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MD-82 Overruns Runway While Landing In Proximity of Severe Thunderstorms

The investigation of the approach-and-landing accident generated several recommendations, including improvement of standard operating procedures regarding the use of airplane spoiler systems, autobrake systems and reverse thrust on wet/slippery runways.

FSF Editorial Staff

At 2350 local time June 1, 1999, American Airlines Flight 1420, a McDonnell Douglas MD-82, overran Runway 4R while landing at Little Rock (Arkansas, U.S.) National Airport. The airplane struck several frangible[1] tubes extending outward from the left edge of an instrument landing system (ILS) localizer array, passed through a chain link security fence, descended over a rock embankment to a flood plain 15 feet (five meters) below the runway and struck an approach-light-support structure. The captain and 10 passengers were killed; the first officer, three flight attendants and 41 passengers received serious injuries; one flight attendant and 64 passengers received minor injuries; and 24 passengers were not injured.

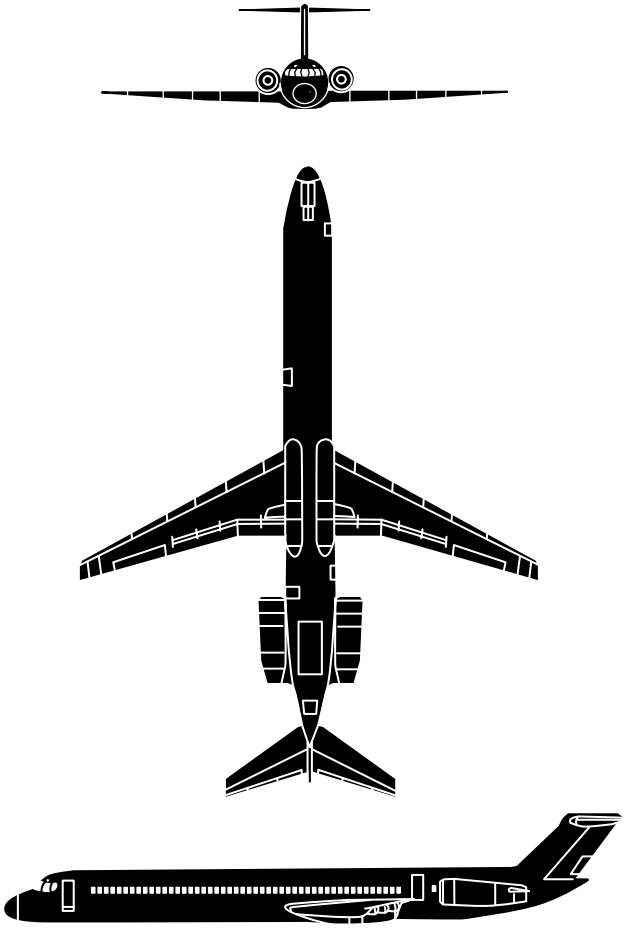
The U.S. National Transportation Safety Board (NTSB) said, in its final report, that the probable causes of the accident were "the flight crew's failure to discontinue the approach when severe thunderstorms and their associated hazards to flight operations had moved into the airport area, and the crew's failure to ensure that the spoilers had extended after touchdown.

"Contributing to the accident were the flight crew's (1) impaired performance resulting from fatigue and the situational stress associated with the intent to land under the circumstances, (2) continuation of the approach to a landing when the company's maximum crosswind component was exceeded, and (3) use of reverse thrust greater than 1.3 engine pressure ratio [EPR] after landing."

Flight 1420 was the third leg and final leg of the first day of a three-day sequence for the flight crew; the previous legs had been conducted with different flight numbers. The first officer reported for duty in Chicago, Illinois, about 1018, and the captain reported for duty about 1038. The captain and first officer previously had not flown together.

The captain, 48, held an airline transport pilot (ATP) certificate and had 10,234 flight hours, including 5,518 flight hours as an MD-80 series pilot-in-command and check airman. He retired from active duty with the U.S. Air Force with the rank of captain in 1979 and was hired by American Airlines. In 1980, he began a 3.5-year furlough and worked as a submarine nuclear propulsion system engineer until he was recalled by the airline. At the time of the accident, he was chief pilot at the airline's base in Chicago and was a lieutenant colonel in the U.S. Air Force Reserve.

The first officer, 35, held an ATP certificate and had 4,292 flight hours, including 182 flight hours as an MD-80 first



McDonnell Douglas MD-82

The MD-80 series jet transports are derivatives of the Douglas DC-9, which first flew in 1965. Douglas Aircraft Co. and McDonnell Co. merged in 1967 to form McDonnell Douglas Corp. The MD-80, originally called the Super 80, has longer wings, a longer fuselage and more fuel capacity than the DC-9, and an integrated digital flight control system.

The prototype flew in 1979, and the airplane entered production in 1980 as the MD-81, with Pratt & Whitney JT8D-209 turbofan engines, each rated at 18,500 pounds static thrust (82 kilonewtons). Production of the MD-82 began in 1981. The airplane was designed for operation at high-density-altitude airports and has JT8D-217 engines, each rated at 20,000 pounds static thrust (89 kilonewtons). Production of a second version of the MD-82 began in 1982. The airplane has JT8D-217A engines, which have the same power rating as the JT9D-217, and a higher maximum takeoff weight — 149,500 pounds (67,813 kilograms) vs. 147,000 pounds (66,679 kilograms). Both versions have a maximum landing weight of 130,000 pounds (58,968 pounds).

The MD-82 has a two-pilot flight deck and can accommodate up to 172 passengers. Maximum cruise speed is 0.8 Mach. Normal cruise speed is 0.76 Mach. Maximum range with 155 passengers is 2,049 nautical miles (3,795 kilometers).♦

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

officer. He held type ratings in the Boeing 737 and Learjet. He received primary flight training in the U.S. Navy in 1988 but was discharged honorably in 1991 because of a reduction in force. He flew as a corporate pilot and flight instructor before being hired by American Airlines in January 1999.

The crew departed from Chicago at 1143 and arrived in Salt Lake City, Utah, at 1458 (1358 local time). They departed from Salt Lake City at 1647 and arrived at the Dallas–Fort Worth (Texas) International Airport at 2010. The flight was 39 minutes late because the crew had to hold until weather conditions improved sufficiently to land at the airport.

For the leg from Dallas to Little Rock, the flight crew was scheduled to fly a different airplane from the airplane they flew on the first two legs. Flight 1420 originally was scheduled to depart from Dallas at 2028 and arrive in Little Rock at 2141. While waiting for their airplane to arrive, the crew received an American Airlines advisory about a widely scattered area of thunderstorms along the route from Dallas to Little Rock and two U.S. National Weather Service (NWS) advisories about an area of severe thunderstorms along the route.

"The airplane originally intended to be used for the flight was delayed in its arrival to Dallas–Fort Worth because of the adverse weather in the area," the report said. "After 2100, the first officer notified gate agents that Flight 1420 would need to depart by 2316 because of American's company duty-time limitation [14 hours]. The first officer then telephoned the flight dispatcher to suggest that he get another airplane for the flight or cancel it."

Another airplane was dispatched for the flight, and the crew departed at 2240. The captain was the pilot flying (PF).

At 2254, the crew received an aircraft communication addressing and reporting system (ACARS) message from the flight dispatcher indicating that weather conditions at Little Rock might be a factor during the arrival. The message said the following:

> Right now on radar there is a large slot to Little Rock. Thunderstorms are on the left and right, and Little Rock is in the clear. Sort of like a bowling alley approach. Thunderstorms are moving east-northeastward toward Little Rock, and they may be a factor for our arrival. I suggest expediting our arrival in order to beat the thunderstorms to Little Rock if possible.

"The flight crew acknowledged this message," the report said. "The first officer indicated, in a postaccident interview, that 'there was no discussion of delaying or diverting the landing' because of the weather."

The flight dispatcher told investigators that the message was based on observation of a high-resolution radar mosaic and

that the radar data were five minutes to 15 minutes old. The dispatcher said that he did not have access to real-time doppler weather surveillance radar (WSR-88D) data or terminal doppler weather radar (TDWR) data.

At 2304, a Fort Worth Center controller broadcast a convective SIGMET (significant meteorological information) about a line of severe thunderstorms moving southeast through Arkansas with hail up to two inches (five centimeters) in diameter and possible wind gusts to 70 knots.

Cockpit voice recorder (CVR) data (see appendix, page 12) showed that at 2325:47, the captain said, "We got to get over there quick."

The first officer said, "I don't like that … that's lightning."

"Sure is," the captain said. "That's about as far as we can go. … This is the bowling alley right here. … In fact, those are the city lights straight out there."

The captain then made a public-address system announcement. "We're now just 80 miles from the airport, and we have started our descent toward it," he said. "Quite a light show off the left-hand side of the aircraft. We'll be passing that on our way toward Little Rock, and we should be landing here … in about 20 minutes. I'm going to have to slightly over-fly the airport in order to turn back around to land."

At 2327:15, the Fort Worth Center controller told the crew to descend to 10,000 feet and to change radio frequencies to Memphis Center. The Memphis Center controller provided an altimeter setting to the crew.

"The controllers at this center did not have access to real-time weather radar data, and no internal meteorological support was available to them because the center weather service unit (CWSU) had closed," the report said. "The CWSU at the Memphis center was not staffed for 24-hour operation and had closed on the night of the accident about 2130, even though severe weather was predicted to affect the center's airspace. The CWSU meteorologists have access to WSR-88D weather products and, thus, could have provided the center controller with … information regarding the line of thunderstorms moving into the area."

