FLIGHT SAFETY FOUNDATION

Accident Prevention

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Failure to Maintain Situational Awareness Cited in Learjet Approach Accident

During the approach, the crew was unaware of 40-knot winds that led to the controlled-flight-into-terrain[1] accident during instrument meteorological conditions. At the time of the accident, no emergency locator transmitter was required on the turbojet; the accident site was not located until nearly three years after the aircraft was reported missing.

FSF Editorial Staff

At 1005 local time on Dec. 24, 1996, a Learjet 35A struck mountainous terrain at 2,300 feet during a very-high-frequency omnidirectional radio (VOR) approach in instrument meteorological conditions to Runway 25 at Lebanon (New Hampshire, U.S.) Municipal Airport. The accident occurred 17 nautical miles (32 kilometers) from the airport. The two flight crewmembers, the only occupants of the airplane, were killed. The airplane was destroyed.

The U.S. National Transportation Safety Board said, in its final report, that the probable causes of the accident were "the captain's failure to maintain situational awareness, which resulted in the airplane being outside the confines of the instrument approach, and the crew's misinterpretation of a step-down fix passage, which resulted in an early descent into rising terrain."

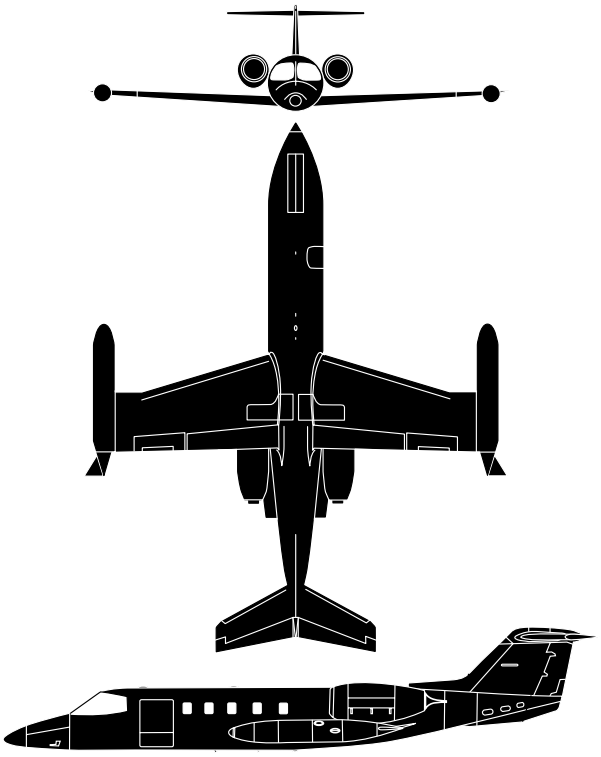
The report said that factors in the accident were "the captain's misreading of the instrument approach procedure, the crew's rushed and incomplete instrument approach briefing, their failure to use additional, available navigational aids and their failure to account for the winds at altitude."

The airplane was being operated by Air Charter Group of Stratford, Connecticut, on a positioning flight to Lebanon from Bridgeport, Connecticut, under U.S. Federal Aviation Regulations (FARs) Part 91, the general operating and flight rules. [Lebanon is approximately 155 nautical miles (287 kilometers) north-northeast of Bridgeport.] The flight crew was scheduled later that day to conduct a charter flight under Part 135, which governs commuter and on-demand operations, to transport passengers from Lebanon to Westhampton Beach, New York.

The Learjet was manufactured in 1981 and had accumulated 6,897 airframe hours. The airplane's registration number was N388LS.

The captain, 30, held an airline transport pilot (ATP) certificate, a Learjet type rating and an instrument instructor certificate. He had 4,250 flight hours, including 750 flight hours in Learjets and 80 flight hours as a Learjet pilot-in-command (PIC).

U.S. Federal Aviation Administration (FAA) records indicate that the captain was issued a private pilot certificate in March 1990 and that he failed his initial examinations for the following certificates and ratings: instrument rating, May 1990; commercial certificate, June 1990; flight instructor certificate, September 1990; and ATP certificate, August 1994.



