



National Transportation Safety Board

Aviation Accident Final Report

Location:	Beaumont, TX	Accident Number:	FTW98MA126
Date & Time:	02/11/1998, 1216 CST	Registration:	N14931
Aircraft:	Embraer 145-ER	Aircraft Damage:	Substantial
Defining Event:		Injuries:	1 Serious, 1 Minor, 2 None
Flight Conducted Under:		Part 91: General Aviation - Instructional	

Analysis

The pilot-in-command (PIC) was administering a proficiency check flight to the first officer (FO) in a regional jet. One of the required check items was the loss of an engine at "V1" speed. While on takeoff roll with the FO at the controls, the PIC retarded the left engine throttle to idle when "V1" speed was attained. The FO called, "check max thrust," and then called, "positive rate gear up." As the PIC reached for the gear lever, he noticed the airplane roll to the left at a rate which he felt was "excessive and dangerous." He then reached for the flight controls and felt the left rudder "go all the way to the floor." As the PIC took control of the airplane, he applied full right rudder and right aileron. The airplane began recovering from the bank and impacted the ground. Flight recorder data revealed that the time interval between the throttle retarded to idle and ground impact was about 8 seconds. The data showed that the airplane became airborne about 2 seconds after the throttle was retarded, and that the airplane had rolled to a 71 degree left bank within 6 seconds from the throttle reduction. Ground scars and wreckage distribution revealed that the left wing had contacted the ground first and then the right wing prior to the airplane coming to rest. The FO had a total of 15 hours in the type aircraft in the last 90 days. Examinations of the airframe, engines, and flight control system did not reveal any anomalies that could have contributed to the accident. Company flight training policy stated that all check airmen should be ready to take control of the airplane while practicing these types of training maneuvers.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The first officer's improper use of the rudder when given a simulated engine failure on takeoff and the pilot-in-command's delayed remedial action which resulted in a loss of control. A factor was the first officer's lack of experience in the regional jet airplane.

Findings

Occurrence #1: LOSS OF CONTROL - IN FLIGHT

Phase of Operation: TAKEOFF - INITIAL CLIMB

Findings

1. ENGINE SHUTDOWN - SIMULATED - PILOT IN COMMAND
 2. (C) RUDDER - IMPROPER USE OF - COPILOT/SECOND PILOT
 3. (F) LACK OF EXPERIENCE - COPILOT/SECOND PILOT
 4. (C) REMEDIAL ACTION - DELAYED - PILOT IN COMMAND
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Occurrence #2: IN FLIGHT COLLISION WITH TERRAIN/WATER

Phase of Operation: DESCENT - UNCONTROLLED

Findings

5. TERRAIN CONDITION - GROUND

Factual Information

HISTORY OF FLIGHT

On February 11, 1998, at 1216 central standard time, an Embraer EMB-145ER regional jet airplane, N14931, was substantially damaged when it impacted the ground following a loss of control during takeoff from runway 30 at the Jefferson County Regional Airport in Beaumont, Texas. The aircraft was registered to First Security Bank, Salt Lake City, Utah, and operated by Continental Express of Houston, Texas. Flight number 910 was being conducted as an aircrew training and proficiency check flight under the provisions of Title 14 Code of Federal Regulations Part 91. The pilot-in-command (PIC) was not injured; the first officer (FO) received serious injuries; the check airman who was seated in the cockpit jump seat received minor injuries; and another FO seated in the cabin received minor injuries. Visual meteorological conditions prevailed and an instrument flight plan was filed.

The check airman who occupied the jump seat was the Continental Express program manager for the EMB-145. He was observing the PIC seated in the left seat who was administering a proficiency check to the FO in the right seat. The check airman was planning to recommend the PIC for observation by the FAA to approve him as a check airman in the EMB-145. The FO who was seated in the cabin had completed his flight earlier with the PIC, and during his flight, there were no reported mechanical problems with the aircraft.

The following information was derived from flight crew interviews and cockpit voice recorder (CVR) transcripts:

The proficiency check flight began with "high work" which included stall recognition, steep turns, holding patterns and other required air work, before the flight progressed to approach and landing maneuvers. The PIC stated that the FO was initially "a little nervous", but was getting comfortable. The check airman who was observing stated that the FO's "high work was very good, very acceptable, a good solid ride." After the air work, the FO completed a coupled ILS approach to runway 12 with a missed approach. He then performed a VOR-A approach and made a full stop landing. The PIC stated that the approach and landing were both satisfactory. The check airman stated that the landing was on centerline and in the touchdown zone.

