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Poorly Flown Approach in Fog Results in Collision With Terrain Short of Runway

"This approach was exactly the type of high-workload and stressful operation that would exceed the captain's normal capabilities," the official report said. Crew fatigue and lack of GPWS may also have contributed to the fatal accident.

Editorial Staff Report

The captain of the Learjet 25D was executing his second instrument landing system (ILS) approach in fog to Dulles International Airport (IAD), Chantilly, Virginia, U.S. The approach, to Runway 1R, was flown with the runway visual range (RVR) below published landing minimums for all but Category III approaches. During the approach, the aircraft's pitch varied from -4 degrees to +7.4 degrees. The aircraft never became stabilized on the glideslope, and crashed 0.8 nautical miles (nm) (1.1 kilometers) south of the runway threshold. The flightpath angle before impact was calculated at -12.8 degrees. All 10 passengers and both crew members were killed in the June 18, 1994, accident.

The U.S. National Transportation Safety Board (NTSB) concluded in its final accident report that the probable causes of the accident were the "poor decision making, poor airmanship and relative inexperience of the captain in initiating and continuing an unstabilized instrument approach that led to a descent below the authorized altitude without visual contact with the runway environment. Contributing to the cause of the accident was the lack of a GPWS [ground-proximity warning system] on the airplane."

The Learjet was owned and operated by Transportes Aereos Ejecutivos S.A. (TAESA) of Mexico. The accident flight was a commercial charter, operating under U.S. Federal Aviation Regulations (FARs) Part 129, the report said. Part 129 regulates the operation of foreign air carriers within the United States, and requires an operator to establish operations specifications (ops specs). TAESA's ops specs required the flight to be conducted in accordance with FARs Part 91.

The accident flight originated in Mexico City, Mexico, and had a planned stop at Lakefront Airport, New Orleans, Louisiana, U.S., to clear U.S. Customs and refuel before proceeding to IAD. The passengers were planning to attend the World Cup soccer games in Washington, D.C., and watch the Mexican team compete, the report said.

On June 17, the crew reported for duty at 2200 hours eastern daylight time. The flight departed Mexico City at 2315, and landed uneventfully in New Orleans at 0125 the next morning. "There was a delay in clearing U.S. Customs because the Customs agent was waiting to meet the airplane at New Orleans International Airport (Moisant Field)," the report said. "The agent arrived at [Lakefront Airport] around 0230, and the flight cleared U.S. Customs about 0300."

The crew then taxied to a fixed-base operator for fuel. The first officer assisted in the fueling of the aircraft, while the captain called the TAESA flight-following department, the report said. "Both the Customs agent and the refueler described the crew as alert and helpful," the report said. The flight was airborne at 0347, on an instrument flight rules (IFR) flight plan to IAD.

At 0525, the flight was at flight level (FL) 410 (41,000 feet [12,505 meters]), and in contact with the Washington U.S. Federal Aviation Administration (FAA) Air Route Traffic Control Center (ARTCC), the report said. The crew was issued holding instructions, the result of another aircraft inbound to IAD that had declared an emergency. Within four and one-half minutes after entering holding, the crew was cleared direct to IAD at 11,000 feet (3,355 meters), the report said.

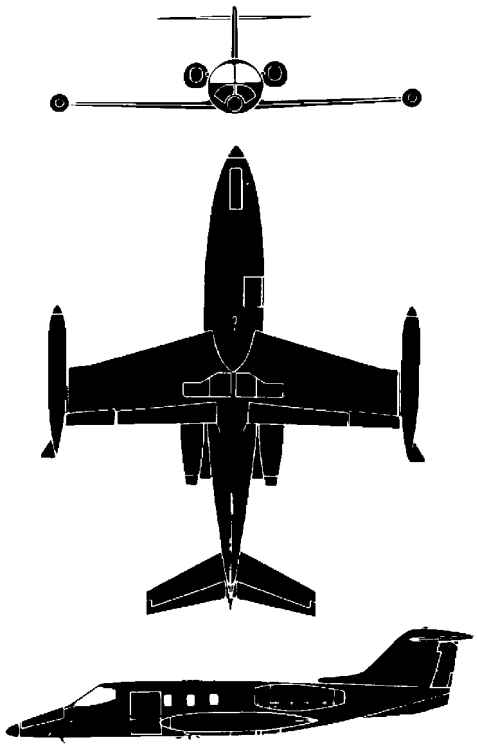
At 0554, the flight was in contact with Dulles approach control, and was told to expect the ILS to Runway 1R. "During the next several minutes, the flight was given additional descent clearance to 6,000 feet [1,830 meters], and a vector for sequencing," the report said. "The first officer was making the radio transmissions, which is consistent with the captain flying the airplane," the report said.