Learjet 35A

The Learjet 35 made its first flight in 1973; deliveries began in 1974. The airplane is similar to the Learjet 25 but has turbofan engines rather than turbojet engines, a longer fuselage and longer wings. The Learjet 35A was introduced in 1976 with "Century III" modifications designed to improve low-speed handling and performance; the modifications included increased wing-leading-edge camber and an improved stall-warning system. "Softflite" wing modifications designed to improve the airplane's stall characteristics were introduced in 1979; the modifications included full-chord stall fences and boundary-layer energizers.

The Learjet 35A has two Honeywell (formerly Garrett and AlliedSignal) TFE731-2-2B engines, each rated at 3,500 pounds thrust (15.6 kilonewtons). Usable fuel capacity is 931 gallons (3,524 liters).

The airplane has accommodations for two pilots and up to eight passengers. (A longer-range version, the Learjet 36A, accommodates up to six passengers and has a usable fuel capacity of 1,110 gallons [4,201 liters]). The pressurization system can maintain a cabin altitude of 6,500 feet at the airplane's maximum operating altitude, 45,000 feet.

Maximum standard takeoff weight is 17,000 pounds (7,711 kilograms); maximum optional takeoff weight is 18,300 pounds (8,301 kilograms). Maximum landing weight is 15,300 pounds (6,940 kilograms). Maximum rate of climb at sea level is 4,760 feet per minute (fpm). Maximum single-engine rate of climb at sea level is 1,470 fpm. Maximum operating Mach number is 0.83. Maximum cruising speed at 41,000 feet and mid-cruise weight is 460 knots. Economy cruise speed at 45,000 feet and mid-cruise weight is 418 knots. Maximum range with four passengers and a 45-minute fuel reserve is 2,289 nautical miles (4,239 kilometers). Stall speed with landing gear and flaps extended is 96 knots.♦

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

Company records indicate that in July 1995, the captain received new-hire training, Piper Navajo PIC training and Learjet 35 initial equipment training. In October 1995, he received Learjet 35 training at FlightSafety International and passed an FAA examination to serve as a Learjet 35 second-in-command (SIC) in Part 135 operations. In November 1996, he received Learjet 35 PIC upgrade training. On Nov. 29, 1996, he passed an FAA examination to serve as a Learjet PIC in Part 135 operations and was issued a Learjet type rating. On Dec. 7, 1996, he was designated as the company's chief pilot.

In December 1996, the captain flew 13 flights in the accident airplane, including 11 flights as PIC.

"The accident flight was the only one in the accident airplane in which the captain and the accident-flight first officer flew together," the report said.

The first officer, 31, held an ATP certificate and a flight instructor certificate. He had 2,067 flight hours, including 268 flight hours as a Learjet SIC.

FAA records indicate that the first officer was issued a private pilot certificate in February 1990 and that he failed his initial examinations for an instrument rating in January 1991, a multi-engine rating in June 1991, a flight instructor certificate in August 1992 and an ATP certificate in October 1995.

Company records indicate that the first officer received initial training as a Beech Baron pilot in February 1996 and initial differences training for the Learjet 25 and Learjet 35 in August 1996. He passed an FAA examination to serve as a Learjet SIC in Part 135 operations in August 1996.

The captain obtained two weather briefings the evening before the accident flight was conducted and an updated weather briefing at 0849 on the morning of the accident flight. The report said that he did not request or receive information on winds aloft.

During the first weather briefing, the captain was told that the Lebanon VOR was out of service. During the weather briefing on the morning of the accident, the captain asked if the VOR remained out of service. The briefer said, "I don't even show that one … . I don't have anything [i.e., notices to airmen (NOTAMs)] for Lebanon this morning."

The airplane departed from Bridgeport at 0919. The first officer was the pilot flying. The cruise segment was conducted at Flight Level 190 (approximately 19,000 feet). About 0933, Boston Center told the crew to fly directly to the Lebanon VOR, which was approximately 4.4 nautical miles (8.1 kilometers) northeast of the airport, and to descend to 17,000 feet. As the airplane neared Lebanon, the crew received several more descent instructions from Boston Center.