At 2328:06, the first officer told the captain that the "Descent" checklist was complete. The captain said, "OK. … We got to get there quick." He then told the flight attendants that "it's going to get a little bumpy" and to complete their passenger services "real quick."

The pilots then began conducting the "Approach" checklist. They computed a landing reference speed (V_{REF}) of 130 knots. The first officer said, "Manual brakes?"

The captain said, "Manual's fine."

At 2333:49, the Memphis Center controller told the crew to change radio frequencies to Little Rock Approach Control. The first officer told the approach controller that the airplane was descending through 11,300 feet to 10,000 feet.

The approach controller told the crew that a thunderstorm northwest of the airport was moving through the area and that the surface wind was from 280 degrees at 28 knots, gusting to 44 knots. He told the crew to expect an ILS approach to Runway 22L. (At the time, the ILS equipment for Runway 4R and Runway 22L was in service; the ILS equipment for Runway 4L and Runway 22R was being upgraded and was not in service.)

"The first officer indicated in a postaccident interview that, during the descent into the terminal area, the weather appeared to be about 15 miles [28 kilometers] away from the airport and that he and the captain thought that there was 'some time' to make the approach," the report said.

The pilots discussed the airline's crosswind limitations for landing. The captain said that a 30-knot crosswind component was the maximum for landing on a dry runway and that a 20-knot crosswind component was the maximum for landing on a wet runway. The report said that these values were correct for landing with an RVR of 4,000 feet (1,120 meters) or more. The airplane flight manual also specified the following maximum crosswind components: 15 knots when RVR is less than 4,000 feet but more than 1,800 feet (549 meters); and 10 knots when RVR is 1,800 feet or less. The airplane operating manual said that the maximum tail wind component for landing was 10 knots.

The approach controller, who also was conducting local-control services at the airport, told the crew to descend to 3,000 feet and asked them what they observed on their weather-radar display.

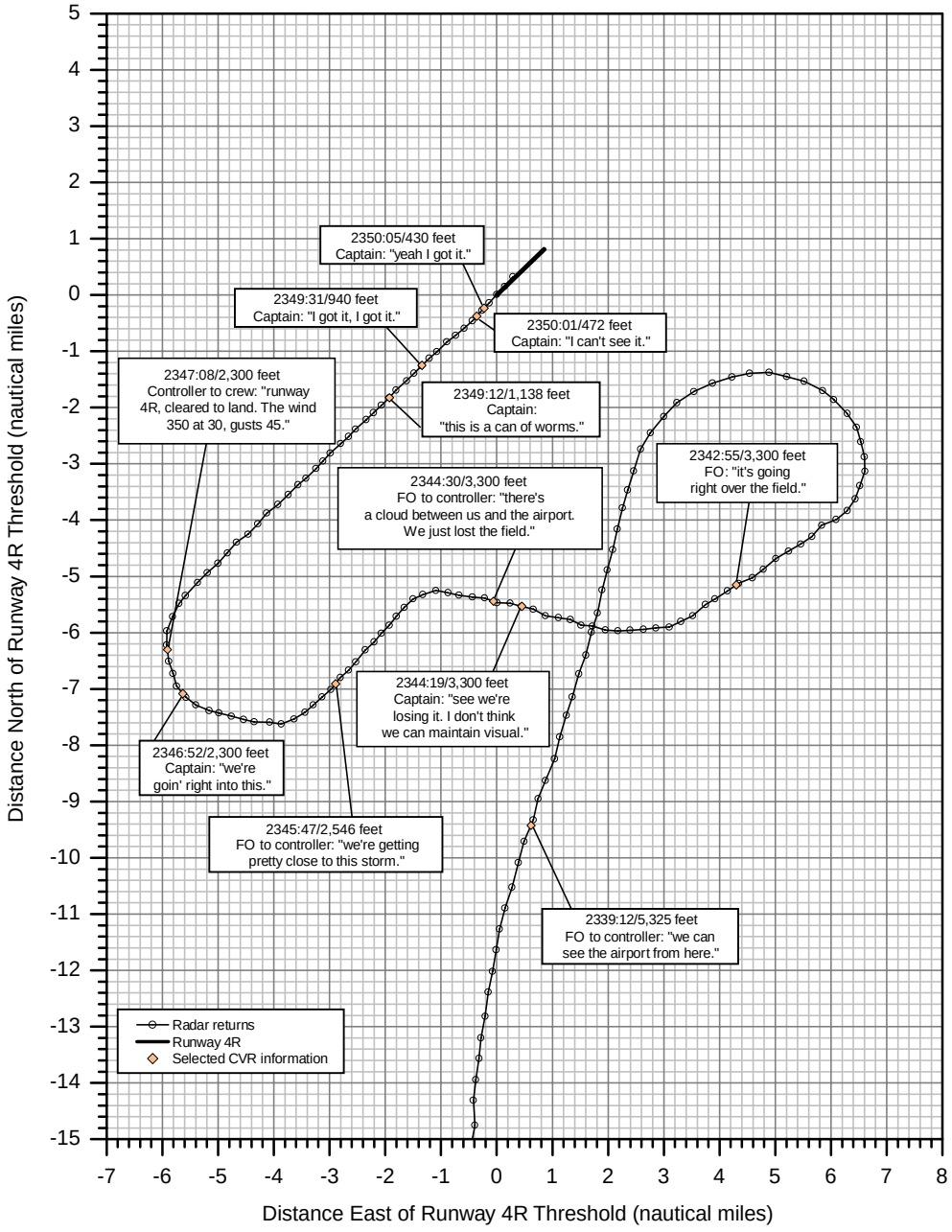
"Your equipment is a lot better than what I have," the controller said. "How's the final for [runway] two two left looking?"

The first officer said, "We can see the airport from here. We can barely make it out, but we should be able to make two two. That storm is moving this way like your radar says it is, but [the storm is] a little bit farther off than you thought."

At this time, the airplane was about nine nautical miles (17 kilometers) south of the airport (see Figure 1, page 4), and heavy rain had begun to fall at the airport. Heavy rain is defined by NWS as 0.03 inch (0.08 centimeter) of rain within six minutes.

"The radar used in ATC [air traffic control] facilities was designed to depict air traffic; it was not designed to show weather," the report said. "If near-real-time color weather had been available at ATC facilities, the Little Rock controller would likely have been able to relay to the Flight 1420 crew that a thunderstorm with extreme reflectivities [was moving toward the] airport."

Flight Path of American Airlines Flight 1420, McDonnell Douglas MD-82, Little Rock (Arkansas, U.S.) National Airport, June 1, 1999



FO = First officer, CVR = Cockpit voice recorder

Source: U.S. National Transportation Safety Board

Figure 1

At 2339:23, the controller asked the crew if they wanted to conduct a visual approach to the airport. The first officer said, "At this point, we can't really make it out. We're going to have to stay with you as long as possible."

At 2339:32, the controller said that the surface winds had "kicked around a little bit" and were from 330 degrees at 11 knots. The controller also told the crew that the airport's low-level wind shear alert system (LLWAS) had generated a wind shear alert. The controller provided wind directions and wind velocities at three LLWAS wind sensors.

The captain told the first officer that they would have a tail wind if they landed on Runway 22L and a head wind if they landed

on Runway 4R. The first officer asked the controller if Runway 4R was available for landing, and the controller said yes.

"We're going to want the head wind, of course, runway four," the first officer said.

The controller told the crew to turn right to a heading of 250 degrees for radar vectors to the ILS Runway 4R final approach course.

At the time, the airplane was on a north-northeasterly heading. "OK, a right turn to two five zero," the first officer said. "The long way around?"

"Yes, sir," the controller said. "You're a little close to the airport."

When the captain began the right turn, the airplane was approximately four nautical miles (seven kilometers) southeast of the runway.

The first officer conducted an abbreviated briefing for the ILS Runway 4R approach; the briefing included the localizer frequency, final approach course, minimum safe altitude, missed approach procedure and the decision altitude. The report said that the pilots did not discuss the missed approach procedure, which included a right turn that would take the airplane away from the weather.

The controller told the crew to maintain 3,300 feet, which was the minimum safe altitude for the approach. The airplane was about halfway through the turn when the captain asked the first officer if he had the airport in sight.

"Yeah, there it is," the first officer said. "I got the airport."

At 2342:27, the controller said, "It appears we have [the] second part of this storm moving through." The controller said that the wind was from 340 degrees at 16 knots, gusting to 34 knots. The report said that the pilots did not discuss this wind report or subsequent wind reports issued by the controller.

The first officer asked the captain if he wanted to accept a "short approach" and "to keep it in tight."

The captain said, "Yeah, if you see the runway, because I don't quite see it."

"It's right here, see it?" the first officer said.

"You just point me in the right direction, and I'll start slowing down here," the captain said. "Give me flaps eleven."

The first officer began a radio transmission but then told the captain, "It's going right over the field."

"American fourteen twenty, did you call me?" the controller said.

"Well, we got the airport," the first officer said. "We're going between clouds. I think it's right off my three o'clock [position] low, about four miles."

The controller confirmed that the airport was at the location described by the first officer and asked whether the crew wanted to conduct a visual approach or "go out" for the ILS approach. The first officer accepted the visual approach. The controller cleared the crew for a visual approach and said, "If you lose it [or] need some help, let me know, please."

The first officer attempted to point out the airport to the captain, but the captain did not have the airport in sight.

"You're on a dogleg," the first officer said. "There's the airport. … Right there. You're downwind. See, it's right there."

"I still don't see it," the captain said. "Well, just vector me."

At 2343:59, the controller cleared the crew to land and said that the wind was from 330 degrees at 21 knots.