At 0601, the controller announced the latest Dulles weather to all aircraft on the frequency, the report said. The weather was reported as indefinite ceiling, 600 feet (183 meters) sky obscured, visibility one-half mile [weather reports are expressed in statute miles] (0.8 kilometer), temperature 71 degrees F (22 degrees C), dewpoint 71 degrees F (22 degrees C), wind calm. The controller then advised that the RVR to Runway 1R was: touchdown 1,200 feet (366 meters), midpoint 1,600 feet (488 meters) and rollout more than 6,000 feet (1,830 meters), the report said.

The crew of an airline flight inbound to Dulles then asked the controller if Category II approaches were in operation. "While this was being researched, the radar controller confirmed that [the accident flight] had also received the weather," the report said. The controller then told the inbound airliner crew that Category III approaches were being conducted to Runway 1R.

After being positioned on the approach, the accident flight crew was told to contact the tower at 0608. The crew's performance during the approach was erratic. The report said: "[The crew] initially intercepted the Runway 1R localizer at IAD 13 [nm] [18.2 kilometers] from the runway, and nine [nm] [12.6 kilometers] from the outer marker (TILLE). The airplane reached a maximum altitude of 3,100 feet [945.5 meters], and was above the full fly-down limit of the projected glideslope beam. The airplane then descended for one minute and 41 seconds, and reached descent rates of 2,600 feet [793 meters] per minute. At an altitude of 1,300 feet [396.5 meters], 2.5 [nm] [3.5 kilometers] from the runway threshold, the flightpath intersected the full fly-down limit of the projected glideslope beam."

The report continued: "The airplane continued to descend until altitude values stabilized at 600 feet [183 meters], approximately 0.8 [nm] [1.12 kilometers] from the runway threshold. This position was also coincident with the intersection of the centerline of the projected glideslope beam. During this approach, the airplane maintained a track within the localizer limits until 0.25 [nm] [0.35 kilometer] from the runway, whereupon it passed through the full fly-left limit of the projected localizer beam. The airplane maintained an altitude of 600 feet MSL [mean sea level] as it continued on a heading parallel to Runway 1R."



Gates Learjet 25D

First flown in 1966 as the Learjet 25, the model 25D accommodates eight passengers and a flight crew of two, with a maximum certificated takeoff weight of 16,300 pounds (7,394 kilograms). The aircraft has a maximum cruising speed at 47,000 feet (14,325 meters) of 451 knots (835 kilometers per hour). The 25D has a service ceiling of 51,000 feet (15,545 meters) and a range of 1,430 nm (2,650 kilometers) with four passengers, maximum fuel and 45-minute reserves.

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

The report said that when the accident flight was one nm (1.4 kilometers) north of the departure end of Runway 1R, and still at 600 feet, the tower asked, "Are you uh on the missed approach sir?" The crew confirmed they were on the missed approach, and were told to contact approach control. When the approach controller asked the crew about their intentions, the first officer replied, "(Unintelligible) vectors for another attem- … attempt for ILS," the report said. Seconds later, the crew of a McDonnell Douglas DC-10 on the ILS to Category II minimums reported a missed approach.

At 0614, the controller told the crew of a Boeing 767 that was on the ILS that the RVR for Runway 1R was touchdown 600

feet (183 meters), midpoint 800 feet (244 meters) and rollout more than 3,000 feet (915 meters), the report said. The B-767 crew landed successfully after flying the ILS to Category III minimums.

As the accident crew was vectored onto their second approach, they appeared to have difficulty getting established on the ILS, the report said. This prompted the radar controller to ask the crew if they were established on the approach. The crew responded, "Affirmative," the report said. Before the Learjet crossed the outer marker, the radar controller told the crew that the RVR was touchdown 600 feet, midpoint 600 feet and rollout 4,000 feet (1,220 meters). The crew contacted the tower about 0623, and was again issued the same RVR information.