After the landing, the airplane was taxied to runway 30 for takeoff. When the control tower cleared the flight into "position and hold," the PIC transferred control of the airplane to the FO and said, "your aircraft." The check airman suspected a "V1 cut was coming" so he checked that both crewmembers' feet were positioned correctly on the rudder pedals. The FO then set the throttle levers to the takeoff detent and called, "set thrust." The PIC saw that both engines had the proper thrust and responded, "thrust set." The airplane accelerated normally and the PIC called, "eighty knots," which the FO acknowledged. When the PIC called "V1," the FO removed his hand from the throttles and the PIC placed his hands on the throttles. The PIC then pulled the left, (number one engine) throttle to idle. The check airman noticed that the throttle was retarded smoothly.

The FO called, "check max thrust," and then called, "positive rate gear up." The PIC reached for the gear lever and noticed the airplane roll to the left at a rate which he felt was "excessive and dangerous." He then reached for the flight controls and felt the left rudder "go all the way to the floor." The PIC "got his hands on the controls when it felt like the left wing quit flying."

He felt like the airplane was going to roll on its back and that all he could do "to save our lives was to level the wings." He felt the stick shaker and thinks he may have felt the stick pusher. The PIC stated that the FO initially put in the wrong rudder and then tried to correct his mistake by putting in more "wrong rudder." The PIC applied full right aileron and full right rudder as "fast" as he could and felt that the bank angle had exceeded "sixty degrees" but did not recall hearing the "bank and angle" warning. The PIC stated that the airplane began recovering from the bank and may have been nearly wings level when it impacted the ground. He stated that the airplane impacted first on the left wing, then the right wing, then slid to a stop.

The FO stated that as soon as he felt the airplane yaw to the left, due to the reduction of the left throttle, he applied "a little right rudder and a little right aileron." He stated that the yoke "felt a little soft and didn't feel right in roll and pitch." He also stated that when the left wing started dipping, he "added" right aileron and rudder. The FO stated that he heard the PIC say "my airplane," and "let go" of the controls and the PIC took control. The FO stated that the first bank "was not that steep," but after the PIC took control "the airplane banked a second time worse than the first." The FO stated that to his best recollection his hands and feet were off the controls during the second bank.

The check airman stated that the airplane rotated for takeoff "normally," but when the left throttle was retarded, the airplane began to roll and yaw to the left. He stated that the airplane began to correct toward wings level and may have been slightly right wing low prior to impact. He stated that the airplane hit the ground, bounced airborne, then impacted and slid to a stop.

PERSONNEL INFORMATION

The PIC, who occupied the left cockpit seat, was employed by Continental Express on May 22, 1994. While at Continental, he flew as an FO on the ATR-42 and Brasilia and as PIC on the Beechcraft BE-1900 and the Embraer EMB-145. He estimated that he accumulated approximately 350 hours on the ATR-42, 1,200 hours on the Brasilia, 800 hours on the BE-1900, and 500 hours on the EMB-145. He was type rated on the EMB-145 on July 31, 1997 and was selected as a check-airman while he was in EMB-145 training. Continental had asked him to be a check-airman on the BE-1900, but he declined in order to upgrade to the EMB-145 as soon as possible. He was qualified as an "off-line aircraft instructor" authorized to conduct flight training in the EMB-145. He had about 8 previous students who had all successfully completed flight training in the EMB-145.

The FO, who occupied the right cockpit seat, was the pilot at the controls at the onset of the accident. He was employed by Continental Express on October 7, 1996. Prior to training on the EMB-145, he flew as an FO on the ATR-42/72 for Continental Express. He estimated that his total flight time was approximately 1,900 hours with about 800-860 hours on the ATR 42/72. His total flight time in the EMB-145 was 15 hours. His total flight time in the last 90 days was 15 hours, all of which were in the actual aircraft. He had completed EMB-145 ground school.