About 0937, the captain selected the radio frequency for the Lebanon automatic terminal information service (ATIS). At

the time, the airport was reporting a 1,200-foot overcast, five statute miles (eight kilometers) visibility with mist and surface winds from 190 degrees at five knots. The ATIS broadcast said that the instrument landing system (ILS) approach to Runway 18 was in use.

The captain told the first officer, "Twelve hundred, over five miles in mist, doing the ILS approach. … You want to review this? I'll take the airplane if you like."

The first officer said, "Yeah, I will. You can have the airplane."

The report said that at 0938, an unintelligible conversation was recorded by the airplane's cockpit voice recorder (CVR). One of the pilots then said, "Yeah, we're set up on eleven nine … one eighty-seven." The localizer frequency was 111.9 megahertz (MHz); the ILS final approach course was 187 degrees.

The crew then conducted the "Approach" checklist, and the captain said, "OK, approach setup is complete."

The airplane was at 7,000 feet, approximately one nautical mile (two kilometers) southwest of the Lebanon VOR and on a heading of 030 degrees at 0945, when a Boston Center controller told the crew to fly a heading of 050 degrees (a vector around traffic), to conduct a descent to 4,700 feet and, when descending through 5,000 feet, to fly directly to the BURGR intersection. BURGR is an initial approach fix and the outer marker/final approach fix for the ILS approach to Runway 18 at Lebanon.

The captain told the controller, "We're going to execute the missed [approach] here. We're not receiving the localizer."

The airplane was approximately three nautical miles (six kilometers) northeast of the VOR and descending through 5,500 feet at 0947, when the controller told the crew to maintain 4,700 feet until established on the ILS approach and cleared the crew to conduct the approach.

At 0948, the controller told the crew that radar service was terminated and to establish radio communication with Lebanon Tower.

The captain told the Lebanon Tower controller, "With you, ILS one eight inbound, seven [nautical miles (13 kilometers)] outside of BURGR."

The controller said, "Weather remains basically the same. Winds are one niner zero [degrees] at seven [knots] now, altimeter two niner eight three."

The captain acknowledged the call and asked if they had clearance to land. The controller told the crew to report passing over BURGR inbound to the airport.

Recorded air traffic control (ATC) radar data indicate that the airplane was approximately 11 nautical miles (20 kilometers) northeast of the airport when the crew completed a "teardrop" turn to intercept the final approach course.

At 0950, the first officer told the captain, "OK, localizer's coming alive. Localizer's alive."

The captain said, "What's up with this?"

The first officer said, "Tuned and identified, right?"

The captain did not answer the first officer's question. He said, "We're not getting a localizer here." The captain then told the controller, "We're BURGR inbound. We're not getting a localizer."

The report said, "The airplane was actually about five nautical miles [nine kilometers] to the left [i.e., southeast of the localizer]. Winds at the airport, about that time, were from 190 degrees true at five knots; however, area winds at 6,000 feet were from 220 degrees, in excess of 40 knots."

The controller said, "Learjet eight lima sierra, you can continue with the approach or execute the missed approach, present position; your choice. Localizer's in the green."

The captain said "roger" and then told the first officer to conduct the missed approach.

The captain told the controller, "We're going to execute the missed [approach] here. We're not receiving the localizer."

The tower controller told the crew to conduct the published missed approach procedure and to establish radio communication with Boston Center.

The tower controller then told the center controller, "The Learjet is coming back to you, published missed. Lost the localizer. We're showing it in the green, and I'm going to have a technician go out and check it just in case." Later, the tower controller told the center controller that the crew of another aircraft had reported receiving "good" signals while conducting the ILS approach and that the maintenance check had found "no problem."

After the captain established radio communication with Boston Center, the controller asked the crew to state their intentions. The captain asked the controller to confirm that the localizer frequency was 111.9 MHz. The controller told the crew to stand by for confirmation of the localizer frequency, to conduct the published missed approach procedure and to maintain 5,000 feet.