The crew was unable to fly a stabilized approach on their second attempt. The report said: "At 0623:04, approximately 1.4 [nm] [2.0 kilometers] from the outer marker, [the accident flight] began to descend from 2,100 feet [640.5 meters]. At 0623:27, [the accident flight] was positioned on the centerlines of both the glideslope and localizer beams. At approximately 0623:34, [the accident flight] was at the outer marker at an altitude between 1,700 and 1,800 feet [518.5 and 549 meters]. The airplane then descended at an average rate of 1,300 fpm [396.5 meters per minute] to an altitude of 400 feet [122 meters] (about a -4 degree flightpath angle), while maintaining a track within the localizer geometry limits. However, [the accident flight] dropped below the full fly-up limits of the projected glideslope beam at 0624:17, at an altitude of 1,000 feet [305 meters], 2.7 [nm] [3.8 kilometers] from the runway."

The report continued: "While still below the full fly-up limit, the airplane leveled off at 400 feet. At a distance of 1.7 [nm] [2.4 kilometers] south of the Runway 1R threshold, the airplane climbed to an altitude of 600 feet [183 meters] in 9.1 seconds. Radar contact was lost at 0625:03.52, 1.1 [nm] [1.5 kilometers] south of the Runway 1R threshold. During the climb from 400 to 600 feet, [the accident flight] attained a flightpath angle of approximately +7.4 degrees and reached the full fly-up limit of the projected glideslope beam at the final radar return. The last radar return was outside the full fly-left limits [of the localizer]."

About 0625, a motorist who was driving on a road that generally parallels the approach to Runway 1R saw the accident airplane through the fog. "The windows of his automobile were down, but he did not hear any noise from the airplane," the report said. "The airplane's attitude was nose-low, and the airplane appeared to be flying at a lower altitude than other airplanes he had seen flying toward the runway."

The Learjet initially collided with relatively tall trees, approximately one nm (1.4 kilometers) south of the Runway 1R threshold. "The ground impact site was approximately 1,100 feet [335.5 meters] on a magnetic bearing of 25 degrees from the initial tree strike, 0.8 [nm] [1.1 kilometers] south of the Runway 1R threshold," the report said. "The initial tree strike area was approximately 729 feet [222.3 meters] east, and the main crash site was approximately 911 feet [277.8 meters] east of the extended runway centerline."

Rescue workers located the crash site at 0725, and determined that there were no survivors. A post-mortem examination reported that all the occupants died from "multiple severe injuries," the report said. No evidence of physical impairment was found in either flight-crew member. No evidence of alcohol or other drugs was found in either crew member, the report said.

The airplane was destroyed by impact. There was no evidence of fire, the report said. The airplane was insured for US$1.5 million.

Using recorded air traffic control radar data, investigators calculated that the accident airplane's flightpath angle at initial impact was -12.8 degrees, at a groundspeed of 134 knots, the report said.

When they examined the wreckage site, investigators found the center post and portions of both windshield halves embedded in the ground to a depth of approximately one foot (30.5 centimeters), the report said. "The airplane came to rest upright approximately 44 feet [13.4 meters] north-northeast of the windshield scar," the report said. "The fuselage separated from the wing section and was resting on top of it, aligned on a heading of about 170 degrees. The right wing tip was generally under the tail section of the fuselage, which came to rest in a tail-high attitude against several small trees."

Investigators found that the right wing-tip tank was still attached, but the left wing-tip tank had separated. "The wing and wing-tip fuel tanks ruptured, but the fuselage tank was intact," the report said. "No fuel was found in the fuel tanks, but fuel drained from the fuel lines, located below the wing tanks, and from fuel-pump cavities and the engines when the aft fuselage was moved. A strong smell of fuel was present at the crash site."

No evidence of a preimpact control problem could be found, the report said. Both engines appeared to have been developing power at impact.

The accident airplane was not equipped with either a flight data recorder (FDR) or a cockpit voice recorder (CVR). "The International Standards and Recommended Practices issued by the International Civil Aviation Organization (ICAO), Annex 6 … requires a five-parameter FDR for all turbine-powered aircraft with a maximum certificated takeoff weight of 5,700 kilograms (12,566 pounds) or more, with airworthiness certificates issued before Jan. 1, 1987," the report said. "TAESA was technically required to comply with ICAO Annex 6 standards, which, in this case, are more stringent than the U.S. rules. However, no FDR was installed."

Because the accident airplane was not U.S.-registered, it was not required to have a CVR. ICAO Annex 6, however, recommends a CVR "for all turbine-powered aircraft, with a

maximum certificated takeoff weight of 5,700 kilograms (12,566 pounds) or more, whose prototype was certificated after Sept. 30, 1969," the report said.