The check airman, who occupied the jump seat, was employed by Continental Express on March 12, 1990. At the time of the accident he was the EMB-145 Program Manager. He described the position as being the "lead check-airman." The FAA had approved him as a check airman on February 15, 1997. He estimated his total flying time as approximately 10,800 hours, with about 700-800 hours in the EMB-145. The FAA appointed him as a designated examiner on the EMB-145, which authorized him to give type ratings. He estimated that he

had given approximately 20-25 type rating check rides on the EMB-145 and had disapproved at least 5 of these candidates for type ratings.

In an interview with the check airman in his capacity as EMB-145 Program Manager for Continental Express, he stated that he had experienced two situations similar to the accident in previous training sessions on the EMB-145. Both occasions had occurred during "V1 cuts." He stated that he was not certain of what caused the first situation, but that the second was caused when the student pilot applied the wrong rudder. He stated that in both instances he was able to prevent an accident by taking control of the airplane and reducing the angle of attack. He reiterated that "the key thing was to reduce the angle of attack even though it may be difficult to do close to the ground." The program manager stated that he had discussed these previous events with the PIC.

AIRCRAFT INFORMATION

The EMB-145 is a low wing, T-tail, pressurized airplane powered by two rear fuselage mounted turbofan engines. The airplane has retractable tricycle landing gear with two tires mounted on each landing gear strut. The EMB-145 was certified by the FAA in January 1997, and Continental Express completed proving runs in April 1997.

Airplane maintenance records were reviewed dating back to the airplane's original delivery date of April 30, 1997. The records revealed that the required inspections had been performed in compliance within the established times. Total airframe hours and cycles at the time of the accident were 1,844.6 and 1,472, respectively. The airplane was equipped with two Allison model AE3007 engines, serial numbers CAE310022 (left engine) and CAE310050 (right engine). The left engine was original on the airframe and had accumulated 1,844.6 hours and 1,472 cycles at the time of the accident. The right engine was installed in October 1997 and had accumulated 905.6 hours and 754 cycles at the time of the accident.

The following records were reviewed, with a specific focus on any flight control difficulties: airplane logbooks, non-routine work cards, and a list of airplane modifications and applicable service bulletins. No open write-ups or trends were found. A review of the airplane logbooks revealed two flight control discrepancies. On January 21, 1998, a write-up indicated that the spoilers deployed on the take off roll. An operational test of the spoilers was conducted, and no defects were discovered. On February 2, 1998, a write-up indicated that both control yokes were offset to the right of neutral (with greater offset on the left yoke). As corrective action, the neutral position between the control yokes and the ailerons was verified.

The maintenance records review also included an examination of Engineering Authorizations (EM) on the airplane, cross-referenced with the original service bulletins (SB) prompting the work, showing those effective on the EMB-145 and those listed or performed on the accident airplane. The records indicated that all SBs related to flight controls had been performed except SB 145-27-0011, which provides for a modification to the rudder PCU input arm to preclude interference of the input arm with the PCU manifold. However, review of records from Parker Aerospace and subsequent examination of the rudder PCU during its testing revealed that the modification had been incorporated.

AIRDROME INFORMATION

Runway 30's surface condition at the time of the accident was classified as "Good." There were no NOTAMS in effect for the runway or the airport facility.

FLIGHT RECORDERS

The airplane was equipped with an Allied Signal two-hour solid state digital cockpit voice recorder (CVR), serial number 0354. After the accident, the unit was removed from the airplane and delivered to the NTSB Audio Laboratory in Washington, DC. The exterior case of the CVR showed no evidence of structural damage and the interior of the recorder and the memory module sustained no apparent heat or impact damage. On February 18, 1998, a CVR group convened in Washington, DC. A transcript was prepared of the final 6:52 minutes of the recording.

The airplane was equipped with an Allied Signal Solid State Flight Data Recorder (SSFDR), serial number 1975. After the accident, the unit was removed from the airplane and delivered to the NTSB Flight Recorder Laboratory in Washington, DC, for read out and evaluation. A SSFDR group was convened in Washington, DC, evaluated the data, and produced a Factual Report. The following is a summary of the pertinent evaluated data from the last 30 seconds of the accident flight:

At 1215:51, SSFDR data indicated that the aircraft was traveling down the runway on a magnetic heading of 298 and at an airspeed of 109 knots. Engine #1 (left engine) N1 and N2 values were 86% and 94%, respectively. Engine #2 (right engine) N1 and N2 values were 86.29% and 94.80%, respectively. The thrust lever angle (TLA) for the left engine was at 75 degrees. Pitch angle values indicate the start of a pitch up, going from a value of 0 degrees to 1 degree. Rudder pedal position (RPP) values indicate right rudder inputs, at values of 1 degree and 2 degrees.