The published missed approach procedure calls for a climb to 2,000 feet, a climbing right turn (i.e., to the west) to 4,800 feet, navigation directly to the White River nondirectional beacon (NDB) and a hold at the NDB. The report said that the crew did not conduct the published missed approach procedure; rather than turning west toward the NDB, the crew flew the airplane on a southeasterly heading to 5,000 feet.

At 0953, the first officer said, "What the hell is up with that? … I'm not even getting an ADF [automatic direction finder]."

The captain said, "Here you go."

The controller told the crew that the localizer frequency was 111.9 MHz.

The captain said, "OK, we were unable to get it. He then requested clearance to conduct the VOR approach to Runway 25 and to circle to land on Runway 18. Runway 25 was 5,496 feet (1,676 meters) long and 100 feet (31 meters) wide. Runway 18 was 5,200 feet (1,586 meters) long and 150 feet (46 meters) wide.

The controller approved the request and told the crew to fly the airplane directly to the VOR. At the time, the airplane was approximately nine nautical miles (17 kilometers) southeast of the VOR. Recorded ATC radar data indicated that the airplane was turned right and flown on a northwesterly heading.

The report said that the captain "partially briefed" the first officer on the VOR approach, then "talked through remaining phases of the approach as they occurred."

The report said that the captain "partially briefed" the first officer on the VOR approach, then "talked through remaining phases of the approach as they occurred."

The company's operations manual includes the following information about approach briefings:

> Prior to commencing any approach, all pilots will review all information available relative to the approach, landing and missed approach procedures. … For two-pilot crews during instrument approaches, normally the pilot flying briefs the pilot not flying on data pertinent to the approach, to include at least: final approach course, altitude to the final approach segment, MDA [minimum descent altitude] or DH [decision height] (both radar and barometric, when available), field elevation, missed approach procedures, and any special requirements or conditions. … If a circling approach in instrument conditions is contemplated, the approach briefing should include the detailed plan for executing the circle. The pilot not flying should add or amend any significant information items that may have been omitted or are erroneous.

At 0954, the captain told the first officer, "Well, let me set you up here. Same thing Lebanon, three oh four."

At 0955, the controller told the crew to "cross the Lebanon VOR at or above four thousand seven hundred; cleared VOR approach Lebanon."

The captain read back the clearance and then told the first officer "three fourteen."

The first officer said, "No problem, dude. I'm going to go outbound on the zero six six radial."

[Figure 1 (page 5) shows the VOR Runway 25 approach procedure that was in effect on May 15, 2003. The approach procedure that was in effect at the time of the accident included a minimum altitude of 4,300 feet while flying outbound from the VOR and while conducting the procedure turn, a minimum altitude of 2,900 feet when established on the final approach course inbound, a minimum altitude of 2,300 feet after passing over the Hanover NDB (2.2 nautical miles [4.1 kilometers] from the VOR) and, a minimum altitude of 1,620 feet — the MDA for the circling maneuver — after passing over the VOR inbound.]

The captain on three occasions told the first officer "three one eight" before saying, "Let me get rid of this thing. It'll probably make things easier for you."

The first officer said "yeah."

At 0956, the captain said, "I'll take our time outbound." The first officer then voiced an expletive. The captain said, "OK, that's going to be our outbound, zero six six. Go off Lebanon."

The first officer said, "OK."

At 0957, the center controller told the crew that radar service was terminated and to establish radio communication with Lebanon Tower.

