National Transportation Safety Board
Aviation Accident Final Report

Location:	WEST PALM BEACH, FL	**Accident Number:**	MIA99FA252
Date & Time:	09/12/1999, 0711 EDT	**Registration:**	N17356
Aircraft:	Boeing B737-300	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	89 None
Flight Conducted Under:	Part 121: Air Carrier - Scheduled		

Analysis

During climb after takeoff, the flight had an uncontained failure of the No. 1 engine. The flight returned to the departure airport and landed without further incident. Examination of the airplane showed there was damage to the left wing high lift devices, fuselage, vertical and horizontal stabilizers, rudder, and tail cone. The No. 1 engine left thrust reverser had separated. Debris from the No.1 engine was located over an eight block long by three block wide city block area. Examination of the No. 1 engine revealed that it had a 360 degree separation in plane with the high pressure turbine (HPT) rotor and that the HPT shaft and the HPT forward rotating air seal had exited the engine. The HPT rotating air seal was recovered in the debris field. Metallurgical examination showed the rotating air seal had two radial fractures that passed through the bore and the HPT front shaft-to-HPT disk attachment bolt holes. Fatigue cracking was identified in one attachment bolt hole which initiated from a heat affected layer. The heat affected layer was caused by abusive machining during the manufacturing process due to loss of coolant during the drilling process. Based on striation count, the fatigue crack was at detectable length during two in-service inspections, but was not detected.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:
The fatigue fracture and separation of the high pressure turbine forward rotating air seal due to a manufacturing defect in a bolt hole that was not detected by the engine manufacturer due to inadequate and ineffective inspection techniques. Contributing to the accident was the engine manufacturers failure to provide adequate hole making requirements at the time the forward rotating air seal was manufactured and the engine manufacturers failure at the time of last inspection to require eddy current inspections for the high pressure turbine forward rotating air seal bolt holes.

Findings

Occurrence #1: LOSS OF ENGINE POWER(PARTIAL) - MECH FAILURE/MALF
Phase of Operation: CLIMB

Findings
1. (C) TURBINE ASSEMBLY,AIR SEAL - FATIGUE
2. (C) INSUFFICIENT STANDARDS/REQUIREMENTS,MANUFACTURER - MANUFACTURER
3. (C) TURBINE ASSEMBLY,AIR SEAL - SEPARATION

Factual Information

HISTORY OF THE FLIGHT

On September 12, 1999, about 0711 eastern daylight time, a Boeing 737-300, N17356, registered to ICX Corporation, and operated by Continental Airlines, Inc., as flight 1933, a Title 14 CFR Part 121 scheduled domestic passenger flight from West Palm Beach, Florida, to Houston, Texas, had a failure of the No. 1 engine shortly after takeoff from West Palm Beach. Visual meteorological conditions prevailed at the time, and an instrument flight rules flight plan was filed. The airline transport-rated pilot, second pilot, 3 flight attendants, and 84 passengers were not injured. The flight was originating at the time of the accident.

The captain stated he was in the right seat and acting as a check airman. The second pilot, who was flying the aircraft from the left seat, was receiving initial operating experience as a captain. Both pilots stated that after takeoff on runway 9 left, as they were climbing through about 1,000 feet, there was the sound of a loud bang, they felt a extremely violent jolt, and felt severe shaking of a short duration. The No. 1 engine gauges went to zero. There was no indication of fire. The second pilot continued to fly the airplane and the captain ensured the No. 2 engine was increased to full power. They entered a left downwind leg for runway 9 left and returned to West Palm Beach International Airport, where they landed without further incident.

A witness stated he was working on the roof of the Palm Beach Post building. He was to the north of the airplanes flight path, and was looking at the left side of the airplane. He saw flames shoot from the left engine that lasted about 2 seconds, and then the engine exploded and the flames went out. A black smoke cloud remained at the point of the explosion. He then saw a large piece of the airplane falling from the sky. He did not see any more smoke or flame coming from the left engine and the airplane turned to the north and then to the west and was lost from sight.

PERSONNEL INFORMATION

The captain (who was acting as a check airman) holds a airline transport pilot certificate with a Boeing 737 type rating. Continental Airlines, Inc. reported that at the time of the accident he had accumulated 10,500 total flight hours with 6,500 flight hours in the Boeing 737. The second pilot (who was receiving initial operating experience as a captain) holds a airline transport pilot certificate with a Boeing 737 type rating. Continental Airlines, Inc. reported that at the time of the accident the second pilot had accumulated 10,000 total flight hours with 550 flight hours in the Boeing 737.