At 1215:52, TLA for the left engine was reduced to 30 degrees, indicating the left throttle lever was being retarded to idle. The airspeed value was 115 knots, while pitch angle values reached 5 degrees. The RPP value was minus 1-degree, indicating left rudder inputs. Control wheel position (CWP) reached a value of 22 degrees, indicating right control wheel inputs.

At 1215:53, TLA for the left engine remained at 30 degrees, while left engine N1 and N2 values dropped to 70% and 84%, respectively. Left rudder inputs continued, indicated by a RPP value of minus 2 degrees. Pitch angle reached 8 degrees. At this time, roll angle values increased from 1 degree to 2 degrees (right roll). During this time, the air/ground switch value indicated "air."

At 1215:54, TLA for the left engine dropped further to 25 degrees. At the same time, left engine N1 and N2 values continued dropping to 47% and 70%, respectively. Left rudder inputs increased, indicated by RPP values reaching minus 7 degrees. The aircraft continued rolling to the right, reaching a 4 degree roll angle. Pitch angle continued to increase, reaching 11 degrees.

At 1215:55, RPP values increased to 6 degrees, indicating right rudder inputs. The airplane began to roll to the left, reaching a roll angle of minus 1 degree at a rate of minus 1 degree per second. Right control wheel inputs continued, with CWP reaching 40 degrees. Airspeed continued increasing, having reached 122 knots.

At 1215:56, the left roll continued, going from minus 9 degrees to minus 23 degrees. At the same time, pitch angle was 10 degrees. According to documentation from the aircraft manufacturer, in the EMB-145, when the main landing gear is on the ground and the pitch

angle is 10 degrees, the wing touches the ground at a roll angle of 11 degrees 20 seconds.

From 1215:57 to 1216:01 (the last second for valid data on the SSFDR), the left roll continued, reaching a maximum left roll of minus 71 degrees at 1215:58 before decreasing to minus 23 degrees at 1216:01. Magnetic heading continued to decrease from 270 degrees to a final value of 237 degrees. The aircraft reached a maximum airspeed of 125 knots at 1215:58 before slowing to 120 knots at 1216:01. Left engine TLA increased to 82 degrees at 1215:58, indicating power being applied to the engine. Left engine N1 and N2 increased to final values of 60% and 87% at 1216:01.

WRECKAGE AND IMPACT INFORMATION

The first physical evidence of the airplane's ground track across the runway was a contact mark, consistent with the left wingtip, beginning at the left edge of runway 30 where it intersects the east edge of taxiway "F" (approximately 2,800 feet from threshold on runway 30). The mark was overall white in appearance and continued to the left and across the taxiway. The mark began thin, became thicker toward the middle of the taxiway, then thinner again toward the far edge of the taxiway. Three small composite pieces from the left wingtip were found adjacent to the mark on the taxiway. No impact scar was observed for the next 55 feet until the beginning of an arcing 117-foot gouge in the soil. Other wingtip composite pieces and a wingtip lens were found adjacent to the gouge. Additional ground scars consistent with the left main landing gear, nose landing gear, and right main landing gear were subsequently observed along the energy path. The airplane came to rest with a final heading of approximately 230 degrees (magnetic) and approximately 750 feet southwest of the left edge of runway 30 and 650 feet northwest of the edge of taxiway "F." All components of the airplane were found along the energy path and the final resting place. There was no evidence of a flight control surface component liberation prior to the impact.

Fuselage

The underside of the fuselage from the nose to the cockpit was crushed up, aft, and slightly to the left and the radome was separated. Cables, bell cranks, and supporting structure located underneath the cockpit were also damaged. The nose landing gear and several associated components separated during the impact sequence and were found early in the debris field. The cockpit windows were intact and undamaged. The main cabin door was opened and used by the airplane occupants to exit the airplane. The service door, baggage door, and over wing emergency exit hatches were in the closed position. Damage between the cockpit and the wing was limited to scraping along the underside of the fuselage. No damage was observed on the left side of the fuselage aft of the wing. The right fuselage skin was dented and wrinkled in an area around the four aft-most windows, and the aft three windows had separated from the frames and were found inside the airplane. In addition, there was a large, vertical gash in the fuselage just above and aft of the aft window. Both sides of the fuselage aft of the wing had mud splatter.

