoi, Vietnam	Airbus A320	major	NA
The right horizontal stabilizer and elevator struck a light pole as the A320 was being towed in darkness from a stand to a hangar.				
March 2	Forli, Italy	Cessna Citation S/II	major	3 minor/none
Visibility was reduced by snow and darkness when directional control was lost at about 100 kt during the takeoff roll. The emergency medical services (EMS) airplane veered off the left side of the runway, and the landing gear collapsed.				
March 2	Oslo, Norway	Fairchild Metro	major	11 minor/none
The Metro veered off the right side of the runway while landing in freezing fog at Oslo Gardermoen Airport. The nose landing gear collapsed.				
March 2	Birmingham, Alabama, U.S.	Bell 206	major	1 minor/none
During a functional check flight following replacement of the engine governor, the pilot performed an autorotative landing in an empty parking lot after hearing a loud bang and feeling the helicopter lurch.				
March 4	Nuuk, Greenland	Bombardier Dash 8	total	34 minor/none
Surface winds were from 160 degrees at 28 kt, gusting to 40 kt, when the Dash 8 veered off the right side of Runway 23 while landing at Godthåb Airport.				
March 4	Houston, Texas, U.S.	Learjet 25	minor	6 minor/none
Visibility was less than 1 mi (1,600 m) in fog when the EMS airplane touched down long and fast, overran the 7,600-ft (2,316-m) runway and struck the localizer antenna.				
March 5	Belgorod, Russia	Antonov An-148	total	6 fatal
The regional jet crashed during a functional check flight for customer familiarization. The right horizontal stabilizer was found 3 km (2 mi) from the main wreckage.				
March 8	Pellatt Lake, Northwest Territories, Canada	Eurocopter AS 350	total	3 minor/none
The survey helicopter was destroyed by fire after it struck a snow-covered lake in white-out conditions.				
March 10	Bakersfield, California, U.S.	Cessna 208 Caravan	major	1 minor/none
Day visual meteorological conditions (VMC) prevailed when the Caravan struck three parked vehicles while being taxied to the cargo ramp.				
March 12	Mulia, West Papua, Indonesia	Cessna 208 Caravan	major	10 minor/none
The Caravan veered off the right side of the runway and struck a ditch after the right main landing gear tire apparently deflated on landing.				
March 13	El Segundo, California, U.S.	Sikorsky S-58	total	1 serious
The helicopter was lifting an air-conditioning unit from the roof of an office building when it lost power and descended into trees.				
March 16	Long Beach, California, U.S.	Beech King Air 200	total	5 fatal, 1 serious
A witness said that the King Air climbed 200 ft after takeoff, "wobbled from side to side," rolled left and descended to the ground.				
March 18	Rurrenabaque, Bolivia	Xian MA-60	major	33 minor/none
The flight crew was unable to extend the nose landing gear on approach and landed the twin-turboprop with the nose gear retracted. The main landing gear collapsed during the ground roll.				
March 19	Toledo, Spain	Bell 407	total	6 fatal, 1 serious
Day VMC prevailed when the helicopter crashed en route to fight a fire.				
March 21	Pointe-Noire, Congo	Antonov An-12	total	4 fatal
The cargo airplane rolled inverted on approach and crashed in a residential area in day VMC. About 19 people on the ground are believed to have been killed, and 14 injured.				
March 24	San Clemente, Chile	Bell UH-1	total	1 fatal, 1 serious
Tail rotor failure is suspected in the crash of the helicopter during a fire fighting operation.				
March 29	Xinjiang, China	Cessna Citation II	total	3 fatal
The Citation is missing and believed to have crashed during a local flight.				
March 30	Pertisau, Austria	Eurocopter EC 135	total	4 fatal
A witness saw the border patrol helicopter flying low over the Archensee before it struck the surface of the lake.				

NA = not available

This information is subject to change as the investigations of the accidents and incidents are completed.

Source: Ascend