The accident airplane was not equipped with, nor was it required to have, GPWS. The report said: "Analysis of [the airplane's] flightpath indicated that had a GPWS been installed on the aircraft, an aural mode 5, Descent Below Glideslope, warning would have been issued approximately 64 seconds prior to initial impact at an altitude of 1,200 feet [366 meters] MSL, and would have continued to the end of the flight. A Mode 1, Excessive Sink Rate, warning would have been issued at 700 feet [213.5 meters] MSL. A Mode 1, a Mode 5 or both warnings would have been active in the last 64 seconds."

The report concluded: "The Safety Board believes that had there been a GPWS installed on [the airplane], there would have been constant warnings and cues to the crew of their proximity to terrain. The warnings would have provided adequate time to allow the flight crew to take appropriate evasive actions to avoid impact with the terrain. Had a GPWS system been installed on [the airplane], the warnings might have prevented the accident."

The maintenance records of the accident airplane were reviewed. The last major inspection of the airplane was completed less than two months before the accident, the report said. "The current aircraft maintenance logbook … contained an entry on June 17 that the right airspeed indicator was five knots lower than the left airspeed indicator at slow speed," the report said. "This item was deferred. The previous maintenance logbook, covering the period from May 3 through June 5, was also examined. The right angle-of-attack indicator was a deferred item. There were also recurring write-ups on the right defogger blower and the weather radar/radome. The records that were available for review indicated that there were no write-ups on either of these components after June 5 and 13, respectively."

"Had a GPWS system been installed on [the airplane], the warnings might have prevented the accident."

The cabin of the accident airplane was configured with eight passenger seats and safety belts, the report said. There were four adults and six children as passengers aboard the accident flight. "The ages of the passengers ranged from 40 to five years," the report said. Part 91, under which the accident flight was operating, requires each person over two years of age to "occupy an approved seat or berth with a safety belt." In addition, ICAO Annex 6 requires an airplane to be equipped with "a seat or berth for each person over an age to be determined by the State if the Operator, and a seat belt for each seat and restraining belts for each berth," the report said. "TAESA was required to meet this standard while operating in the United States."

Investigators calculated the airplane's weight-and-balance for both takeoff at New Orleans and landing at IAD. "The calculation performed by the pilots at [New Orleans] did not include the standard crew weight of 340 pounds [154 kilograms]," the report said. "Using the corrected data, the airplane was below the allowable ramp weight of 16,800 pounds [7,610 kilograms], and the center of gravity (CG) … was also within the allowable limits. However, using a nominal fuel taxi burn of 100 pounds [45.3 kilograms], the aircraft would have exceeded the allowable takeoff weight of 16,300 pounds [7,384 kilograms] by 345 pounds [156 kilograms]."

The calculations for landing at IAD indicated that the aircraft was under the maximum landing weight, and within CG, the report said. These calculations were based on a fuel burn of 4,641 pounds [2,102 kilograms], leaving 1,953 pounds [885 kilograms] of fuel, all in the wing tanks.

The background and qualifications of the flight crew were reviewed. The captain, age 27, held a Mexican pilot certificate, with ratings for captain in Learjet Models 20 series and 30 series. He held a current first-class medical certificate, with no limitations. The captain had 1,706 total flying hours, with 1,314 hours in the Learjet, the report said. He had approximately 87 hours as pilot-in-command (PIC) in the Learjet.

The captain had received four days of upgrade training at FlightSafety International (FSI), slightly more than two months before the accident. The report said: "The simulator instructor for the captain during his upgrade training described him as focused, with reasonably good motivation, and a quick learner. As a pilot, he had smooth airplane control, and was polished as a first officer. He seemed like he might have been relieved when the training was over; it was a humbling experience. Captain upgrade candidates normally have 4,000–5,000 flight hours. … [T]his captain was at the low end of experience."

The report said that the instructor's notes contained the following comments about the captain's four simulator rides:

"[Day 1] — Instrument scan defective and flight director usage poor. Briefed on correct scan techniques and [flight director operations]. Crew coord. poor;

"[Day 2] — [Flight director] usage improving. Instrument scan improving. Crew coord. marginal;

"[Day 3] — V_1 cut outside limits. Veered 45 degrees off heading and insufficient pitch for V_2 climb. Pilot received many pacing hints from first officer and in the presence of these hints, [cross-country] flight went quite well; [and,]

"[Day 4] — Pilot needs more CRM [crew resource management] training to be competent as PIC. Below FSI [standards] for PIC. Additional training offered and declined."

