



## Business Jet Overruns Wet Runway After Landing Past Touchdown Zone

*Recorded radar data showed groundspeeds of more than 160 knots when the Cessna Citation 500 was on final approach. The aircraft struck a navigational-aid-support structure, terrain and two mobile homes off the departure end of the runway. The three occupants were injured during the impact, but they exited the aircraft before it was destroyed by fire.*

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*FSF Editorial Staff*

At 1548 local time on Jan. 6, 1998, a Cessna Citation 500 overran the runway while landing at Allegheny County Airport (AGC) in West Mifflin, Pennsylvania, U.S. The aircraft struck an instrument landing system (ILS) localizer antenna, terrain and two mobile homes. The pilot-in-command (PIC) and a passenger received minor injuries; the second-in-command (SIC) was seriously injured. The occupants exited through a torn section of the upper fuselage before the aircraft was consumed by a postaccident fire.

The U.S. National Transportation Safety Board said, in its final report, that the probable cause of the accident was “the failure of the pilot to make a go-around when he failed to achieve a normal touchdown due to excessive speed, and which resulted in an overrun.”

The report said that factors in the accident were reduced visibility in fog and the wet runway.

The Citation was manufactured in 1974 and was owned by a company based in Statesville, North Carolina, U.S. The company president was the PIC.



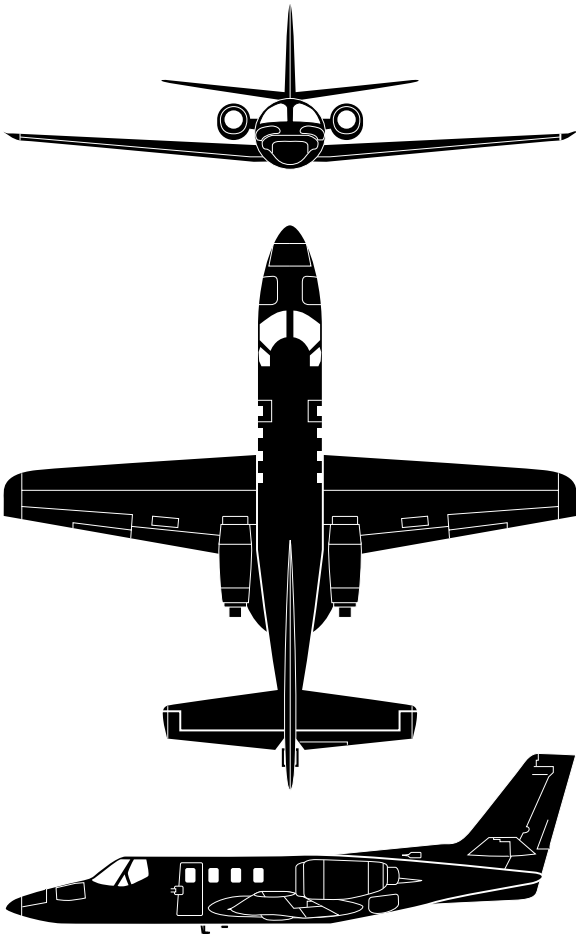
The report said that the company operated a “fleet of airplanes” for charter operations conducted under U.S. Federal Aviation Regulations (FARs) Part 135. The Citation was the company president’s personal airplane and was not used for charter operations.

“The airplane was originally certificated for two-pilot operations and had been modified for single-pilot operations,” said the report. “In addition, the wings had been extended in accordance with [U.S. Federal Aviation Administration (FAA)] supplemental type certificate (STC) SA2172NM, and the [Pratt & Whitney] JT15D-1 engines had been replaced with

higher-thrust JT15D-1A engines in accordance with STC SA8176SW.

“The airplane was not equipped with thrust reversers or an anti-skid braking system.”

The PIC, 44, had a commercial pilot certificate, a multi-engine airplane rating and an instrument rating. He had 3,745 flight hours, including 1,260 flight hours as PIC in type. His type rating in the Citation authorized him to fly the light, twin-turboprop business jet without a copilot.



## Cessna Citation 500

Cessna Aircraft Co. in 1968 announced that it was developing the Fanjet 500, an eight-seat, twin-turbofan airplane that would be capable of being operated from most airports used by light twin-engine airplanes. The name of the airplane was changed to Citation after the first flight of the prototype in 1969.