Left Wing

The left wing was intact and relatively undamaged except for the forward portion of the wing tip, which had separated during the impact sequence. All control surfaces were intact and attached. The left main landing gear (MLG) was folded outboard but remained attached, although the rear spar was broken at the gear attach point. The landing gear actuator was in a position consistent with the gear-extended position. The fuel cell was intact and still holding

fuel.

Right Wing

Except for a large section of upper skin, the outboard portion of the right wing, aileron, and outboard flap had separated during the impact sequence and the fuel tank had been breached. Most of the upper skin remained attached but was curled up and aft. A section of lower skin was found embedded in the ground approximately 125 feet from the airplane, and ground fire damage was observed just beyond this area. Soot was observed on some of the separated pieces of leading edge and trailing edge panels that were found in this area. No fire damage was observed on the portion of the right wing remaining attached to the airplane. The right MLG was folded up in the wheel well and appeared intact.

Empennage

The empennage was undamaged and had mud splatter. All control surfaces were attached. The right and left elevator positions were split, but the surfaces were intact with all trim tabs attached.

Flight Controls

The aircraft had inboard and outboard flaps located on each wing. Flap position was documented using both the flap selector lever in the cockpit and the flap position marks on the wing trailing edge. Both of these indications confirmed the flap setting as 9 degrees.

The roll (aileron) trim function is provided by an electromechanical actuator installed beneath the cockpit and connected to the aileron torque tube through an artificial feel unit. No damage to the actuator assembly was observed. The roll trim actuator rod was extended 2 3/16 inches from the body of the trim unit, which equates to 20% of the trim actuator's authority. Embraer indicated that this corresponds to a right aileron-down (and corresponding left aileron-up) deflection of 3.65 degrees.

Pitch trim is performed by positioning of the horizontal stabilizer (HS). The pitch trim position was determined by documenting the position of the HS leading edge relative to reference marks located along the top of the vertical stabilizer forward of the HS leading edge. According to Embraer, the pitch trim marks represent HS trim position in 2-degree increments, from 4 degrees airplane nose-down to 10 degrees airplane nose-up. The HS leading edge was observed in a position between 5 and 6 marks down from the top, which is consistent with a pitch trim position of approximately 5 degrees airplane nose-up. This position was confirmed by measurement of the stabilizer trim actuators. Both actuator rods were extended 6 1/16-inches from the body of the trim unit, which equates to a trim position of 4.8 degrees airplane nose-up according to Embraer.

Rudder trimming is performed by an electromechanical actuator installed on the rudder PCU. The rudder trim actuator rod was extended 2.5 feet from the body of the trim unit. Embraer indicated that this corresponds to a neutral rudder trim position. The rudder PCU was removed from the airplane and examined at the manufacturer's facility under NTSB supervision. See "Test and Research" section of this report for details of the examination.

Cockpit

Structural deformations to the fuselage beneath the cockpit disturbed mechanisms associated

with the elevator and aileron disconnect systems. The left and right cable circuits for both the elevator and aileron systems were found damaged. The elevator and aileron disconnect levers in the cockpit remained in place and had not been pulled. In the same general damage area under the cockpit, the cable that transmits commands from the aileron autopilot actuator to the aileron torque tube was broken. No other broken or damaged cables were observed.

The captain's seat position was full forward. The first officer's seat position was two pin stops back from full forward.

Both fire handles were found in the pulled (actuated) position and turned (discharged) to the "B" side. A check of the fire bottle pressures revealed no pressure on the "B" bottle, and the "A" and auxiliary power unit (APU) bottles were found charged. Cockpit settings from the forward panels and control pedestal revealed no anomalies.

Left Engine

Although dirt and mud were found deposited on the inside and outside of the nacelle inlet, the fan rotor rotational path was free of dirt and mud. All fan blades were in place, but 6 of the blades exhibited blade tip bending opposite to the direction of rotation and one had foreign object damage on the leading edge. No damage was observed beyond the fan rotor in the exhaust section of the engine.

Right Engine

The inside and outside surfaces of the nacelle contained substantial deposits of mud and dirt in the forward and rear areas. The fan rotor rotational path was smeared with mud. All fan blades were in place, but 16 of the blades exhibited blade tip bending opposite to the direction of rotation. No damage was observed beyond the fan rotor or in the exhaust section of the engine.