The report continued: "The instructor stated that the captain had problems prioritizing the workload and directing the first officer. He did fairly well under basic control, but with an engine out, there was enough distraction for him to lose control [of the aircraft]. He left the pavement on every rejected takeoff on [day 4]. Although he flew nonprecision approaches well, and the two-engine ILS on day 2 was normal, his instrument approaches definitely did not meet ATP [airline transport pilot] standards."

The captain was offered additional training at the end of the four days. "Although he was interested in the extra training, he believed that the company needed him back to fly the line," the report said. "He completed the training below the PIC level."

When the captain returned to Mexico, he was required to perform as PIC in an airplane for 10 hours with an instructor pilot, the report said. After completion of the 10 hours, the captain successfully completed a written test and a flight check, and was upgraded to captain.

The TAESA executive director of operations told investigators that he had requested confidential reports of evaluations for the captain during the captain's training at FSI, "but that the only documentation received was the Pilot Record of Training, which was hand-delivered by the accident captain," the report said. "The director of operations again requested written confidential evaluations, including instructor notes. FSI advised that the simulator instructor notes were for internal use, but that they did provide a confidential written evaluation of each pilot."

"[The captain] completed the training below the PIC level."

The report said that the evaluations of the accident captain provided to TAESA contained the following comments:

"During [his] simulator training, he demonstrated satisfactory flying skills when flying the aircraft under normal conditions. He requires emphasis in crew management and decision-making skills during his training to upgrade to Captain. [He] needs to improve his airmanship and command skills, especially when operating under the stress of abnormal and emergency situations.

"[His] most notable strength is his ability to smoothly fly the aircraft under normal operations. He displayed excellent qualities when acting in the capacity of First Officer. [He] can be considered for upgrade to Pilot-in-Command. During upgrade training, situational awareness under high-workload conditions should be emphasized. He should fly with a strong training Captain or First Officer during his upgrade."

The report noted that "had FSI made the instructor notes available to TAESA, the comments, in combination, might have enabled TAESA to understand the intent of FSI, and might have led to a delay in his upgrade."

The background of the first officer, age 25, was also reviewed. He held a Mexican commercial pilot certificate with a rating for copilot in Learjet Model 20 series. He also held a first-class medical certificate that was issued in October 1993, with the limitation that he use corrective lenses. At the time of the accident, the first officer had 852 total flying hours, with 426 hours in the Learjet, the report said.

The first officer received his initial Learjet training at FSI in 1991, recurrent training from FSI in 1992 and training from TAESA in 1994, the report said. The instructor comments from his 1992 recurrent training were positive.

The NTSB concluded that the flight crew's "relative inexperience in both total flying time and in the Learjet is considered to be critical in this accident," the report said. Although the crew's qualifications met the basic requirements of the regulations in both the United States and Mexico, "the circumstances of this operation were far from 'basic.'"

The report cited examples from FARs Part 121 for scheduled U.S. air carrier service, and FARs Part 135 for commuter and charter operations in turbine-powered airplanes, both of which limit a captain to landing minimums of not less than 300 feet (91.5 meters) and one mile until accruing 100 hours as PIC in a specific aircraft type. "Both of these regulations indicate a recognized need for more pilot experience to meet the greater demands of such approaches," the report said. "This approach was exactly the type of high-workload and stressful operation that would exceed the captain's normal capabilities. Instead of an experienced training captain to assist him during the approach, he was paired with a relatively inexperienced first officer."

The weather that affected the accident crew's destination and alternate airports consisted of a high-pressure ridge over the northeastern United States, the report said. There was widespread fog over the states of Maryland and Virginia. The crew's filed alternate was Baltimore-Washington International Airport (BWI), which is 40 nm (64.4 kilometers) northeast of IAD. The official terminal forecast prepared by the U.S. National Weather Service for IAD and "issued at 2200 on June 17, and valid after 0300, called for: Partial obscuration, ceiling 1,200 feet [366 meters], visibility three miles [4.8 kilometers] haze, occasional partial obscuration, visibility one and one-half miles [2.4 kilometers] [in] fog," the report said.