Cessna made several design changes before the first production Citation 500 was flown in 1971. Maximum takeoff weight was increased from 9,500 pounds (4,309 kilograms) to 10,350 pounds (4,695 kilograms).

The Pratt & Whitney JT15D-1 turbofan engines each produce 2,200 pounds (998 kilograms) of thrust. Maximum fuel capacity is 3,403 pounds (1,544 kilograms).

Maximum ramp weight is 10,500 pounds (4,763 kilograms). Maximum landing weight is 9,900 pounds (4,491 kilograms).

Landing field length at 7,800 pounds (3,538 kilograms) gross weight is 2,250 feet (686 meters). Stall speed in landing configuration and at maximum landing weight is 76 knots (141 kilometers per hour [kph]).

Cruising speed (true) with maximum cruise thrust at 25,400 feet is 348 knots (645 kph). Range with maximum cruise thrust at 35,000 feet is 1,340 nautical miles (2,482 kilometers).

Source: *Jane's All the World's Aircraft*

“He had flown 120 hours in the preceding 90 days, including 90 hours in make and model,” the report said. “A review of the PIC’s training record ... revealed that he had received his authorization to operate the Cessna 500 in single-PIC operations on April 6, 1997.”

Both passengers were pilots. The PIC said that the flight was conducted single-pilot. Nevertheless, the report referred to the passenger in the right cockpit seat as the SIC.

“The operator had employed the SIC for two months,” the report said. “She had flown with the PIC three previous times, including one previous time in the Cessna 500. When asked what her duties were, she reported that she read the checklist and set the radios.”

The SIC, 26, had a commercial pilot certificate, a flight instructor certificate with a multi-engine airplane rating and an instrument rating, and a Citation 500 type rating. She had 946 flight hours, including 150 flight hours in type, of which 60 flight hours were as PIC of the Citation.

“She had flown 62 hours in the preceding 90 days, including 20 hours in make and model,” the report said. “A review of FAA records revealed that she had passed a PIC check in the Cessna 500 on April 25, 1997.”

On the day of the accident, the aircraft was used for several personal business flights conducted under FARs Part 91. The PIC and SIC were aboard the aircraft for the first flight, from Statesville to AGC. The passenger boarded the aircraft in AGC. The aircraft then was flown to Akron-Canton (Ohio, U.S.) Regional Airport (CAK), where the passenger conducted a pre-purchase flight evaluation of a Learjet 24D for the PIC’s company.

“We departed [AGC] at approximately 1015,” the passenger said. “[The PIC] flew the airplane while [the SIC] operated the radios and acted in a limited capacity as copilot. The approach and landing at CAK were uneventful. I [then] conducted the evaluation of the Learjet, which took approximately four hours.”

The PIC intended to take the passenger back to AGC and then return to Statesville.

“We checked weather, filed an instrument flight plan and launched out of CAK about 1500 en route direct to AGC,” the PIC said. He said that the aircraft had 2,000 pounds (907 kilograms) of fuel.

The passenger said that, before departure, the PIC and SIC discussed the weather conditions at AGC and described them as “the same” as the weather conditions that they had encountered at AGC on the earlier flight. On departure from CAK and on approach to AGC, the passenger occupied a seat in the forward section of the cabin.

Pittsburgh Approach Control provided radar vectors to position the aircraft on the localizer for the ILS approach to Runway 28 at AGC.

The PIC said that the ceiling and visibility reported by the automatic terminal information system (ATIS) were lower than the weather conditions reported during their preflight briefing. Nevertheless, the PIC said that the weather conditions reported by the ATIS were “acceptable.”

The crew told Pittsburgh Approach at 1517 that they had copied the ATIS information. [The report did not identify which pilot made the radio transmission.]

The report did not include a transcript of the ATIS information but said that Pittsburgh Approach at 1530 told the crew that a new weather report had been issued and that surface visibility was 0.25 statute mile (0.4 kilometer), an indefinite ceiling was at 300 feet, temperature and dew point both were 14 degrees Celsius (57 degrees Fahrenheit), and surface wind was calm.