FIRE

The exterior of the APU cowling displayed soot and light heat damage. No fire damage to the interior of the cowling was observed. Similar fire damage was observed on some of the channel cover pieces from the right wing. Ground fire damage was observed just beyond the location where a portion of the right wing was embedded in the ground.

SURVIVAL ASPECTS

After the aircraft came to rest, the FO stated that he heard the jump seat rider say "kill the batteries, pull the T-handles and get out." He also heard the FO who was seated in the cabin say, "the airplane was on fire," and that fuel was leaking and that everyone should get out. The PIC stated that he pulled both fire handles, while the check airman "blew at least one and maybe both bottles." The PIC stated that the check airman "took a little time to get the jump seat out of the way" before they evacuated. The FO stated that he pulled the number two fire handle before he evacuated but did not "fire the bottle." The check airman stated that he noticed the right T-handle was already pulled so he pulled the left T-handle, "fired the bottle," and turned off both batteries before evacuating the airplane.

The PIC stated that all of the occupants of the airplane exited through the main cabin door and gathered in front of the airplane and noticed a fire burning approximately 50-100 yards behind the airplane. Airport emergency personnel and equipment arrived within 1-3 minutes to assist the crew and extinguish the fire. The FO and the check airman were taken to a hospital for

treatment. The PIC and the FO who was seated in the cabin reentered the airplane to recover their belongings. Crew interviews indicated that the cockpit occupants were wearing seatbelts and shoulder harnesses and the cabin occupant was wearing his seatbelt at the time of the accident. The FO was treated for broken ribs, strained muscles, and a sore neck. The other 3 occupants had minor injuries.

TESTS AND RESEARCH

The following information was provided by Embraer: The EMB-145 rudder is comprised of fore and aft segments. The aft rudder segment is connected to the forward rudder segment and deflected as a function of forward rudder movement. Rudder pedal movement is transmitted by cables, torque tubes, and push rods to the rudder PCU. Each pedal assembly is mechanically connected to the other assembly and to the rudder PCU. The PCU controls the hydraulic pressure through a servo valve that controls the pressure to the two actuators linked to the forward rudder segment.

The PCU is a dual hydraulic unit; both systems are similar but independent. Each hydraulic system controls power to one of the two hydraulic actuators. During normal operation, both systems are powered at speeds below 135 knots. To reduce rudder authority at higher airspeeds, system 1 is automatically shut off above 135 knots. This rudder system would be reactivated if system 2 failed. SSFDR data revealed that the airplane never exceeded 125 knots during the accident flight. Primary stops on the rudder rear torque tube limit the maximum rudder deflection to plus or minus 15 degrees. According to Embraer, this corresponds to 9.05 degrees of rudder pedal movement to the left and 8.8 degrees of rudder pedal movement to the right. The SSFDR indicated that the maximum left pedal position recorded during the takeoff sequence was 7.15 degrees and the maximum right pedal position recorded was 7.48 degrees.

The airplane's rudder PCU (part number 360300-1001 and serial number 0008) was shipped to Parker Aerospace's Irvine, California, facility for examination under NTSB supervision. The examination was also attended by representatives from the FAA and Embraer. Visual examination of the PCU revealed that the exterior was undamaged except for a very small gouge near the spring reload for one of the compensators. The PCU's ports were covered and the lock wire seals were present. After being installed in a test fixture, the PCU was connected to hydraulic system lines and adjustments were made to ensure proper rigging. The PCU was operated through 10 cycles without any binding. The PCU was then tested per the acceptance test plan (ATP). The PCU tested without anomalies and within specifications.

ORGANIZATIONAL AND MANAGEMENT INFORMATION

In an interview with the NTSB investigator-in-charge, Continental Express's Vice President of Safety and Regulatory Compliance stated that in December 1995, the company had made a decision to add regional jet aircraft to its primarily turboprop fleet. In August 1996, Continental Express signed a purchase agreement with Embraer for the EMB-145. One section of the agreement concerned flight crew member simulator training. At the time the purchase agreement was executed, a simulator was not available, but the agreement stipulated that a certified simulator would be available to Continental Express by July 31, 1997. Continental Express planned to place the first EMB-145 in passenger service in April 1997.