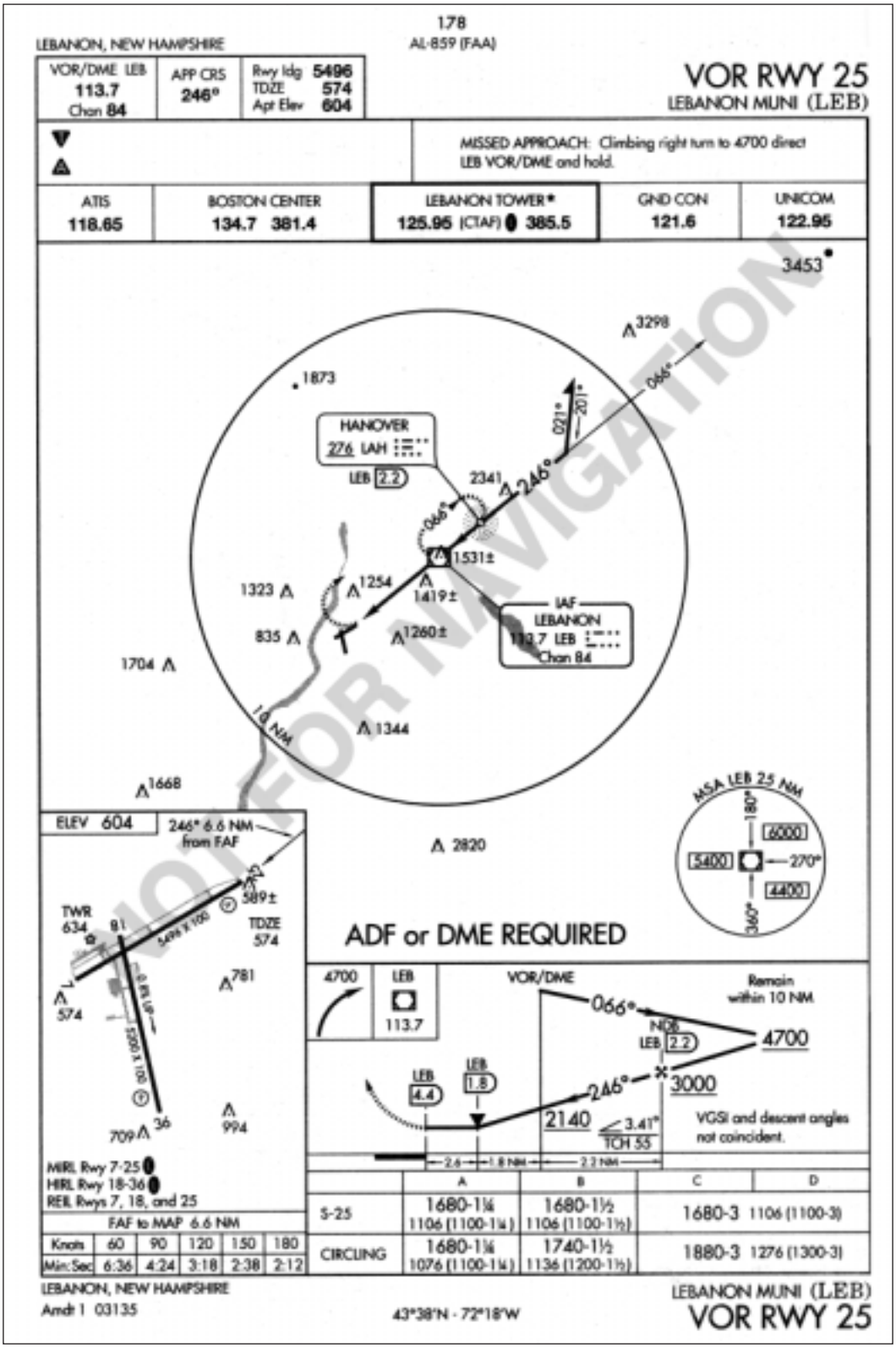
The captain told the tower controller that they were conducting the VOR approach to Runway 25 and would circle to land on Runway 18. The controller told the crew to state the airplane's position. The captain said, "We're five miles to the southeast of the VOR."

The report said, "Other than when the air traffic controller asked the crew the airplane's distance from the Lebanon VOR, there were no additional discussions of distances on the CVR transcript."

The controller told that crew that the "inbound winds" were from 230 degrees at five knots and that they could conduct a straight-in approach to Runway 25.

"Yeah, that's what we'll do," the captain told the controller. "We'll take two five."