At 1533, the AGC air traffic control tower cleared the crew to land on Runway 28; the controller said that the wind was calm and that Runway 28 runway visual range was 700 feet (214 meters).

The passenger said that the PIC reviewed the missed-approach procedures and commented that they probably would not be able to land because of the limited visibility.

The PIC conducted the approach with the autopilot coupled. The required visual references were not observed when the aircraft descended to the published decision height at 250 feet above ground level (AGL), and the crew declared a missed approach. The tower controller told the crew to fly the runway heading and climb to 3,000 feet.

While conducting the missed approach, the PIC noticed that the weather conditions began to improve at mid-field.

“Visibility improved greatly at ... mid-field and through the approach end of Runway 10,” the PIC said. “I would estimate ceiling 300 [feet] and 1.5 miles visibility [with] light mist [and] fog.”

The crew told Pittsburgh Approach that they wanted to conduct the ILS approach to Runway 10, which had a 200-foot decision height. The controller said that the ILS approach to Runway 10 would be available no sooner than 10 minutes to 15 minutes.

The crew then requested the weather conditions at Pittsburgh (Pennsylvania, U.S.) International Airport (PIT) [which is approximately 18 nautical miles (33 kilometers) northwest of AGC]. After being told by the controller that the airport had two statute miles (three kilometers) visibility and a 700-foot ceiling, the crew said that they wanted to land at PIT.

The controller, however, then said that the ILS to Runway 10 at AGC was available and confirmed that the crew preferred to land at AGC. The controller provided radar vectors to position the aircraft for the ILS approach to Runway 10 at AGC and told the crew to “reduce to minimum approach speed.”

The PIC flew the approach with the autopilot coupled and the flaps extended 15 degrees. Reference speed for final approach ( $V_{REF}$ ) was 110 knots.

The passenger said that he saw an indicated airspeed of 160 knots when the aircraft was at about 700 feet AGL. Data recorded by Pittsburgh Approach showed that the groundspeed was more than 160 knots on final approach (see Figure 1, page 4).

“The data revealed that the airplane crossed the outer marker [an ILS navigational fix 5.3 nautical miles (9.8 kilometers) from the runway threshold] at a groundspeed of 163 knots and maintained a groundspeed of 164 knots until about 1.8 nautical miles [3.3 kilometers] from the approach end of Runway 10, at which time the groundspeed dropped to 158 knots,” the report said. “The airplane was unable to be tracked below an altitude of 1,800 feet ... due to surrounding terrain.” [Airport elevation is 1,252 feet, and decision altitude was 1,452 feet.]

The SIC said that the approach was conducted at an indicated airspeed of 140 knots and that the approach lights became visible about 75 feet above decision height.

The PIC said that the initial approach was conducted at an indicated airspeed of 130 knots until the approach lights became visible.

“The approach was normal, right on centerline, and we broke out well above [decision height],” the PIC said. He said that he reduced thrust to flight idle, extended flaps to the landing position (40 degrees) and made a “normal landing” about 100 feet (31 meters) beyond the numbers on Runway 10.

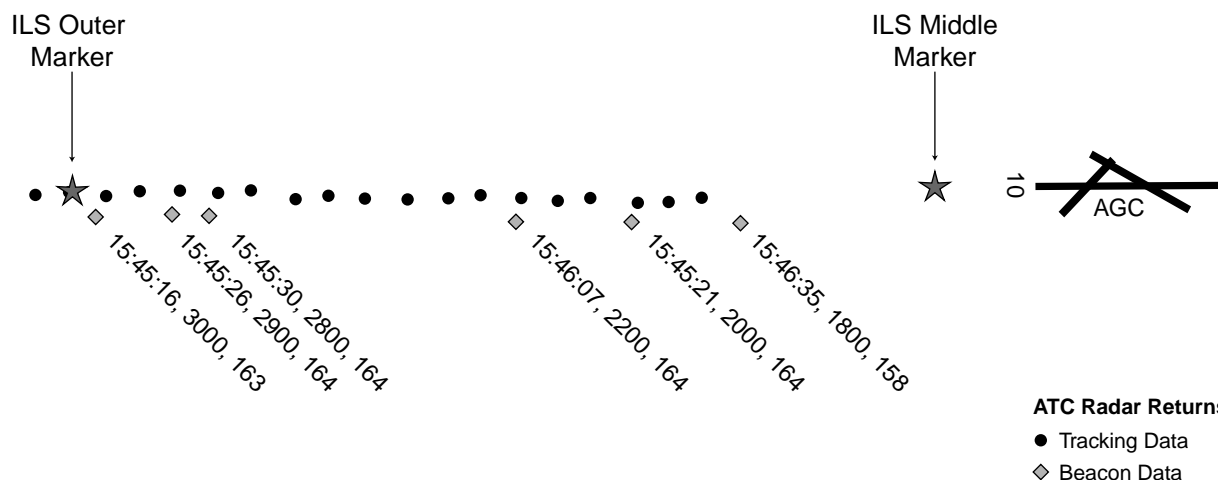
The witnesses in the airport control tower and the passenger said that the aircraft landed several hundred feet past the runway touchdown zone.