"The subsequent scheduled forecast [for IAD] issued at 0400 called for: Ceiling 800 feet [244 meters] broken, visibility one and one-half miles [in] fog, occasionally ceiling 300 [feet (91.5 meters)] obscured, visibility one-fourth mile [0.4 kilometer], fog," the report said. "[After] 0600: Ceiling 400 feet [121.6 meters] overcast, visibility one mile [1.6 kilometers], [in] fog, occasional ceiling 100 feet [30.5 meters] obscured, visibility one-fourth mile [in] fog."

The official terminal forecast for BWI issued on June 17 at 2000 called for: "0300 — Partial obscuration, ceiling 1,200 feet [366 meters] overcast, visibility three miles [915 meters] [in] fog [and] haze, occasional partial obscuration, ceiling 800 feet [244 meters] overcast, visibility one and one-half miles [in] fog," the report said. An amendment to the forecast was issued at 0415 that called for: "Ceiling 0 feet obscured, visibility 0 miles [in] fog, occasional ceiling 300 [feet] [92 meters] obscured, visibility three-fourths mile [1.2 kilometers] [in] fog."

The NTSB report did not indicate the nature of the weather briefing that was given to the crew before departing Mexico City, the weather information that was obtained by the captain in New Orleans or if any weather information was obtained by the crew en route to IAD.

The possible effects of fatigue on the accident flightcrew were also examined. "At the time of the accident, the captain was awake about 11-1/2 hours, a length of time that has been associated with cockpit errors, and especially tactical decision errors, in aviation accidents," the report said. Investigators were unable to determine how long the first officer had been awake.

The NTSB believed that the crew could have been affected by circadian disruption. "In the present accident, the crew began duty at 2200, which ended at 0625 the next morning, thereby disrupting the normal sleep/wake cycle that the accident crew displayed in the days before the accident," the report said.

The report added: "Another form of circadian disruption occurs when an individual remains awake during a time period that the body is physiologically primed to be asleep. The time that the accident occurred, shortly after 0400 in Mexico City time, represents a period of typically low physiological alertness as regulated by brain activity (the period of greatest sleepiness typically occurs between 3 [a.m.] to 5 a.m. every day). Based on these circadian considerations, the pilots would have been exposed to reduced alertness during the time that critical decisions had to be made concerning landing."

The report concluded: "The evidence suggests that, after flying all night, the crew could have been experiencing the effects of fatigue due to both the length of hours they had been awake and circadian disruption. Such fatigue would have added to the problems caused by the relatively low experience levels of both crewmembers, further degrading decision making and other aspects of performance. However, because of the limitations in the information available, the Safety Board could not conclude that fatigue was involved in the accident. Nor could the Safety Board rule it out as a factor."

In assessing the captain's decisions when arriving at IAD, the report said: "Apart from the low visibility on Runway 1R, the captain's decision making in the terminal area might also have been affected by the unscheduled holding at an unfamiliar fix (due to the earlier emergency), any fatigue from the all-night operation, the customs delay at [New Orleans], concern that the BWI weather might be the same, and the probable logistical problems associated with a diversion to BWI. These are possible factors in his decision-making process that might have created a strong incentive to complete the charter to IAD. In this context, it is not surprising that he made a second attempt to land."

The Dulles terminal radar approach control (TRACON) facility is equipped with minimum safe altitude warning (MSAW), which is "a computer function that assists air traffic controllers in detecting aircraft that are within, or are approaching, unsafe proximity to terrain or obstacles," the report said. Investigators examined why there were no MSAW alerts during the two approaches flown by the accident aircraft.

"A plot of the MSAW site variables parameters and the [accident aircraft's] radar track indicated that [the aircraft] had one return below the alarm altitude of the Runway 1R capture box in both tracking and beacon data," the report said. "However, the FAA states in their MSAW system functional specifications, two 'current position' hits, or three 'predicted position' hits must be received on radar before an alert will activate the aural and visual warnings."

The investigation found discrepancies in two site variables that, if changed, would have resulted in an MSAW alert during the accident aircraft's second approach, the report said.

Dulles International Airport is equipped with a low-level wind shear alert system (LLWAS). As part of the investigation, data from the IAD LLWAS was requested for the time in which the accident aircraft flew the two approaches, the report said. The data supplied to investigators by the FAA in a memorandum included the geometric configuration file (GCF) for Tampa International Airport, Florida, U.S. "The [FAA] memorandum further stated that it was likely that IAD was using an incorrect LLWAS GCF at the time of the accident," the report said.