Very-high-frequency Omnidirectional Radio (VOR) Runway 25 Approach, Lebanon, New Hampshire, U.S., as of May 15, 2003



Source: U.S. Federal Aviation Administration

Figure 1

The captain then told the first officer, "That OK with you?"

"That's fine with me," the first officer said. "We're over station passage."

"Yeah," the captain said. "This is the airport. That's the VOR. They're not on the field. … Just to let you know."

"Oh, I see," the first officer said. "I might as well start turning now. Zero zero six?"

The captain said, "All right now, inbound heading is two forty-six. Keep … on the turn."

"Two forty-six?" the first officer said.

"The inbound," the captain said. "Remember, we've got to go outbound."

At 0959, the captain said, "OK, station passage, time is set." He then told the controller that the airplane was "VOR outbound." The controller told the crew to report passing over the VOR inbound to the airport.

At 1000:03, the first officer said, "Down to what alt[itude]?"

"Zero six six outbound, buddy boy," the captain said. "Let's go. Zero six six. Grab it. Let's go."

"Zero six six," the first officer said.

At 1000:19, the first officer said, "Altitude?"

"Four thousand seven hundred," the captain said.

The CVR recorded the controller saying, "Go ahead, maintenance. … Maintenance, roger."

The captain told the first officer, "Well, they're fixing the ILS."

"You bet," the first officer said. "OK, time it."

"OK, let's just track back," the captain said. "We have plenty of time. Let's just intercept that. Take a big cut into that. … Needle's coming alive. … Go to a heading of two two one."

Twelve seconds later, at 1001:41, the captain said, "Let's go. Two two one. Get it around there, buddy."

"Sorry," the first officer said. "Two two one. Altitude?"

"No," the captain said. "Zero two one. Zero two one for one minute."

"Yeah," the first officer said. "All right."

The report said that two minutes elapsed from the time the captain called station passage (i.e., passing over the VOR outbound) to the time he corrected his statements about the initial heading for the procedure turn.

"The last recorded radar data for the flight, at 1001:47, indicated that the airplane was about seven nautical miles [13 kilometers] northeast of the Lebanon VOR, at 4,800 feet," the report said. "The average groundspeed outbound was about 230 knots, and the airplane was proceeding along an east-northeasterly ground track."

At 1002:04, the captain said, "We stay at this altitude until we intercept. Then we go down to twenty-nine hundred. … We can go down to twenty-nine now."

Two minutes elapsed from the time the captain called station passage (i.e., passing over the VOR outbound) to the time he corrected his statements about the initial heading for the procedure turn.

"All right," the first officer said. "Right turn or left turn to two two one?"

"You make a right turn," the captain said. "Two forty-six on that. You go to two oh one … and intercept that."

"And make a right turn to intercept?" the first officer said.

"A right turn," the captain said.

At 1002:38, the captain said "approach flaps."

The first officer said, "Let me know, ah, time."

"OK, you got about fifteen seconds," the captain said.

The CVR recorded the sound of the airplane's altitude-alert chime. The first officer said "twenty-nine."

At 1003:06, the captain said, "OK, let's turn. Maintain three thousand. Let's maintain three. … Let's put thirty degrees of bank in there … intercept."

"Oh, yeah," the first officer said. "Give me approach flaps."

"Speed checked, approach flaps," the captain said. "Put thirty degrees of bank in there. … Thirty degrees of bank to intercept. … OK, it's alive. Keep it going."

"Coming around," the first officer said. "Down to what altitude?"

"OK, we'll just intercept that first," the captain said.

At 1004:46, the captain said, "There's the outer marker right there. Do you have it?"

"Yeah," the first officer said.

"OK, we can go down to twenty-three," the captain said.

At 1004:54, the first officer said, "The VOR doesn't want to … See that? … See the VOR? … The VOR's out."

"Well, there's the VOR right there," the captain said.

"Yeah, but it's all over the place," the first officer said.

At 1005:22, the captain said, "Let's get deflection."

The first officer said, "Going down to twenty-three."

At 1005:28, the CVR recorded the sound of static. The CVR recording ceased two seconds later.

At 1010, the controller told the crew to report the airplane's position.