“The control-tower personnel reported that the airplane was airborne as it passed the intersection of Runway 13/31, where 2,500 feet of Runway 10 remained for landing,” the report said. “[The airplane then] disappeared into fog while still airborne.”

The passenger said, “There was a significant delay before the touchdown. I turned to see where we had touched down, and it appeared that we had approximately 3,000 feet of runway remaining. The aircraft did not decelerate as I expected and felt as if it was hydroplaning.”

The PIC said that he considered going around but that he believed that the aircraft would stop on the remaining runway.

## Air Traffic Control Radar Data; Cessna Citation 500; West Mifflin, Pennsylvania, U.S.; Jan. 6, 1998



Note: ATC radar beacon data returns are labeled with corresponding local time (hours:minutes:seconds), altitude (feet), and calculated groundspeed (knots). ATC radar did not track the aircraft below 1,800 feet.

AGC = Allegheny County Airport ILS = Instrument landing system

Source: U.S. National Transportation Safety Board and Flight Safety Foundation

**Figure 1**

“For an instant, a ‘go-around’ came to mind, but I elected not to attempt [a go-around] as I clearly saw the 3,000-foot [runway-remaining] marker several hundred feet ahead and, based on previous experience, felt that stopping in the remaining distance was assured,” said the PIC.

The PIC modulated brake pressure in an attempt to prevent the aircraft from hydroplaning.

“I used all available runway, looking for dry spots, and applied the brakes at all times, on as applicable and off when [the brakes] locked up,” the PIC said.

The PIC said that he was surprised by the amount of water on the runway.

“There was no report of standing water on the runway or [of] any other previous aircraft having trouble braking,” he said. “I had encountered no rain in the area.”

Runway 10/28 was 6,500 feet (1,983 meters) long and 150 feet (46 meters) wide. The runway surface was concrete and grooved; the runway was not crowned (i.e., higher in the center than on the edges, to facilitate drainage).

“During the investigation, small puddles of standing water were observed on the runway following periods of rain,” the report said. “The puddles were aligned with the seams between the concrete slabs, and the depth [of the water] in all cases was about

0.25 inch [0.6 centimeter] or less. A check with airport personnel revealed no previous problem with standing water on the runway and landing airplanes.”

The aircraft overran the end of the runway, crossed over a grassy area, became airborne momentarily while descending down a slope, struck a localizer-antenna support structure, struck a fence and came to rest against two mobile homes.

“A light skid mark was found on the runway, which started 257 feet [78 meters] prior to the departure end of the runway,” the report said. “The skid mark was aligned with a tire mark in the grass, which was identified [as having been made by] the right-main-landing-gear tire. ...

“Parallel tire marks were found in the grass at the end of the runway. The right-side tire mark was aligned with the skid mark found on the runway. The left-side tire mark was aligned with the white paint on the runway centerline, and no skid mark was visible on the white paint.”

The tire marks in the grass ended where the terrain begins a downward slope of 28 degrees. The fuselage passed between two poles supporting the localizer antenna; outer portions of both wing separated on contact with the poles.

The passenger said that the impact was “extremely violent.” He said, “I was aware of pieces of wood structure passing the window and an outer section of wing tearing off.”