The captain observed red lights on the ground and asked the first officer about the lights. The first officer said that the airport had three runways.

"Yeah, I know," the captain said. "See, we're losing it. I don't think we can maintain visual."

The first officer told the controller that the crew did not have visual contact with the airport. The controller told the crew to fly a heading of 220 degrees for radar vectors for the ILS approach and to descend to 2,300 feet.

The first officer said, "We had it."

"I never saw the runway," the captain said. "I hate droning around visual at night in weather without having some clue where I am."

At 2345:29, the first officer said, "We're going right into this crap." He then told the controller, "We're getting pretty close to this storm. We'll keep it tight if we have to."

The controller told the crew to turn right to a heading of 270 degrees. "When you join the final, you're going to be … just outside the marker, if that's going to be OK for you."

The captain said, "That's great."

The first officer told the controller, "That's great with us."

The report said that the pilots' acceptance of a turn onto the final approach course close to the outer marker "increased the crew's already high workload by compressing the amount of time that was available to accomplish required tasks."

At 2346:25, the controller told the crew to turn right to a heading of 300 degrees. After the first officer acknowledged the instruction, the controller said that the airplane was three miles [six kilometers] from the outer marker, told the crew to turn right to a heading of 020 degrees and cleared the crew for the ILS approach.

The captain said, "Aw, we're going right into this."

The controller told the crew that the airport had heavy rain and that the current automatic terminal information service (ATIS) information was not correct. "I don't have new weather for you, but the visibility is less than a mile. Runway four right RVR [runway visual range] is three thousand." The controller cleared the crew to land and said that the wind was from 350 degrees at 30 knots, gusting to 45 knots.

The report said that pertinent weather information recorded by the airport's automated surface observing system (ASOS) was not available to the flight crew around this time because the system is designed to issue no reports between 47:20 and 53:20 after the hour. During this time — called the lockout period — weather observers prepare and transmit meteorological aerodrome reports (METARs).

"If the lockout had not been in place, the system would have issued a special observation when the reduced visibility, heavy rain and strong gusting winds associated with the thunderstorm were detected," the report said.

During the lockout period, a special observation generated by the ASOS at 2347:22 was canceled.

"The canceled observation would have likely indicated that the thunderstorm was at the airport and provided the flight crew with critical situational awareness information about the intensity of the storm," the report said. "The information … would have provided the flight crew with another indication that it was unsafe to land."

The report said that, based on the surface-wind information and RVR information provided by the controller, the pilots might have believed that they could land before the thunderstorm arrived over the airport.

"Other flight crews might continue an approach to a runway under the same circumstances," the report said. "On the other hand, … the approaching storm and the reports of heavy rain, [decreasing] visibility and increasing crosswinds (from 10 [knots] to 30 knots with gusts to 45 knots) would be sufficient for some flight crews to hold until the storm passed or proceed to an alternate airport."

The report said that the wind conditions reported by the controller (350 degrees at 30 knots, gusting to 45 knots) would result in crosswind components for Runway 4R of 23 knots for the steady-state wind and 34 knots for the gusting wind. The first officer, however, read back the wind conditions as "zero three zero [degrees] at four five [knots]," which would result in a crosswind component less than 10 knots. The controller did not correct the first officer's readback.

At about this time, the airplane intercepted the localizer. The captain said, "Can we land? … Three thousand RVR. We can't land on that. … What do we need?"

The first officer said "2,400 [feet] RVR," which was the lowest RVR authorized for the ILS approach.

The captain told the first officer to extend the landing gear and activate the landing lights. The report said that none of the other "Before Landing" checklist items were conducted. The checklist items included the autospoilers, autobrakes, flaps and slats.

At 2347:53, the controller issued another wind shear alert and provided data on wind directions and velocities recorded by the LLWAS sensors. The centerfield wind sensor, which is used by controllers to provide real-time wind data to pilots, recorded wind from 350 degrees at 32 knots, gusting to 45 knots.

The captain said, "Add twenty. … Add twenty knots." The report said that this meant the captain wanted the first officer to add 20 knots to the approach speed. At this time, the airplane was at the leading edge of the line of thunderstorms.

At 2348:12, the controller told the crew that RVR had decreased to 1,600 feet.

The captain said that the airplane was "established on the final."

The first officer told the controller, "We're established inbound."

The report said, "If the weather is reported to be below published minimums, American Airlines and [U.S.] Federal Aviation Regulations [FARs] ([Part] 121.651) allow airplanes that are established on the final approach segment to continue the approach."

The first officer told investigators that the report of 1,600 feet RVR "did not concur" with what he and the captain were seeing.

At 2348:26, the controller again cleared the crew to land and said that the wind was from 340 degrees at 31 knots.

At 2348:50, the first officer called out "thousand feet" and said, "Want forty flaps?"

"Oh, yeah," the captain said. "Thought I called it."

The first officer said, "Forty, forty, land." This indicated that the flaps were selected to position 40, the flap-position indicator indicated 40 and the "SLAT/LAND" light was illuminated.

At 2349:10, the controller said that the winds were from 330 degrees at 28 knots. About two seconds later, the captain said, "This is a can of worms."

The report said that flight data recorder (FDR) data indicated that the airplane was at about 1,140 feet (880 feet above field level [AFL]) at this time and that the captain was "making active control inputs to keep the airplane on the localizer and glideslope."

The first officer told investigators that he had the runway in sight throughout the approach. He attempted to help the captain obtain visual contact with the runway.

"There's the runway off to your right," the first officer said. "Got it?" The captain said no. The first officer said, "I got the right runway in sight. You're right on course. Stay where you're at."

About one second later, the captain said, "I got it. I got it." The report said that this indicated that the captain had the runway in sight. At this time, the airplane was at about 940 feet (680 feet AFL).

At 2349:32, the controller said that the wind was from 330 degrees at 25 knots. Four seconds later, the controller said that the wind was from 320 degrees at 23 knots.

The report said that the airplane's average airspeed on final approach was 156 knots — about 26 knots faster than V_{REF} — and "jumped erratically within a band of [plus/minus] five knots, which was consistent with the gusty and turbulent winds on approach."

At 2349:46, the first officer said, "Five hundred feet." Four seconds later, he said, "We're way off."

The first officer told investigators that the approach was stabilized until the airplane began drifting right about 400 feet AFL. He said that the instruments indicated that the airplane was one dot right of the localizer course and that he observed the runway edge lights drifting left.

"The first officer also stated that he said 'go around' … but not in a very strong voice," the report said. "The first officer indicated that he had looked at the captain to see if he had heard him, but the captain was intent on flying and was doing 'a good job.'"

The airplane operating manual said that "before descending below the specified minimum stabilized approach altitude [500 feet AFL when operating under visual flight rules (VFR) or 1,000 feet AFL when operating under instrument flight rules (IFR)], the airplane should be:

- "In the final landing configuration (gear down and final flaps);
- "On approach speed;
- "On the proper flight path and at the proper sink rate;
- "And at a stabilized thrust."

The airplane operating manual also required either flight crewmember to call out any observed localizer deviation greater than 1/3 dot and any glideslope deviation greater than 1/2 dot.

The report said, "FDR data indicated that the localizer and glideslope were both displaced in excess of these values, but the CVR contained no callout from either the captain or the first officer regarding the fact that the airplane was high on the glideslope and was to the right of the localizer."

As the airplane descended through decision height (460 feet), the glideslope deviation was between one dot and 1 1/2 dots and increasing, the report said.

At 2350:01, the captain said, "I can't see it." At the time, the airplane was between five feet and 20 feet above decision height.

The first officer said, "Got it?"

"Yeah, I got it," the captain said.

The first officer called "hundred" at 2350:11 and "fifty" at 2350:13.7; after both calls, the ground-proximity warning system (GPWS) announced "sink rate," indicating that the rate of descent exceeded a predetermined threshold. [The report did not include information on the GPWS sink-rate threshold or the airplane's descent rate.] The first officer continued calling out radio altitude in 10-foot increments. At 2350:20, the CVR recorded two thuds. The report said that the first thud was the sound of the main-landing gear touching down on the runway; the second thud was the sound of the nosegear touching down.

"We're down," the first officer said. Two seconds later, he said, "We're sliding."

The airplane weighed about 127,749 pounds (57,947 kilograms); maximum landing weight is 130,000 pounds (58,968 kilograms). At this weight, the demonstrated landing distance was 2,830 feet (863 meters). The report said that, under the existing conditions, FARs Part 121 required a minimum usable runway length of 5,425 feet (1,655 meters). Runway 4R was 7,200 feet (2,196 meters) long.

The airplane touched down about 2,000 feet (610 meters) from the runway threshold with a right drift angle of five degrees. The airplane's groundspeed was 160 knots.

The report said, "The NWS [ASOS] weather data indicated that surface winds from 290 degrees at 16 knots, gusting to 22

knots, [resulting in a five-knot tail wind on Runway 4R] were present about the time that Flight 1420 touched down, but this information was not available to the flight crew or the controller because the system's two-minute wind data are not directly reported to the control tower."

AWOS wind sensors are mounted at 32 feet. The LLWAS centerfield wind sensor at Little Rock was mounted at 70 feet. (LLWAS centerfield wind sensors at other airports are mounted up to 100 feet.)

"Thus, the LLWAS centerfield wind information [which is available to controllers] does not always reflect surface wind conditions … ," the report said. "The [U.S. Federal Aviation Administration (FAA)] *Aeronautical Information Manual* (*AIM*) … includes only general information on the LLWAS. The information does not indicate that, in some circumstances, LLWAS centerfield wind information alone may not accurately represent the winds that are present at the runway surface."