"When no reply was heard, the tower controller contacted a number of aircraft, as well as other [ATC] facilities in an attempt to communicate with the airplane," the report said.

The Learjet was not equipped with an emergency locator transmitter (ELT); at the time of the accident, the FARs did not require ELTs to be installed in turbojet aircraft.[2] Media reports said that extensive searches on the ground and in the air failed to locate the airplane.

The wreckage of the Learjet was found by a forester on Nov. 11, 1999. Portions of the wreckage had been covered by debris from trees damaged during an ice storm. The wreckage was 12.5 nautical miles (23.2 kilometers) from the Lebanon VOR, on the 061-degree radial.

"A path of sheared trees was found, with a debris trail alongside, that led to the main fuselage," the report said. "The path began about 360 feet [110 meters] prior to wreckage and proceeded along a 229-degree magnetic heading at a varying three-[degree] to five-degree descent angle. The descent path terminated near the bases of two trees, which had been uprooted and pushed over. The main fuselage was found about 60 feet [18 meters] beyond and upslope of those trees with only the right engine still attached. The front of the main fuselage and a nearby tree exhibited fire damage. The left engine was found to the right of the main wreckage. The cockpit area had been destroyed."

The report said that FAA on Dec. 25, 1996, conducted ground checks of the Runway 18 ILS equipment and the Lebanon VOR. FAA records indicate that the ILS equipment and the VOR were found to be operating satisfactorily. FAA records indicate that the Lebanon VOR failed at 0126 on Dec. 26, 1996, because a cable had been crushed by ice that built up in the cable duct. Flight tests of the Runway 18 ILS equipment conducted by FAA on Dec. 26, 1996, indicated that the equipment was operating satisfactorily. Repair of the VOR was completed on Jan. 3, 1997, and subsequent flight checks by FAA indicated that the VOR was operating satisfactorily.♦

[FSF editorial note: This article, except where specifically noted, is based on U.S. National Transportation Safety Board (NTSB) Brief of Accident report NYC97FA194 (two pages), adopted Dec. 7, 2000; NTSB Factual Report, Aviation, NYC97FA194 (17 pages); and NTSB Docket ID 9084 (562 pages with appendixes and illustrations).]

Notes

1. Controlled flight into terrain (CFIT) occurs when an airworthy aircraft under the control of the flight crew is flown unintentionally into terrain, obstacles or water, usually with no prior awareness by the crew. This type of accident can occur during most phases of flight, but CFIT is more common during the approach-and-landing phase, which begins when an airworthy aircraft under the control of the flight crew descends below 5,000 feet above ground level (AGL) with the intention to conduct an approach and ends when the landing is complete or the flight crew flies the aircraft above 5,000 feet AGL en route to another airport.

2. As a result of the accident, the U.S. Congress in April 2000 passed legislation that, in part, directed the U.S. Federal Aviation Administration (FAA) to revise Federal Aviation Regulations Part 91.207, *Emergency Locator Transmitters*. FAA in December 2000 revised Part 91.207 to require installation by Jan. 1, 2004, of ELTs in turbojet aircraft, except those with a maximum payload capacity of more than 18,000 pounds (8,165 kilograms) when used in air transportation.

Further Reading From FSF Publications

FSF Editorial Staff. "International Efforts Raise Awareness to Prevent Approach-and-landing Accidents." *Flight Safety Digest* Volume 21 (December 2002).

FSF Editorial Staff. "Nonadherence to Standard Procedures Cited in Airbus A320 CFIT in Bahrain." *Accident Prevention* Volume 59 (December 2002).

FSF Editorial Staff. "Reduced Visibility, Mountainous Terrain Cited in Gulfstream III CFIT at Aspen." *Accident Prevention* Volume 59 (November 2002).

FSF Editorial Staff. "MD-82 Overruns Runway While Landing in Proximity of Severe Thunderstorms." *Accident Prevention* Volume 59 (February 2002).

FSF Editorial Staff. "Runway Overrun Occurs After Captain Cancels Go-around." *Accident Prevention* Volume 58 (June 2001).

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