The report said, “The ... impact marks found on the poles used to support the Runway 10 localizer antenna ... were located 98 feet [30 meters] further and 10 feet [3.1 meters] lower than the previous ground marks. The impact marks were about 13.5 feet [4.1 meters] above the ground.

“The outboard wing panels from both wings were found forward and outboard of the poles. The outboard wings had separated near the flap/aileron boundary. The airplane struck the ground, continued forward, penetrated a chain-link fence and came to rest against two mobile homes, 33 feet [10 meters] after striking the localizer antenna structure.”

The passenger said that the impact with the ground “stopped the aircraft and was much more intense than the [impact with the poles].”

A fire erupted in the left-rear section of the cabin, and thick smoke began to fill the cabin. The passenger attempted to open the cabin door, but the door was jammed.

“The pilot was yelling, ‘Get out, get out,’” the passenger said. “As I stood up, I noticed the copilot attempting to climb out the wreckage to my left. The pilot was also struggling, as his feet were entangled.

“The copilot was having great difficulty making her way out of the wreckage and started to fall back on me. I pushed her up, and she moved out of the airplane, and I followed. The pilot had freed himself and was climbing out at the same time.”

The passenger said that the left engine was running and began to spool up to high power as they exited the aircraft. Investigators found both power levers in the full-forward position. The passenger said that the cabin fire became more intense.

“The copilot could not walk, so the pilot and I assisted her away from the wreckage that by now was burning intensely,” he said. “We moved about 50 feet [15 meters] away and around another trailer.

“The copilot sat down, and the pilot and I tried to comfort her. She was bleeding profusely from several face wounds and was complaining about her right ankle. Shortly thereafter, several paramedics appeared and attended to her.

“I walked around the trailer to observe the plane and the first trailer engulfed in fire. A fire truck was on the scene shortly thereafter and started to extinguish the fire.”

The aircraft and two mobile homes were destroyed by the impact and postaccident fire. Two other mobile homes were damaged by debris.

A few seconds after control-tower personnel lost sight of the airplane in the fog, they heard the localizer alarm and an emergency locator transmitter signal.

“The airport fire fighting vehicle was dispatched to the departure end of Runway 10,” the report said. “The occupants observed the airplane on fire at the edge of a mobile-home park. Due to unsuitable vehicle terrain, they were unable to reach the accident site via airport property and returned to the [airport] terminal area to exit the airport property. The fire fighting vehicle reached the site via off-airport hard-surface roads.”

The report said that the Citation aircraft flight manual (AFM) provided the following information regarding published landing field lengths and operations on wet runways:

- “Landing-field-length data in the FAA-approved [AFM] assumes a threshold crossing speed of  $V_{REF}$  at 50 feet ... ;
- “All flight-manual field-length data assumes a dry, hard-surface runway ... . Precipitation-covered-runway conditions will degrade braking effectiveness and will require significantly greater actual takeoff-abort [lengths] and landing-field lengths ... ;
- “Considerations for landing on a precipitation-covered runway are similar to those for short-field operations where velocity and speed are minimized, and maximum roll-out distance is made available ... ; [and,]
- “The Citation’s minimum dynamic-hydroplaning-initiating groundspeed may occur at speeds above approximately 70 knots.”

The Citation AFM said that dry-runway landing distances should be multiplied by 2.2 to correct for landing distance on a wet runway with less than 0.5 inch (1.3 centimeters) of water.

“According to the performance charts, the airplane would require about 2,509 feet for [landing on] a dry runway and 5,520 feet for [landing on] a wet runway,” said the report.

The landing-distance calculations assume optimal brake performance. Postaccident examination showed that the aircraft’s wheel brakes were worn.

“Wear measurements taken on the brake linings revealed several areas where the brakes were worn beyond the maximum allowed,” the report said. “According to the FAA airworthiness inspector who participated in the investigation, it was not possible to determine if the brakes were within limits when inspected 34 [flight] hours prior to the accident because the wear would be dependent upon pilot technique for the brakes and the number of landings since the last inspection.”♦

[Editorial note: This article, except where specifically noted, is based entirely on U.S. National Transportation Safety Board factual accident report NYC98FA060. The 77-page report contains photographs and diagrams.]



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