The report said that the *AIM* also does not say that an LLWAS alert is a valid indicator of wind shear or a microburst, or that LLWAS sensors are not the same as sensors used through the late 1980s, which provided alerts when "normal" gusting winds occurred.

"The latest LLWAS sensors include technologies to reduce such false alerts," the report said.

Investigators calculated that, under the conditions that existed when the airplane touched down on the runway, the crew could have stopped the airplane with 700 feet (214 meters) of runway remaining if the spoilers had extended, maximum braking had been used and reverse thrust had been maintained symmetrically at 1.3 EPR. (EPR is the ratio of engine exhaust-gas pressure and inlet-air pressure.)

The spoilers did not extend automatically upon touchdown because the crew had not selected the autospoiler system. The crew did not manually extend the spoilers after touchdown.

The report said that the airplane operating manual requires that both pilots monitor the spoilers after touchdown and that the captain manually extend the spoilers if they do not extend automatically. CVR data indicated that neither pilot announced that the spoilers had not extended automatically and that there was no attempt to manually extend the spoilers.

"The lack of spoiler deployment led directly to the flight crew's problems in stopping the airplane within the remaining available runway length and maintaining directional control of the airplane on the runway," the report said.

When the spoilers on an MD-80 series airplane extend fully (i.e., 60 degrees) on touchdown, about 77 percent of airplane weight is supported by the main-landing gear, about 3 percent of airplane weight is supported by the nose gear and about 20 percent of airplane weight is supported by the wings (i.e., by lift), the report said. With the spoilers retracted, about 7 percent of the airplane weight is supported by the main gear, 3 percent by the nose gear and 90 percent by the wings.

"When less weight is applied on the main gear, it has less braking force and produces less cornering force in a skid," the report said. "The lack of spoiler deployment was the single most important factor in the flight crew's inability to stop the airplane."

FDR data indicated that, during a seven-second period following touchdown, both thrust reversers were deployed; left EPR increased to 1.89, and right EPR increased to 1.67. The thrust reversers momentarily moved to the unlocked position before they again were deployed; left EPR increased to 1.98, and right EPR increased to 1.64.

The MD-80 thrust-reverser system includes "clam-shell" doors that deploy behind the engines and redirect the flow of exhaust gas. The airplane operating manual said that "when reverse thrust increases above 1.3 EPR, rudder effectiveness decreases [because of disrupted airflow over the rudder and vertical stabilizer] until it provides no control at about 1.6 EPR. Do not exceed 1.3 EPR reverse thrust on slippery portions of the runway, except in an emergency."

The report said, "The captain was likely applying excessive reverse thrust because he perceived that the landing had become an emergency situation."

As the accident airplane traveled down the runway, its drift angle — that is, the difference between heading and direction of travel — was as much as 16 degrees left and right. Some passengers told investigators that the airplane "fish-tailed" after touchdown.

The crew had not selected the autobrake system. FDR data indicated that manual braking began five seconds after touchdown and that maximum manual braking occurred about 11 seconds after touchdown.

"These time intervals are not indicative of aggressive manual braking," the report said. "The use of autobrakes requires either automatic or manual spoiler deployment at touchdown … . If the spoilers had deployed and the flight crew had selected maximum autobrakes for the landing, initial brake application could have occurred about four seconds sooner."

The report said, "The left brake pedal was relaxed momentarily after full braking was achieved [and] while the airplane was drifting to the right (that is, its nose was pointed to the left of the direction of travel) and coincided with the application of full right rudder. Thus, the brake pedal relaxation may have been the result of the captain's attempt to apply differential brakes to correct the airplane's heading or his inability to maintain full braking while applying full right rudder."

At 2350:31.8, the CVR recorded an unidentified voice saying "on the brakes." The first officer told investigators that he did not help with the flight controls until the captain said "brakes." He said that the airplane was near the end of the runway at this time and that he helped the captain with the brakes.

Postaccident examination of the runway surface showed that its "ability to prevent hydroplaning and other braking problems was excellent," the report said. Calculations of braking coefficients indicated that the airplane's tires did not hydroplane on the wet runway.

"The accident airplane experienced a wet runway braking coefficient of at least 0.23 at 140 knots and 0.25 at 160 knots," the report said. "Typical braking coefficients to indicate dynamic hydroplaning range from 0.02 to 0.04. Thus, Flight 1420 experienced a maximum braking coefficient that was over six times greater than the maximum typical hydroplaning braking coefficient."

The airplane overran the runway at 97 knots and struck the approach-light-support structure at about 83 knots. The CVR recorded expletives in an unidentified voice, followed by sounds of impact. The CVR stopped recording at 2350:48.1. The airplane came to rest 800 feet (244 meters) from the runway end.

The left wing separated from the fuselage, which broke into three sections. The left side of the forward fuselage, from the nose to the flight deck rear bulkhead was crushed on impact with the nonfrangible approach-light support structure. The rear-fuselage section was consumed by a postaccident fuel-fed fire. Passengers in the rear-fuselage section said that smoke entered the cabin when the fire began but the fire did not enter the cabin until evacuation was complete.

The captain and five passengers died from traumatic injuries; five passengers died from smoke-and-soot inhalation and/or thermal injuries.

The controller had lost sight of the airplane during its rollout. After receiving no response from the crew to five radio transmissions, the controller at 2352 used the "crash phone" to call the airport's aircraft rescue and fire fighting (ARFF) station.

"According to ARFF personnel, the controller stated that an American Airlines airplane was down on Runway 4R but did not specify the approach [end] or departure end of the runway," the report said. "The ARFF station responded with all available assets — four firefighters (including a fire captain) and three fire trucks."

One fire truck driver told investigators that he drove into "blinding rain and wind." The report said that a microburst had begun at 2352.

"A microburst is a severe localized wind blasting down from a thunderstorm," the report said. "A microburst usually covers an area of less than 2.5 miles [four kilometers] in diameter and lasts less than 20 minutes."

All three fire trucks were driven to the approach end of Runway 4R. At 0000, a firefighter told the controller by radio that the airplane was not at the approach end of Runway 4R and asked if the fire trucks should "sweep the runway." The controller said that the airplane was at the departure end of the runway.

"I saw him [the airplane] as he went past midfield," the controller said.

At the departure end of the runway, the firefighters observed a glow and blowing smoke. They were unable to proceed directly to the airplane because of the sloped terrain; they drove on an access road and the airport-perimeter road to the accident site.

"The ARFF trucks arrived at the accident scene about 0008," the report said. "The firefighters applied water and aqueous-film-forming foam to the fire and extinguished the exterior fire within 60 seconds."

Little Rock National Airport did not conduct — and was not required by the FARs to conduct — a postaccident emergency-response critique with all the agencies that were involved in responding to the Flight 1420 accident.

"Nine months after the accident, the airport completed individual critiques with all of the agencies involved with the emergency response and a group critique with some of these agencies," the report said.

The U.S. Federal Railroad Administration (FRA) requires rail carriers to conduct a critique within 60 days of an emergency response.

"Such a critique, if performed in a timely manner after an aviation accident, would enable participants to take immediate, appropriate actions to rectify any identified emergency-response deficiencies," said the report.

During postaccident observations of simulator training of American Airlines pilots, investigators found that some pilots exceeded 1.3 EPR when using reverse thrust on a wet runway and that they failed to notice when spoilers had not extended on touchdown. The report said this was one indication that FAA did not oversee effectively the airline's flight training and flight operations.

The FAA principal operations inspector (POI) for the airline told investigators that he needed more inspectors to conduct surveillance but that an FAA hiring freeze was in effect.

"The POI also indicated that he needed almost double the number of air safety inspectors he had in his office at the time and that his inability to hire more inspectors had severely impacted his office's surveillance activities," the report said.

The report said that during the accident flight, both pilots made basic errors in flight management and in the completion of routine tasks, and that their performance was inconsistent with what would have been expected.

"The captain was described in postaccident interviews as a conservative pilot who used common sense, demonstrated wisdom and experience, and was professional," the report said. "The first officer was described … as an above-average new hire who was very competent and knowledgeable, and an experienced pilot with good cockpit discipline."

The report said that situational stress and fatigue were factors in the crew's "degraded performance." Situational stress resulted from the adverse weather and the crew's efforts to expedite the landing.

"The flight crewmembers' intention to expedite the landing despite the weather diverted their attention away from other activities during the final minutes of the flight and, as a result, affected the crew's ability to properly assess the situation and make effective decisions."

Both pilots had slept about 9.5 hours the night before the accident occurred and had not accumulated any sleep loss in the days preceding the accident. Nevertheless, at the time of the accident, the pilots had been awake for at least 16 hours.

"Research indicates that the normal waking day is between 14 [hours] and 16 hours, and that lapses in vigilance increase and become longer if the normal waking day is extended," the report said. "Thus, the flight crew's extended continuous hours of wakefulness was consistent with the development of fatigue."

The report said that the changing weather conditions that occurred during the accident crew's approach show how quickly RVR readings can decrease; RVR decreased from 3,000 feet to 1,600 feet in less than 1.5 minutes.

The RVR system at Little Rock, however, was not designed to transmit data directly to the ASOS; weather observers were required to obtain 10-minute-average RVR readings from tower controllers to prepare METARs and special observations.

The report also said that RVR data recorded each minute during the accident airplane's approach and landing were not available to investigators because an "event log" had not been started. As a result, the RVR data recorded during the accident airplane's approach and landing were overwritten by newer data.