The report noted: "According to the FAA, the GCF for each LLWAS airport contains specific and unique parameters that are vital for the correct operation of the enhanced LLWAS software. In order to run the LLWAS wind shear/microburst detection software, the FAA has stated that it is necessary to input an appropriate GCF that is distinct and unique to the airport of concern. Following the accident, the GCF was corrected at IAD."

As a result of the investigation, the NTSB developed the following findings:

- "The airplane and flight crew were properly certificated;
- "There were no mechanical problems with the airplane or the engines;
- "The Runway 1R RVR at IAD was below published landing minimums for all but Category III approaches; [Category I minimums are ceiling 200 feet (62 meters)

above ground level (AGL), 1,800 feet (549 meters) or one-half mile (0.8 kilometer) RVR.]

- "There probably [were] ineffective communications between the carrier and the contract training facility regarding the pilots' skills;

- "The captain was not authorized to attempt the approach, and was relatively experienced for an approach under these conditions; [The captain was not certified for Category II or Category III approaches.]

- "The captain failed to adhere to acceptable standards of airmanship during two unstabilized approaches;

- "After the unsuccessful ILS approach to Runway 1R, the captain should have held for improvements in the weather, requested the Runway 19L ILS, or proceeded to his alternate;

- "The MSAW equipment at IAD was improperly adjusted; however, this discrepancy did not contribute to the cause of the accident;

- "All components of the Runway 1R ILS were operating within prescribed tolerances at the time of the accident;

- "Air traffic control services provided to [the Learjet] were in accordance with procedures outlined in FAA Order 7110.65, *Air Traffic Control*;

- "An operating GPWS aboard the airplane would have provided continuous warning to the crew for the last 64 seconds of the flight and might have prevented the accident;

- "The airplane was not equipped with a flight data recorder, as required under Annex 6 of the [ICAO] provisions for international flights;

- "The crew may have been experiencing the effects of fatigue following an all-night flight;

- "There were only eight cabin seats and safety belts installed, which meant that at least two passengers were not properly restrained. This was not in compliance with Annex 6 of the ICAO standards for international flights; [and,]

- "Oversight of the operation of the accident airplane and the accident flight by TAESA and the Mexican government was inadequate."

As a result of this investigation, and other accidents, the NTSB made the following recommendations to the FAA:

- "Require within two years that all turbojet-powered airplanes equipped with six or more passenger seats have an operating [GPWS] installed; [Only turbine-powered airplanes with 10 or more passenger seats operated under Part 135 are required by the FAA to be equipped with GPWS. ICAO has approved a recommendation by Flight Safety Foundation — one of nine proposals issued as part of a campaign to reduce controlled-flight-into-terrain (CFIT) accidents — that amends Annex 6 to require GPWS installation in turbine-engine airplanes of a maximum certificated takeoff mass more than 12,566 pounds (5,700 kilograms) or authorized to carry more than nine passengers. The new regulation is effective Dec. 31, 1998.]

- "Require that all Operations Specifications of [FARs] Part 129 operators be reviewed to ensure that they are current, and contain specific language that establishes RVR, when reported, as controlling for purposes of establishing visibility minimum; [and,]

- "Formally notify the Mexican director general civil aviation of the circumstances of the accident, with particular emphasis on the lack of adherence to pertinent regulations and requirements of the United States, Mexico and ICAO."

In addition, in November 1994, the NTSB issued the following recommendations to the FAA:

- "Review the calculations establishing the runway threshold coordinates for all runways at IAD with respect to the air surveillance radar to verify proper alignment of the MSAW capture boxes;

- "Conduct a complete national review of all radar environments using MSAW systems. This review should address all user-defined site variables for the MSAW programs that control general terrain warnings, as well as runway capture boxes, to ensure compliance with prescribed procedures; [and,]

- "Ensure that all airports equipped with the Phase II (enhanced) LLWAS are using geometric configuration files appropriate to those facilities."

The report said that the FAA responded favorably to all three of these recommendations.♦

Editorial note: This article was adapted from *Controlled Collision with Terrain, Transportes Aereos Ejecutivos, S.A. (TAESA), Learjet 25D, XA-BBA, Dulles International Airport, Chantilly, Virginia, June 18, 1994*. Report No. NTSB/AAR-95/02, prepared by the U.S. National Transportation Safety Board (NTSB). The 63-page report includes charts, diagrams and illustrations.

ACCIDENT PREVENTION

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