The initial cadre of FAA and Continental Express flight instructors and check airmen were trained on the prototype EMB-145s in Brazil in November 1996. Continental Express took delivery of their first EMB-145 in January 1997, and the first Continental Express crews began

training in the USA at that time. At the time of the accident, Continental Express had accepted delivery of 18 EMB-145 airplanes.

Flight Safety International (FSI) constructed two EMB-145 simulators, however construction delays prevented simulator availability until early 1998. The first EMB-145 simulator was located in Tulsa, Oklahoma, and was certified by the FAA on January 9, 1998. The Tulsa simulator was primarily committed to another airline. The simulator intended for Continental Express was located in Houston and was certified by the FAA on February 28, 1998. Prior to the accident, as a result of the delays in construction and certification of the EMB-145 simulators, all flight training maneuvers were accomplished and checked utilizing airplanes instead of simulators.

Continental Express's Flight Operations Training Program (FOTP) for the EMB-145 current at the time of the accident was approved by the FAA on the following dates:

Flight Maneuvers and Procedures: November 11, 1996

Aircraft Ground Training: September 25, 1997

An excerpt from the FOTP stated that, "flight training can be given entirely in the aircraft, or a combination Flight Training Device (FTD), Simulator and Aircraft. Company policy is that a flight simulator be utilized to the greatest extent possible for training."

Continental Express's Flight Training and Standards Handbook, in the chapter titled "Check Airmen Guidelines," on page 3-13, listed the mandatory items to be covered in briefings prior to flight training. Those items included: syllabus items to be accomplished; transfer of aircraft control; procedures for simulation of an inoperative engine; response to an actual emergency or malfunction; cockpit vigilance and discipline; and emergency evacuation procedures. Item 15 on page 3-15 stated: "During in-flight simulated engine failures, the throttle closure rate should be smooth, continuous and at a rate faster than normal spool down/deceleration. The check airman will block any improper rudder application immediately. If a severe yaw should occur, equalize thrust immediately by either advancing the throttle of the simulated engine failure or retarding the thrust on the operating engine(s). Check Airmen will never allow a flight maneuver to deteriorate to a point where safety is compromised."

In an interview, the Continental Express Manager of Flight Standards and Training stated that flight instructor applicants receive nine hours of "instructors ground school and a one-hour airplane training session in which the instructor is familiarized with training from the right seat." The instructor then attends an "informal ground school on how to fill out paperwork and conduct line checks." An "off-line check-airman is authorized to give flight instruction in airplanes and also give proficiency checks." He further stated that there was no regulatory amount of training required to be an off-line check-airman and there was no specific requirement to teach the flight instructor to cope with incorrect control inputs from a student. He stated that the FAA aircrew program manager (APM) had never expressed concern about the inexperience of the check-airmen. He added that the lack of a simulator was a concern because "you can't do some things in the airplane that you can do in the simulator."

In an interview, the FAA APM for Continental Express expressed concern at the relative inexperience of pilots at regional airlines, including Continental Express. He stated that he was concerned about the rapid progression of pilots at Continental Express and the loss of experienced pilots to the large airlines. The FAA APM also stated that at the time of the accident all flight training had been accomplished in the airplane. He added that although the

airplane training "is nice, it does not accomplish everything you need to show students."

In an interview, the Continental Express Vice-President of Flight Operations said he had no concerns about the training program because check airmen were high time and highly experienced. He stated that potential check-airmen were selected as early as possible during their initial training on the airplane. He added that the FAA had the final authority and approved the flight instructor and pilot flight training programs. He also stated that "flow through" was a concern. "Flow through" was defined as pilots leaving Continental Express for positions with major airlines. He said he was concerned there were not enough qualified pilots to hire as replacements. Normally a new pilot applicant at Continental Express was required to pay for his initial training. However, in order to secure qualified pilot applicants, Continental Express instituted what they called a "signing bonus" for pilots who had over 2,000 hours total time and 500 hours multi-engine time. The "signing bonus" meant that those higher time pilots were not required to pay for their initial training. At the time of the accident, Continental Express was hiring approximately 30 pilots each month and about 10 percent of those hired qualified for the "signing bonus."

ADDITIONAL INFORMATION

The wreckage was released to the owner.