AIRCRAFT INFORMATION

The airplane is a Boeing 737-3TO, serial number 23942, registered to ICX Corporation. Continental Airlines, Inc. reported the airplane had accumulated 34,602 total flight hours at the time of the accident and 222 flight hours since the last inspection.

The No. 1 engine is a CFM International, model CFM56-3-B1, SN 720957, that had accumulated 31,732 total flight hours time since new, 16,496 cycles since new, 5,604 hours time since overhaul, and 2,771 cycles since overhaul at the time of the accident. The last maintenance visit for the engine was at General Electric Engine Services Inc., Strother, Kansas, from July - October 1997. The engine was removed by Continental on July 27, 1997, and was sent to GE Strother because of damage to the high pressure compressor 6th-stage compressor blades. The engine was returned to service on October 27, 1997. Prior to the 1997 shop visit, the engine was overhauled by GE Strother in September 1996.

The No. 1 engine forward rotating air seal was forged by Wyman-Gordon, Grafton, Massachusetts, and was shipped on January 24, 1986, to NCI Inc., Asheville, North Carolina, for finish machining. There was no maintenance review board (MRB) activity at Wyman-Gordan. The forward rotating air seal was finished machined as PN 1282M72P03, SN NCE24161, and was Fluorescent Penetrant Inspected (FPI). There was no MRB activity for the rotating air seal at NCI. NCI shipped the forward rotating air seal on July 31, 1986, and Continental installed it in CFM56-3-B1 engine, SN 721641, on January 1, 1987. According to the GE Strother's "Received Offlog Configuration" sheet, dated October 10, 1988, the HPT rotor, which includes the forward rotating air seal, was removed from engine SN 721641 and was not disassembled. A GE Strother's "Onlog-Offlog Comparison Final Report", dated April 10, 1989, indicated that the HPT rotor removed from SN 721641 was installed on CFM56-3-B1 engine SN 721729 where it remained until January 1993. The forward rotating air seal had accumulated 5,426 hours TSN and 2,222 CSN when installed in engine SN 721729.

According to GE Strother's "Cycle Limited Parts Disposition Sheet", dated January 29, 1993, Work Order (W/O) 905422, the HPT rotor was removed from engine SN 721729 and the front shaft was replaced. Overhaul sheets, marked W/O 905422, indicated that HPT blades were replaced but that the forward rotating air seal, HPT disk, and HPT rear shaft were not disassembled and inspected. Final build sheets indicate that the HPT rotor was installed on CFM56-3-B1 engine, SN 720957, the accident engine, on April 23, 1993, where it remained until October 1996. The forward rotating air seal had accumulated 17,555 hours TSN and 8,289 CSN when installed in engine SN 720957.

In October 1996, GE Strother removed the HPT rotor from engine SN 720957, disassembled it, and shipped the forward rotating air seal to GE Engine Services, Aviation Component Service Center (ACSC), Cincinnati, Ohio, for inspection and repair. ACSC paperwork (W/O 26092C) indicated that a visual and FPI was performed on the forward rotating air seal on October 25, 1996, with no nonconformances noted. The FPI was the first in-service inspection of the forward rotating air seal and the second inspection since it was manufactured. A seal teeth coating replacement repair, CFMI Engine Manual Task 72-52-03 was also performed. GE Engine Services ASCS issued a FAA Form 8130-3 Airworthiness Approval tag for the forward rotating air seal on November 1, 1996, and shipped it to GE Strother were it was reinstalled on engine SN 720957. Engine SN 720957 remained in operation until July 1997. The forward rotating air seal had accumulated 27,460 hours TSN and 14,102 CSN when repaired by ACSC.

Continental removed engine SN 720957 and shipped it to GE Strother because of damage to the HPC 6th-stage blades. The HPT rotor was disassembled and the forward rotating air seal was FPI'd on September 16, 1997, with no nonconformances noted. The FPI was the second in-service inspection of the forward rotating air seal and the third inspection since it was manufactured. GE Strother's maintenance records also indicate that a part re-marking repair was performed because the part number had become illegible. The forward rotating air seal was reinstalled on engine SN 720957 where it remained until the accident. The configuration comparison final report for engine SN 720957 indicated that the forward rotating air seal had 29,362 hours TSN and 15,067 CSN when installed.

The forward rotating air seal had accumulated 5,604.3 hours TSO, 2,771 CSO, 34,966 hours TSN, and 17,838 CSN at the time of the accident. The forward rotating air seal has a published service life limit of 20,000 cycles, and at the time of the accident, 94 percent of the service life had been utilized.