Based on these findings, NTSB made the following recommendations to FAA:

- "For all [FARs] Part 121 and [Part] 135 operators of airplanes equipped with automatic spoiler systems, require dual crewmember confirmation before landing that the spoilers have been armed and verify that these operators include this procedure in their flight manuals, checklists and training programs. (A-01-49);

- "For all [FARs] Part 121 and [Part] 135 operators, require a callout if the spoilers do not automatically [deploy] or manually deploy during landing and a callout when the spoilers have deployed, and verify that these operators include these procedures in their flight manuals, checklists and training programs. The procedures should clearly identify which pilot is responsible for making these callouts and which pilot is responsible for deploying the spoilers if they do not automatically or manually deploy. (A-01-50);

- "Issue a flight standards information bulletin that requires the use of 1.3 [EPR] as the maximum reverse thrust power for MD-80 series airplanes under wet [runway conditions] or slippery runway conditions, except in an emergency in which directional control can be sacrificed for decreased stopping distance. (A-01-51);

- "Require [POIs] of all operators of MD-80 series airplanes to review and determine that these operators' flight manuals and training programs contain information on the decrease in rudder effectiveness when reverse thrust power in excess of 1.3 [EPR] is applied. (A-01-52);

- "Require all operators of MD-80 series airplanes to require a callout if reverse thrust power exceeds the operators' specific [EPR] settings. (A-01-53);

- "For all [FARs] Part 121 and [Part] 135 operators, require the use of automatic brakes, if available and operative, for landings during wet, slippery or high-crosswind conditions and verify that these operators include this procedure in their flight manuals, checklists and training programs. (A-01-54);

- "Establish a joint government-industry working group to address, understand and develop effective operational strategies and guidance to reduce thunderstorm penetrations, and verify that these strategies and guidance materials are incorporated into air carrier flight manuals and training programs as the strategies become available. The working group should focus its efforts on all facets of the airspace system, including ground-[based solutions] and cockpit-based solutions. The near-term goal of the working group should be to establish clear and objective criteria to facilitate recognition of cues associated with severe convective activity and guidance to improve flight crew decision making. (A-01-55);

- "Incorporate, at all [ATC] facilities, a near-real-time color weather radar display that shows detailed precipitation intensities. This display could be incorporated by configuring existing and planned [TDWR] or weather systems processor [WSP] systems with this capability or by procuring, within one year, a commercial computer weather program currently available through the Internet or existing stand-alone computer hardware that displays the closest single-site [WSR-88D] doppler data or regional mosaic images (A-01-56);

- "Provide U.S. air carriers operating under [FARs] Part 121 access to [TDWR] at airports where the system is available and access to the [WSP], when it becomes available, so that their flight dispatch offices can use this information in planning, releasing and following flights during periods in which hazardous weather might impact safety of flight. (A-01-57);

- "In cooperation with the [NWS], ensure that [CWSUs] are adequately staffed at all times when any significant weather is forecast. (A-01-58);

- "Modify automated weather systems to accept [RVR] data directly from RVR sensors. (A-01-59);

- "Maintain at least a 48-hour archive of one-minute [RVR] data. (A-01-60);

- "Provide additional information on [LLWAS] in the [*AIM*], including that an LLWAS alert is a valid indicator of wind shear or a microburst. (A-01-61);

- "Issue a mandatory briefing item to tower controllers that describes the circumstances of this accident, including the interactions between the controller and the [ARFF] crews. This briefing item should emphasize that location information provided to ARFF crews should be as complete and specific as possible to minimize opportunities for confusion. (A-01-62);

- "Amend [FAA] Order 7110.65, *Air Traffic Control*, to require controllers to monitor the progress of [ARFF] crews responding to emergencies to ensure that the response is consistent with known location information. (A-01-63);

- "Amend [FAA] Order 7210.3R, *Facility Operations and Administration*, to direct tower managers to establish mutual annual briefings between [ATC personnel] and [ARFF] personnel to ensure that these personnel have a common understanding of the local airport emergency plan and sections of FAA's Advisory Circular 150/5210-7C, *Aircraft Rescue and Firefighting Communications*, that are applicable to local ATC/ARFF emergency response procedures. (A-01-64);

- "Amend [FARs Part] 139.319(j) to require a minimum [ARFF] staffing level that would allow exterior fire fighting and rapid entry into an airplane to perform interior fire fighting and rescue of passengers and crewmembers. (A-01-65);

- "Evaluate crash-detection-and-location technologies, select the most promising candidate(s) for ensuring that emergency responders could expeditiously arrive at an accident scene and implement a requirement to install and use the equipment. (A-01-66);

- "Develop specific criteria, using the [FRA] requirements as guidance, to be evaluated during a postaccident interagency emergency response critique and amend [FARs] Part 139 to require airport operators to conduct this critique within 60 days after any air carrier accident and provide the results of the critique to [FAA]. (A-01-67);

- "Conduct research activities to determine if recent technological advances would enable submerged low-impact structures and other nonfrangible structures at airports to be converted to frangible [structures]. (A-01-68);

- "Define detailed parameters for a stabilized approach, develop detailed criteria indicating when a missed approach should be performed and ensure that all [FARs] Part 121 and [Part] 135 carriers include this information in their flight manuals and training programs. (A-01-69); [and,]

- "Provide additional personnel to accomplish direct oversight of American Airlines' flight training and flight operations, and include the [POI] for American [Airlines] in decisions regarding where these personnel are to be placed. (A-01-70)."

NTSB made the following recommendations to NWS:

- "In cooperation with [FAA], ensure that [CWSUs] are adequately staffed at all times when any significant weather is forecast. (A-01-71); [and,]

- "Eliminate the [ASOS] lockout feature as soon as possible. (A-01-72)."

[NTSB issued these recommendations to FAA and NWS on Dec. 10, 2001. As of Feb. 6, 2002, the recommendations were classified by NTSB as "open, awaiting response."]

The report said that after the accident, American Airlines made several changes, including the following addition to its flight manual:

> American Airlines has a no-fault go-around policy, recognizing that a successful approach can end in a

missed approach. Captains are required to execute/order a missed approach if the aircraft is not stabilized by 1,000 feet AFL (IFR) or 500 feet AFL (VFR), or if in the pilot's judgment a safe landing cannot be accomplished within the touchdown zone, or the aircraft cannot be stopped within the confines of the runway.

The changes also included a requirement for challenges by the pilot not flying (PNF) and responses by the PF for all mechanical-checklist items; a requirement that the PF and PNF verify that the autospoiler system is armed for landing; a clarification that landing limitations for wind conditions include gusts; expanded guidance for operations in severe weather; revision of training-and-evaluation standards on use of weather radar, autobrakes and reverse thrust; and installation of predictive wind shear weather radar in all airplanes operated by the airline.♦

[FSF editorial note: This article, except where specifically noted, is based on U.S. National Transportation Safety Board Aircraft Accident Report NTSB/AAR-01/02, *Runway Overrun During Landing, American Airlines Flight 1420, McDonnell Douglas MD-82, N215AA, Little Rock, Arkansas, June 1, 1999*. The 216-page report contains photographs, diagrams and appendixes.]

Note

1. U.S. Federal Aviation Administration Advisory Circular 150/5300-13, *Airport Design*, defines a *frangible navigational aid* as one that "retains [its] structural integrity and stiffness up to a designated maximum load, but on impact from a greater load, breaks, distorts or yields in such a manner as to present the minimum hazard to aircraft."

Appendix

Cockpit Voice Recorder Transcript, American Airlines Flight 1420, June 1, 1999

[FSF editorial note: The following transcript is as it appears in the U.S. National Transportation Safety Board (NTSB) report, except minor editing for consistency and style. All times are local.]

RDO	=	Radio transmission from accident aircraft
CAM	=	Cockpit area microphone voice or sound source
PA	=	Voice transmitted over aircraft public address system
INT	=	Voice transmitted over aircraft interphone system
CTR	=	Radio transmission from Fort Worth Center controller (through 2328:32) or from Memphis Center controller
APR	=	Radio transmission from the Little Rock Approach/Tower controller
-1	=	Voice identified as captain
-2	=	Voice identified as first officer
-3	=	Voice identified as first female flight attendant
-4	=	Voice identified as second female flight attendant
-5	=	Voice identified as aircraft mechanical voice
-?	=	Voice unidentified
*	=	Unintelligible word
@	=	Non-pertinent word
#	=	Expletive
( )	=	Questionable insertion
[ ]	=	NTSB editorial insertion
…	=	Pause

Time	Source	Content
2319:44	**Start of Recording, Start of Transcript**	
2319:53	**CAM-2**	It warmed it up pretty good.
2319:55	**CAM-1**	aah.
2319:56	**CAM-2**	like it. * * …
2319:56	**CAM-1**	actually, it's getting pretty hot.
2320:07	**CAM-2**	did they complain about the temperature?
2320:09	**CAM-1**	naw, it's getting warm up here.
2320:11	**CAM-2**	ah, OK.
2320:15	**CTR**	American fourteen twenty, are you gonna want still want lower?
2320:18	**CAM-1**	ah, so far it's OK.
2320:20	**RDO-2**	so far so good ma'am. fourteen twenty we'll let you know.
2320:24	**CTR**	right.
2320:52	**CAM-2**	twenty-five for twenty-four. set and armed.
2321:01	**CAM-2**	this stuff is working out pretty well. * get ahead of that stuff.
2321:45	**CAM-1**	* *, we're almost down to max landing weight.
2321:55	**CAM-1**	we'll be there.
2321:57	**CAM-2**	yeah.
2322:17	**CAM-2**	you want to use one thirty, right?
2322:19	**CAM-1**	yeah, well. I don't know. we've got a hundred miles to go. yeah, I guess so.
2322:32	**CAM-1**	and we'll use flaps forty since * *.
2322:35	**CAM-2**	sure.