Pilot Information

Certificate:	Airline Transport	Age:	38, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):		Restraint Used:	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	Airplane Multi-engine; Airplane Single-engine	Toxicology Performed:	No
Medical Certification:	Class 1 Valid Medical--w/ waivers/lim.	Last Medical Exam:	11/17/1997
Occupational Pilot:		Last Flight Review or Equivalent:	02/03/1998
Flight Time:	4670 hours (Total, all aircraft), 500 hours (Total, this make and model), 3500 hours (Pilot In Command, all aircraft), 140 hours (Last 90 days, all aircraft), 60 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Co-Pilot Information

Certificate:	Commercial	Age:	35, Male
Airplane Rating(s):	Multi-engine Land	Seat Occupied:	Right
Other Aircraft Rating(s):	None	Restraint Used:	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	No
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	Last Medical Exam:	10/23/1997
Occupational Pilot:		Last Flight Review or Equivalent:	12/21/1996
Flight Time:	1932 hours (Total, all aircraft), 15 hours (Total, this make and model), 15 hours (Last 90 days, all aircraft), 15 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Check Pilot Information

Certificate:	Airline Transport	Age:	54, Male
Airplane Rating(s):	Multi-engine Land	Seat Occupied:	Center
Other Aircraft Rating(s):	None	Restraint Used:	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	Airplane Multi-engine; Instrument Airplane	Toxicology Performed:	No
Medical Certification:	Class 1 Valid Medical--w/ waivers/lim.	Last Medical Exam:	08/20/1997
Occupational Pilot:		Last Flight Review or Equivalent:	
Flight Time:	10800 hours (Total, all aircraft), 800 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Manufacturer:	Embraer	Registration:	N14931
Model/Series:	145-ER 145	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	No
Airworthiness Certificate:	Transport	Serial Number:	013
Landing Gear Type:	Retractable - Tricycle	Seats:	54
Date/Type of Last Inspection:	12/07/1997, Continuous Airworthiness	Certified Max Gross Wt.:	45414 lbs
Time Since Last Inspection:	336 Hours	Engines:	2 Turbo Jet
Airframe Total Time:	1844 Hours	Engine Manufacturer:	Allison
ELT:	Installed, not activated	Engine Model/Series:	AE3007A
Registered Owner:	First Security Bank	Rated Power:	7468 lbs
Operator:	CONTINENTAL EXPRESS	Air Carrier Operating Certificate:	Flag carrier (121)
Operator Does Business As:		Operator Designator Code:	C2XA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	BPT, 0 ft msl	Observation Time:	1216 CST
Distance from Accident Site:	0 Nautical Miles	Direction from Accident Site:	0°
Lowest Cloud Condition:	Clear	Temperature/Dew Point:	15°C / 6°C
Lowest Ceiling:	None	Visibility:	10 Miles
Wind Speed/Gusts, Direction:	7 knots, 270°	Visibility (RVR):	0 ft
Altimeter Setting:	30 inches Hg	Visibility (RVV):	0 Miles
Precipitation and Obscuration:			
Departure Point:	Beaumont, TX (BPT)	Type of Flight Plan Filed:	IFR
Destination:	Beaumont, TX (IAH)	Type of Clearance:	IFR
Departure Time:	1216 CST	Type of Airspace:	Class C

Airport Information

Airport:	Jefferson County (BPT)	Runway Surface Type:	Asphalt
Airport Elevation:	16 ft	Runway Surface Condition:	Dry
Runway Used:	30	IFR Approach:	None
Runway Length/Width:	6751 ft / 150 ft	VFR Approach/Landing:	None

Wreckage and Impact Information

Crew Injuries:	1 Serious, 1 Minor, 1 None	Aircraft Damage:	Substantial
Passenger Injuries:	1 None	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Serious, 1 Minor, 2 None	Latitude, Longitude:	

Administrative Information

Investigator In Charge (IIC):	Alexander Lemishko	Adopted Date:	06/03/2002
Additional Participating Persons:	JOHN W MCGRAW; FAA; Atlanta, GA John J Swift; Rolls-Royce; Indianapolis, IN Fred Junek; Continental Express; Houston, TX Manuel S Monteiro; Embraer; Ft. Lauderdale, FL		
Publish Date:			
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov , or at 800-877-6799. Dockets released after this date are available at http://dms.ntsb.gov/pubdms/ .		

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report.