METEOROLOGICAL INFORMATION

The West Palm Beach International Airport 0653 surface weather observation was clouds 20,000 feet scattered, visibility 10 statute miles, altimeter setting 29.92 inches Hg., temperature 81 degrees F., dewpoint temperature 73 degrees F., wind from 030 at 3 knots.

FLIGHT RECORDERS

The cockpit voice recorder (CVR) was a Fairchild model A100, serial number 6670. The CVR was taken to the NTSB, Vehicle Recorder Laboratory, Washington, D.C., after the accident for readout. Information contained on the CVR was recorded while the aircraft was parked after returning to West Palm Beach International Airport after the failure of the No. 1 engine, and did not contain any information recorded at the time of the failure of the No. 1 engine. A transcript was not prepared.

The digital flight data record (DFDR) was a Sunstrand model UFDR, serial number 6386. The DFDR was taken to the NTSB, Vehicle Recorder Laboratory, Washington, D.C., after the accident, for readout. Readout of the DFDR revealed that at FDR Subframe Reference Number 772 seconds, the airplane was at 167 knots airspeed, at an altitude of 1,196 feet. Engine No.1 and engine No. 2 N1 values were 89.5% and 90.9%, respectively. The following second, N1 for engine No. 1 dropped to 25.7% and airplane pitch angle dropped from 16.1 degrees nose up to 12.8 degrees nose up. Vertical acceleration dropped to its lowest recorded value at 0.574 G's. Over the next 17 seconds, N1 for engine No.1 decreased to approximately 12% and pitch angle decreased to approximately 4 degrees before leveling off at 6 degrees. Vertical acceleration values increased and remained at approximately 1 G. N1 for engine No. 2 decreased to 82.4% at 775 seconds before increasing to 97.5% at 788 seconds. Airplane altitude increased to a maximum value of 1,367 feet after the No. 1 engine failure and airspeed was maintained at approximately 160 knots prior to the airplane starting to accelerate 7 seconds after the No. 1 engine failure.

WRECKAGE AND IMPACT INFORMATION

Postcrash inspection of the airplane revealed there was an uncontained failure of the No. 1 engine, along with damage to the wing's high lift devices, the fuselage, vertical and horizontal stabilizers, and the tail cone. Debris from the engine fell over an 8 x 3 city block area off the departure end of runway 09L, and caused damage to vehicles and residences; however, no one on the ground was injured.

Examination of the airplane and No. 1 engine nacelle revealed that the left-hand thrust reverser had departed the airplane intact, the vertical stabilizer had three major penetration wounds, the vertical fin front spar lower truss fitting left hand chord was severed, and the rudder skin was torn. The left-hand thrust reverser was recovered intact in the debris field along the flight path of the airplane. The left-hand thrust reverser exhibited a puncture wound in the upper hinge beam aft of the middle hinge.

The No. 1 engine was severed 360 degrees circumferentially in plane with the HP rotor. The aft section of the engine was sagging downward from the rear engine mount about 10 degrees creating a 13-inches axial x 30 degrees circumferential gap at about the 5:00 to 6:30 o'clock positions. Everything forward of the combustion case was intact with no noticeable damage except for minor impact damage to external components and parts. Large pieces of metal were found in the engine tailpipe at the 6:00 o'clock position. The 4th-stage LPT blades were intact and exhibited minor damage when examined from the rear.

The combustion case rear flange was torn from the rest of the case from about the 7:00 to 1:00 o'clock positions and was not recovered. The combustion case skin from the mid flange area on back to the rear flange was missing from about the 4:00 to 7:00 o'clock positions. The remaining part of the case skin was distorted, fragmented, and pushed outward and forward. A piece of the combustion case rear flange was still attached to the LPT case from about the 1:00 to 7:00 o'clock positions. An 18-inch piece of the combustion case mid flange area was recovered in the debris field along the airplane's flight path.

The HPT nozzle inner support was fractured and pushed radially outward and forward about 6-inches at the 10:00 o'clock position. The integral HPT shroud/LPT nozzle support was almost completely fractured aft of the 5th-stage cooling air holes, and most of the support was completely separated from the engine. The remaining pieces were pushed outward and forward from the 3:00 to 12:00 o'clock positions creating an opening about 6 inches axially. Remaining sections of the HPT cooling air distributor located outboard of the HPT shroud were pushed outward through this opening.

Five HPT nozzle segments were found still attached and in place from about the 6:00 to 9:00 o'clock positions. The nozzle segments were heavily impact damaged. Many nozzle segments were recovered in the debris field along the airplane's flight path and exhibited similar damage. The HPT inner and outer nozzle supports were also missing from the 9:00 to 6:00 o'clock positions. The HPT shrouds (outer air seal - stationary seal) from the 6:00 to 9:00 o'clock positions were installed.