2322:47	**CAM-?**	* *.
2322:50	**CAM-?**	* *.
2323:02	**CAM-1**	we're right on the edge of this * *.
2323:24	**CAM-?**	* *.
2323:58	**CAM-2**	this is the ground over here on the right.
2324:00	**CAM-1**	yeah I see an occasional ground * *.
2324:13	**CAM-?**	[sound of yawn]
2324:24	**CAM-1**	boy, this is too much (return).
2324:44	**CAM**	[sound of "ding dong' similar to flight attendant call chime]
2324:47	**CAM-2**	there's a moon out there. or a space ship.
2324:53	**CAM-1**	yeah. the mother ship.
2324:56	**CAM-2**	[sound of chuckle] got your Nike's on?
2325:00	**CAM-1**	yeah, right.
2325:01	**CAM-?**	[sound of chuckle]
2325:03	**CAM-1**	what was that guy's name?
2325:04	**CAM-2**	@, @ or.
2325:06	**CAM-1**	yeah @.
2325:10	**CAM-2**	center pumps comin' off.
2325:11	**CAM-1**	all right.
2325:12	**CAM**	[sound of two clicks]
2325:17	**CAM-2**	there's your big wadiddily.
2325:19	**CAM-1**	yeah.
2325:23	**CAM-2**	thirteen miles?
2325:25	**CAM-?**	* * *.
2325:30	**CAM**	[sound similar to ice bag being struck in galley]
2325:47	**CAM-1**	we got to get over there quick.
2325:52	**CAM-2**	I don't like that … that's lightning.
2326:00	**CAM-1**	sure is.
2326:24	**CAM-2**	oh.
2326:40	**CAM-1**	that's about as far as we can go.
2326:41	**CAM-2**	yeah, I would say right about. maybe a little bit more and that's about it. we could start down here pretty soon.
2326:49	**CAM-1**	I'm gonna ask her to come * * …
2326:52	**CAM-1**	this is the bowling alley right here.
2326:54	**CAM-2**	yeah, I know.
2326:59	**CAM-1**	in fact those are the city lights straight out there.
2327:01	**CAM-2**	that's it.
2327:07	**CAM-2**	want to go down?
2327:09	**CAM-1**	uuh, not just yet … but pretty soon.
2327:14	**CAM-1**	(seventy-two), yeah.
2327:15	**CAM-?**	* *.
2327:15	**CTR**	American fourteen twenty descend and maintain one zero thousand. the Little Rock altimeter is two niner eight six.
2327:24	**RDO-2**	ten thousand, two niner eight six. American fourteen twenty, thanks.
2327:27	**CAM-1**	ten set and armed.
2327:28	**CAM-2**	thanks.
2327:31	**PA-1**	Uh, we're now just uh, eighty miles from the airport and we have started our descent, uh, toward it. quite a light show off the left hand side of the aircraft. we'll be passing that on our way toward Little Rock … and we should be landing here in about uh, probably about twenty minutes. I'm gonna have to slightly over-fly the airport, in … order to turn back around to land. it's been a pleasure having you on board for this short flight and I'd like to take this opportunity to thank you for flying American Airlines.
2328:06	**CAM-2**	descent checks are complete.
2328:08	**CAM-1**	OK.
2328:23	**CTR**	American fourteen twenty contact Memphis center one three five point eight. good day.
2328:27	**RDO-2**	thirty-five eight, American fourteen twenty, good night.
2328:30	**CAM-1**	we gotta get there quick.
2328:31	**CAM-2**	yep.
2328:44	**RDO-2**	American fourteen twenty leaving two two zero for one zero thousand.
2328:51	**CTR**	Amer… fourteen twenty, Memphis rog …
2329:02	**CAM-2**	sit 'em down early?
2329:03	**CAM**	[sound of "ding dong, ding dong" similar to flight attendant call chime]
2329:06	**INT-3**	this is Nancy.

2329:07	**INT-1**	yeah, how you guys uh, doing back there?
2329:08	**INT-4**	this is Jennifer.
2329:09	**INT-1**	yeah, how you guys doing back there?
2329:10	**INT-4**	um, pretty OK.
2329:11	**INT-3**	they're still out in the aisle with the cart doing the service.
2329:14	**INT-4**	yeah.
2329:14	**INT-1**	really uh …
2329:15	**INT-3**	yeah.
2329:15	**INT-1**	it's uh, I think it's gonna get a little bumpy here again and if you don't mind uh …
2329:18	**INT-4**	do we need to sit down?
2329:19	**INT-1**	yeah, how far through are you?
2329:21	**INT-4**	we're almost done but not quite, so …
2329:23	**INT-1**	OK, well, finish it real quick.
2329:24	**INT-4**	OK.
2329:25	**INT-1**	all right.
2329:25	**INT-4**	'bye.
2329:26	**INT-1**	'bye.
2329:35	**CTR**	American fourteen twenty, roger. Little Rock altimeter's two niner eight six.
2329:40	**RDO-2**	two niner eight six, American fourteen twenty.
2329:47	**CAM-2**	yeah, that alley's getting' big … closing to the west.
2329:51	**CAM-1**	yeah it is.
2329:52	**CAM-2**	* be OK.
2329:55	**CAM-2**	say we get down as soon as we can.
2329:59	**CAM-1**	two nine eight six?
2330:00	**CAM-2**	* nine eight six. altimeters are set and cross checked.
2330:09	**CAM-2**	aw #, no right side * *.
2330:52	**CAM-2**	OK, hydraulic pumps are on, high, and on.
2330:55	**CAM-1**	OK.
2330:55	**CAM-2**	altimeters? two nine eight six.
2330:59	**CAM-1**	reset, two nine eight six.
2331:00	**CAM-2**	flight instruments and bugs?
2331:02	**CAM-1**	uuh, I got a hundred, and thirty.
2331:06	**CAM-2**	yeah.
2331:08	**CAM-1**	with the flaps forty, a hundred and thirty thousand pounds. four hundred and sixty feet, two hundred feet * * * …
2331:16	**CAM-2**	set and cross checked.
2331:18	**CAM-2**	tail deice? uh, not required?
2331:21	**CAM-1**	uh, not required.
2331:22	**CAM-2**	manual brakes?
2331:24	**CAM-1**	uuh, manual's fine.
2331:32	**CAM-1**	I have to go a little to the right here.
2331:33	**CAM-2**	yeah.
2331:34	**CAM-?**	(don't turn left)
2331:38	**CAM-2**	actually there's the city right there.
2331:39	**CAM-1**	yeah.
2331:42	**CAM-2**	breaking out of this (crud). good … doing good.
2331:55	**CAM-2**	whoa. looks like it's movin' this way though.
2331:57	**CAM-1**	yeah *.
2331:58	**CAM-2**	* * *.
2332:08	**CAM-1**	* just some lightning straight ahead.
2332:14	**CAM-2**	* * * think we're gonna be OK. right there.
2332:18	**CAM-?**	*.
2332:31	**CAM-1**	down the bowling alley.
2332:47	**CAM-2**	as my friends would say, California cool.
2332:51	**CAM-1**	cool.
2332:52	**CAM-2**	[sound of chuckle]
2332:54	**CAM-1**	peachy.
2332:55	**CAM-2**	exactly.
2333:48	**CAM-1**	that's forty miles.
2333:49	**CTR**	American fourteen twenty, contact Little Rock approach one three five point four.
2333:50	**CAM-2**	yeah.
2333:55	**RDO-2**	thirty five four, American fourteen twenty. you have a good night.
2333:57	**CTR**	good night.
2334:05	**RDO-2**	American uh, fourteen twenty at uh, eleven three for ten thousand.

2334:11	**APR**	American fourteen twenty, Little Rock approach roger. ah we have a thunderstorm just northwest of the airport moving uh, through the area now. wind is two eight zero at two eight, gusts four four and uh, I'll have new weather for you in just a moment I'm sure.
2334:23	**RDO-2**	yeah we can see the uh, lightning and uh, you want to repeat those winds again.
2334:28	**APR**	right now the wind current wind is two niner zero at two eight, gusts four four.
2334:34	**CAM-1**	all right two eight zero at four four.
2334:36	**CAM-2**	gusts to forty-four *.
2334:38	**CAM-1**	right near the limit.
2334:39	**CAM-2**	yeah, it's uh, forty degrees off. what's our cross(wind) *.
2334:43	**APR**	American fourteen twenty expect an ILS runway two two left.
2334:46	**CAM-1**	thirty.
2334:47	**RDO-2**	two two left, we've got that, fourteen twenty.
2334:50	**CAM-2**	no that's that's *, you're, not out of the limits because of the angle *, but it's pretty close.
2334:56	**CAM-1**	yeah.
2335:21	**CAM-2**	two two left is the right one … so uh …
2335:29	**CAM-2**	I uh, I didn't realize that.
2335:32	**CAM-?**	eerraaw.
2335:37	**APR**	American fourteen twenty, descend at pilot's discretion. maintain four thousand.
2335:40	**RDO-2**	* down to four thousand, American uh, fourteen twenty.
2335:46	**CAM-1**	four thousand set.
2335:50	**CAM-2**	OK, ten thousand foot, seat belt sign no smoking.
2335:52	**CAM**	[sound of "ding dong" similar to flight attendant call chime]
2335:53	**CAM-1**	yeah I'll get down in a second *.
2335:55	**CAM-2**	OK.
2336:02	**CAM-2**	yeah it's ten knots uh …
2336:04	**CAM-1**	thirty knots is the crosswind limitation but …
2336:06	**CAM-1**	thirty knots is the … wet, well.
2336:08	**CAM-2**	that's the dry.
2336:09	**CAM-1**	yeah, dry.
2336:10	**CAM-2**	what about wet?
2336:11	**CAM-1**	wet.
2336:12	**CAM-2**	yeah.
2336:12	**CAM-1**	is twenty.
2336:13	**CAM-2**	ah, it's twenty-five. aw, what the #.
2336:30	**PA-1**	flight attendants prepare for landing please.
2336:40	**CAM-2**	you got the NOTAMS with ya?
2337:17	**CAM-2**	see the airport?
2337:18	**CAM-1**	see it blinking out there.
2337:20	**CAM-2**	* * to the north,
2337:20	**CAM-1**	straight ahead.
2337:21	**CAM-2**	well there's a couple runways here so, the problem is we're sixteen miles south of the VOR and the airport's another five miles past that.
2337:29	**CAM-1**	all right. (doesn't) matter.
2337:32	**CAM-2**	so we've still got a little ways to go … bad part … I'll tell you what. I'm gonna stay on the run … the VOR till we get a little closer.
2338:22	**CAM-1**	oh I think I see, I see where it is.
2338:25	**CAM-2**	yeah it's on * *.
2338:26	**CAM-1**	it's straight up there, yeah …
2338:27	**CAM-2**	* (blinking) *.
2338:28	**CAM-1**	it looks like there's stratus layer, right over there.
2338:36	**CAM-2**	* * * I definitely got * *. (I'll show you this later).
2338:54	**CAM-1**	he said there was a storm just northwest of the field?
2338:56	**CAM-2**	he said northwest.
2338:57	**CAM-1**	yeah.
2338:58	**CAM-2**	lightning strike he said storm, uh.
2339:00	**APR**	American fourteen twenty, descend and maintain three thousand.
2339:03	**RDO-2**	out of four for three, American uh, fourteen twenty.
2339:06	**APR**	American fourteen twenty uh, your equipment's a lot better than uh, what I have. how's the final for two two left lookin'?
2339:12	**CAM-1**	what's that?

2339:12	**RDO-2**	OK, we can uh, see the airport from here. we can barely make it out but uh, we should be able to make two two. uh, that storm is moving this way like your radar says it is but a little bit farther off than you thought.
2339:23	**APR**	American fourteen twenty roger, would you just want to shoot a visual approach?
2339:27	**CAM-1**	naw.
2339:28	**RDO-2**	uh, at this point we can't really make it out. we're gonna have to stay with you as long as possible.
2339:32	**APR**	American fourteen twenty roger. and uh, the winds kinda kicked around a little bit right now. it's three three zero, at uh, one one.
2339:38	**CAM-1**	whoa.
2339:39	**RDO-2**	OK, well that's a little bit better than it was.
2339:42	**CAM-1**	* thirty is a, tail wind though.
2339:45	**APR**	*.
2339:45	**APR**	and uh, right now I have a uh, wind shear alert. the centerfield wind is three four zero at one zero. north boundary wind is three three zero at two five. northwest boundary wind is zero one zero at one five.
2339:53	**CAM-?**	*.
2339:56	**CAM-1**	* * be landing on four?
2339:59	**RDO-2**	is there a possibility to get runway four?
2340:01	**APR**	American fourteen twenty yes sir. we can do runway four if * you'd prefer that.
2340:05	**CAM-1**	it'd be a head wind.
2340:06	**CAM-2**	yeah.
2340:06	**CAM-2**	I think we're gonna need …
2340:08	**RDO-2**	… we would rather do the head winds sir.
2340:09	**APR**	I'm sorry, say again American fourteen twenty.
2340:12	**RDO-2**	yeah, we're gonna want the head wind of course … runway four.
2340:19	**CAM-1**	we're going to three, right?
2340:20	**APR**	American uh, fourteen twenty uh, turn right heading of uh, two five zero vectors for the ILS runway four right final approach course.
2340:22	**CAM-2**	yeah, three thousand.
2340:26	**RDO-2**	OK, a right turn to two five zero uh, the long way around?
2340:29	**APR**	uh, yes sir, you're a little close to the airport.
2340:31	**CAM-1**	yeah right.
2340:32	**RDO-2**	two five zero, that'll work.
2340:36	**CAM-2**	*, runway four.
2340:46	**CAM-2**	four right. one one one point three … zero four two. I think we were, I think that was the airport right below us.
2341:02	**CAM-1**	yeah it was. OK, one eleven three.
2341:07	**CAM-2**	one eleven three. zero four two. four sixty on decision altitude.
2341:14	**CAM-2**	four thousand for three thousand, is armed.
2341:16	**CAM-1**	OK.
2341:19	**CAM-2**	uh, MSA is thirty-three hundred feet all the way around.
2341:22	**APR**	American fourteen twenty uh, maintain three thousand three hundred for now please.
2341:25	**RDO-2**	three thousand three hundred. we just saw it, thanks.
2341:28	**CAM-1**	yeah, the uh *.
2341:31	**CAM-2**	OK. and two two seventeen glideslope intercept all the way down missed approach right turn to four thousand … * * *.
2341:57	**CAM-2**	let's see, you got the airport? tell you what. *.
2342:00	**CAM-1**	yeah. * * I don't have the airport.
2342:03	**CAM-2**	* *, I'm saying you got the ILS.
2342:04	**CAM-1**	yeah, I got the ILS.
2342:07	**CAM-1**	it's uh …
2342:13	**CAM-2**	yeah, there it is. I got the airport.
2342:16	**CAM-1**	OK, and decision height is four sixty.
2342:17	**CAM-2**	yeah.
2342:19	**CAM-1**	do you have the airport?
2342:20	**CAM-2**	*.
2342:20	**CAM-1**	is that it right there?
2342:21	**CAM-?**	OK.
2342:23	**CAM-2**	* see, I can't.

2342:24	**CAM-1**	I don't see a runway.
2342:26	**CAM-2**	go out this way.
2342:27	**APR**	American fourteen twenty, it appears we have uh, second part of this storm moving through. the winds now, three four zero at one six, gusts three four.
2342:34	**CAM-1**	OK.
2342:35	**RDO-2**	roger that.
2342:40	**CAM-2**	you wanna accept a short approach? want to keep it in tight?
2342:42	**CAM-1**	yeah, if you see the runway. 'cause I don't quite see it.
2342:45	**CAM-2**	yeah, it's right here, see it?
2342:48	**CAM-1**	[sound of grunt] you just point me in the right direction and I'll start slowing down here. give me flaps eleven.
2342:54	**RDO-2**	and uh …
2342:55	**CAM-2**	#, it's going right over the … f-field.
2342:55	**CAM-1**	*.
2342:56	**APR**	American fourteen twenty, did you call me?
2342:59	**RDO-2**	well we got the airport. we're going between clouds. I think it's right off my uh, three o'clock low, about four miles.
2343:05	**APR**	American fourteen twenty, that's it. do you wanna shoot the visual approach or you wanna go out for the ILS?
2343:09	**RDO-2**	I can, we'll, we'll (start) the visual. if we we can do it.
2343:11	**APR**	American fourteen twenty's cleared visual approach runway four right. if you lose it, need some help, let me know please.
2343:15	**RDO-2**	I'll stay with you as long as possible, OK?
2343:18	**APR**	that's fine, I'm working everything, American fourteen twenty.
2343:20	**RDO-2**	that works for me.
2343:21	**APR**	all right.
2343:23	**CAM-1**	well you keep me straight.
2343:23	**CAM-2**	keep it right here, keep it right here, * * right here.
2343:25	**CAM-1**	what?
2343:26	**CAM-2**	OK, did you notice something? there's the airport right there. OK?
2343:31	**CAM-1**	where?
2343:31	**CAM-2**	OK, you're set up on a base for it. OK?
2343:33	**CAM-1**	I'm on a base now?
2343:35	**CAM-2**	well, you're on a dogleg. you're comin' in. there's the airport.
2343:38	**CAM-1**	uh, I lost it.
2343:39	**CAM-2**	right there, you're you're downwind. see it's right there.
2343:44	**CAM-1**	I still don't see it. [sound of chuckle] well just vector me. I don't know.
2343:47	**CAM-2**	OK, well just go * right here.
2343:49	**CAM-1**	OK.
2343:59	**APR**	American fourteen twenty, you can monitor one one eight point seven, runway four right, cleared to land. the wind right now three three zero at two one.
2344:05	**RDO-2**	eighteen seven, we'll monitor, American fourteen twenty, thanks. cleared to land runway four.
2344:10	**CAM-1**	* * * * * *.
2344:13	**CAM-2**	if you look at …
2344:14	**CAM-1**	those red lights out there. where, where's that in relation to …
2344:18	**CAM-2**	there's another, there's two runways here. there's three runways.
2344:19	**CAM-1**	yeah I know. see we're losing it. I don't think we can maintain visual.
2344:22	**CAM-2**	* * yeah.
2344:23	**RDO-2**	hold on and uh …
2344:26	**CAM-1**	oh, you're on tower.
2344:27	**CAM-2**	oh, I'm sorry.
2344:28	**RDO-2**	and approach American fourteen twenty.
2344:29	**APR**	American fourteen twenty, yes sir.
2344:30	**RDO-2**	and there's a cloud between us and the airport. we just lost the field and I'm uh, on this vector here, I have the uh, basically last vector you gave us, we're on kind of a dogleg it looks like.
2344:39	**APR**	American fourteen twenty, can you fly heading two two zero? I'll take you out for the ILS.
2344:42	**CAM-1**	* *.
2344:43	**RDO-2**	yeah two two zero's fine.

2344:45	**APR**	and it will be just one probably one turn on from uh, downwind to final, for the ILS.
2344:49	**RDO-2**	OK that's how it's gonna have to be, thanks.
2344:51	**CAM-2**	yeah, I had it but I lost it with the clouds and that's what I was saying.
2344:54	**CAM-1**	OK.
2344:54	**APR**	American fourteen twenty, descend and maintain two thousand three hundred.
2344:56	**RDO-2**	two thousand three hundred, American fourteen twenty.
2344:59	**CAM-2**	two thousand three hundred.
2345:00	**CAM-1**	set and armed. uh, now it is.
2345:07	**CAM-2**	#, * we had it.
2345:09	**CAM-1**	yeah. I just, I never saw the runway.
2345:11	**CAM-2**	no no, it's OK. I * *.
2345:12	**CAM**	[sound similar to stabilizer-in-motion horn]
2345:13	**CAM-5**	stabilizer motion
2345:15	**CAM-1**	I hate droning around visual at night in weather without having some clue where I am.
2345:23	**CAM-2**	yeah but, the longer we go out here the …
2345:24	**CAM-1**	yeah, I know.
2345:25	**CAM**	[sound similar to stabilizer-in-motion horn]
2345:26	**CAM-5**	stabilizer motion.
2345:29	**CAM-2**	see how we're going right into this crap.
2345:31	**CAM-1**	right.
2345:47	**RDO-2**	and approach American fourteen twenty, I know you're doing your best sir. we're getting pretty close to this storm. we'll keep it tight if we have to.
2345:52	**APR**	* American fourteen twenty uh, turn right heading of uh, two seven zero.
2345:56	**CAM**	[sound similar to stabilizer-in-motion horn]
2345:57	**RDO-2**	two seven zero, American fourteen twenty.
2345:59	**APR**	and uh, when you join the final, you're going to be right at just a little bit outside the marker if that's gonna be OK for ya.
2346:04	**CAM-1**	that's great.
2346:05	**RDO-2**	that's great with us.
2346:06	**APR**	American fourteen twenty, roger.
2346:11	**CAM**	[sound similar to stabilizer-in-motion horn]
2346:11	**CAM-2**	see we're right on the base of these clouds so …
2346:13	**CAM-1**	yeah.
2346:14	**CAM-2**	… it's not worth it.
2346:15	**CAM**	[sound similar to stabilizer-in-motion horn]
2346:20	**CAM-2**	two seven zero, two thousand three hundred?
2346:23	**CAM-1**	yes sir. * where I am.
2346:25	**APR**	American fourteen twenty, turn right heading three zero zero.
2346:29	**RDO-2**	right turn three zero zero American fourteen twenty.
2346:39	**APR**	American fourteen twenty is uh, three miles from the marker. turn right heading zero two zero. maintain two thousand three hundred 'til established on the localizer. cleared ILS runway four right approach.
2346:43	**CAM**	[brief sound of Morse code identifier]
2346:47	**RDO-2**	zero two zero 'til established, American fourteen twenty, cleared four left approach.
2346:52	**CAM-1**	aw, we're goin' right into this.
2346:52	**APR**	American fourteen twenty, right now we have uh, heavy rain on the airport. the uh, current weather on the ATIS is not correct. I don't have new weather for ya, but the uh, visibility is uh, less than a mile. runway four right RVR is three thousand.
2346:53	**CAM**	[sound similar to stabilizer-in-motion horn]
2347:04	**CAM-1**	three thousand.
2347:04	**RDO-2**	roger that, three thousand, American uh, fourteen twenty. this is four right, correct?
2347:07	**CAM**	[sound similar to stabilizer-in-motion horn]
2347:08	**APR**	American fourteen twenty, that's correct sir. and runway four right, cleared to land. the wind three five zero at three zero, gusts four five.
2347:10	**CAM-1**	can we land?

2347:16	**RDO-2**	zero three zero at four five, American fourteen twenty.
2347:19	**CAM-2**	* * zero forecast right down the runway.
2347:22	**CAM-1**	three thousand RVR. we can't land on that.
2347:24	**CAM-2**	three thousand if you look at uh …
2347:26	**CAM**	[sound similar to stabilizer-in-motion horn]
2347:27	**CAM-1**	what do we need?
2347:28	**CAM-2**	no it's twenty-four hundred RVR.
2347:29	**CAM-1**	OK, fine.
2347:30	**CAM-2**	yeah, we're doing fine.
2347:31	**CAM-1**	all right.
2347:34	**CAM-1**	uh, fifteen.
2347:36	**CAM**	[sound of clicks similar to flap handle movement]
2347:40	**CAM**	[sound similar to stabilizer-in-motion horn]
2347:44	**CAM-1**	landing gear down.
2347:46	**CAM**	[sound similar to landing gear being operated]
2347:47	**CAM**	[sound similar to stabilizer-in-motion horn]
2347:49	**CAM-1**	and lights * * please.
2347:51	**CAM**	[sound similar to stabilizer-in-motion horn]
2347:52	**CAM-5**	stabilizer motion
2347:53	**APR**	wind shear alert, centerfield wind, three five zero at three two, gusts four five. north boundary wind, three one zero at two niner. northeast boundary wind, three two zero at three two.
2348:01	**CAM**	[sound similar to stabilizer-in-motion horn]
2348:02	**CAM-5**	stabilizer motion.
2348:03	**CAM-2**	flaps twenty eight?
2348:10	**CAM-1**	add twenty.
2348:12	**CAM-2**	right.
2348:12	**CAM-1**	add twenty knots.
2348:12	**APR**	American fourteen twenty, the runway four right RVR now is one thousand six hundred.
2348:14	**CAM-2**	OK.
2348:17	**CAM-2**	aw #.
2348:18	**CAM-1**	well we're established on the final.
2348:20	**CAM-2**	we're established, we're inbound, right.
2348:24	**RDO-2**	OK, American fourteen twenty, we're established inbound.
2348:26	**APR**	American fourteen twenty roger, runway four right, cleared to land, and the wind, three four zero at three one. north wind, north uh, boundary wind is three zero zero at two six, northeast boundary wind, three two zero at two five, and the four right RVR is one thousand six hundred.
2348:36	**CAM**	[sound similar to stabilizer-in-motion horn]
2348:41	**RDO-2**	American uh, fourteen twenty, thanks.
2348:43	**CAM-2**	that's a good point.
2348:45	**CAM**	[unidentified intermittent tone]
2348:47	**CAM-2**	keep the speed.
2348:50	**CAM-2**	thousand feet.
2348:54	**CAM-1**	I don't see anything. lookin' for four sixty.
2348:58	**CAM**	[sound similar to stabilizer-in-motion horn]
2349:00	**CAM-2**	it's there.
2349:02	**CAM-2**	want forty flaps?
2349:04	**CAM-1**	oh yeah, thought I called it.
2349:05	**CAM-2**	forty now. thousand feet. twenty, forty forty land.
2349:10	**CAM**	[unidentified tone similar to sound at time 2348:45]
2349:10	**APR**	wind is three three zero at two eight.
2349:12	**CAM-1**	this is, this is a can of worms.
2349:17	**CAM**	[sound similar to stabilizer-in-motion horn]
2349:22	**CAM**	[sound similar to stabilizer-in-motion horn]
2349:24	**CAM-1**	(I'm gonna stay above it a little)
2349:24	**CAM-2**	there's the runway off to your right, got it?
2349:26	**CAM-1**	no.
2349:27	**CAM-2**	I got the right runway in sight.
2349:30	**CAM-2**	you're right on course. stay where you're at.
2349:31	**CAM-1**	I got it, I got it.

2349:32	**APR**	wind three three zero at two five.
2349:37.7	**CAM-?**	wipers.
2349:41.4	**CAM**	[sound similar to windshield wiper motion]
2349:46.4	**CAM-2**	five hundred feet.
2349:50.1	**CAM-?**	*.
2349:53.1	**APR**	wind three two zero, at two three.
2349:53.7	**CAM-1**	plus twenty.
2349:56.6	**CAM-?**	aw #, we're off course.
2349:57.6	**CAM-?**	* *.
2350:00.4	**CAM-2**	we're way off.
2350:01.5	**CAM-1**	I can't see it.
2350:04.4	**CAM-2**	got it?
2350:05.1	**CAM-1**	yeah I got it.
2350:07.9	**CAM-2**	hundred feet.
2350:09.4	**CAM-?**	above.
2350:11.1	**CAM-2**	hundred.
2350:12.8	**CAM-5**	sink rate.
2350:13.7	**CAM-2**	fifty.
2350:14.2	**CAM-5**	sink rate.
2350:14.5	**CAM-2**	forty.
2350:15.8	**CAM-2**	thirty.
2350:17.6	**CAM-2**	twenty.
2350:18.3	**CAM-2**	ten.
2350:20.2	**CAM**	[sound of two thuds similar to aircraft touching down on runway concurrent with unidentified squeak sound]
2350:22.2	**CAM-2**	we're down.
2350:24.4	**CAM-2**	we're sliding.
2350:26.1	**CAM-1**	# … #
2350:31.8	**CAM-?**	on the brakes.
2350:33.1	**CAM-?**	oh shi…
2350:33.5	**CAM**	[sound similar to increase in engine RPM]
2350:35.1	**CAM-?**	other one, other one, other one.
2350:40.9	**CAM-?**	aw #.
2350:41.6	**CAM-?**	# #.
2350:43.8	**CAM**	[sound of impact]
2350:44.3	**CAM-?**	# #.
2350:46.9	**CAM**	[sound of several impacts]
2350:48.1	**End of Recording. End of Transcript.**	

Accident Prevention

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