All the HPT blades were fractured transversely across the airfoil at various lengths and exhibited considerable leading edge and tip damage. The HPT blade front retainer was missing except for a 60 degree arc from about the 12:00 to 2:00 o'clock positions. The HPT disk was circumferentially fractured just forward of the HP disk-to-forward rotating air seal attachment flange transition radius, about 0.25 inches forward of the disk face.

The HPT forward rotating air seal assembly (subsequently referred to as the forward rotating air seal), PN 1282M72P03, SN NCE2{4161} exited the engine. Two pieces of the forward rotating air seal were recovered in the debris field along the airplane's flight path. The smaller of the two pieces was an 12.5-inch long section of the 4-tooth seal. The entire piece was twisted about 90 degrees along its axis and the 4-tooth seal was heavily damaged with portions of the seal completed obliterated.

The larger piece of the forward rotating air seal comprised about 2/3rds of the entire seal. This piece was heavily distorted, impact damaged, and exhibited two primary radial fractures that went through the bore. The two primary fracture surfaces bisected a bolt hole. The fracture surfaces were damaged and metal transfer was observed. The forward rotating air seal has two sets of knife edge seals: a 4-tooth seal that is located outboard of a 2-tooth seal. The entire 4-tooth seal was missing and a small piece of the 2-tooth seal remained and was rolled over. Pieces of the HPT shaft and the HPT disk attachment flange were still secured to the forward rotating air seal.

The front HPT shaft fractured about 1-inch aft of the compressor discharge pressure (CDP) seal and just forward of the forward rotating air seal. The entire HP shaft exited the engine except for the pieces still attached to the CDP and the forward rotating air seals. Piece of the HPT shaft were recovered in the debris field along the airplane's flight path. The small center vent tube and the larger air duct were fractured 360 degrees in plane with the forward rotating air seal.

MEDICAL AND PATHOLOGICAL INFORM,ATION

The captain, first officer, three flight attendants, and 84 passengers were not injured. No toxicology testing was performed on specimens from the flightcrew.

TESTS AND RESEARCH

Pieces of the HPT shaft and the HPT forward rotating air seal were sent to the Safety Board's materials laboratory in Washington D.C. for initial metallurgical evaluation. The examination occurred September 21-23, 1999, with a representative from General Electric Aircraft Engines (GEAE) in attendance. After initial evaluation at the Safety Board, the forward rotating air seal was sent to GEAE Evandale, Ohio, for further evaluation. Nondestructive evaluation of the forward rotating air seal was conducted at the GEAE Quality Technology Center and destructive metallographic evaluation was conducted at the GEAE Materials Engineering and Process Department Metallography Laboratory. The examination at GEAE occurred September 27-30, 1999, with a representative of the Safety Board in attendance.

Examination of the high pressure turbine shaft fracture surfaces with the aid of a binocular microscope revealed fracture features typical of overstress separations and areas obliterated by mechanical damage. No evidence of a pre-existing fracture was found.

The recovered forward rotating air seal had two radial fractures that passed through the bore and the HPT front shaft-to-HPT disk attachment bolt holes. The third fracture was a circumferential fracture outboard near the 4-tooth seal area and the inducer holes. The seal portion contained 36 complete bolt holes with radial separation through two additional holes. The two radial fractures were identified as fractures "1" and "2" and the bolt holes were numbered No. 1 through 38 starting with hole No. 1 at fracture "1". The circumference of the ID of the bore measured 19.25-inches.The width of the bore at fracture "1" measured 1.420-inches and at fracture "2" 1.705-inches. Approximately 230 degrees of the front shaft, 130 degrees of the HPT disk forward rotating air seal attachment flange (located on the aft side of the forward rotating air seal) and 16 of the 52 disk-to-seal attachment bolts were still attached to the seal.

Fracture surface "1" contained substantial damage and areas of transferred metal deposits. Macroscopic examination of the fracture surface revealed a flat fracture region inboard of the bolt hole with the texture of the fracture surface gradually become more coarse as the distance from the bolt hole increased. The fracture region, which extended 0.34-inches inboard from the bolt hole, had dark gray discoloration with the color changing to a red-brown beyond the fracture region. The red-brown color faded as the distance from the hole increased. A rough, irregular shear lip was noted closer to the inboard edge of the bore but no shear lip was present in the web area inboard of the bolt hole. According to GEAE, "the fracture morphology of the fatigue area was consistent with crack propagation by high alternating stress, low frequency loading (LCF)".

Examination of fracture surface "1" using a scanning electron microscope (SEM) revealed isolated patches of fatigue striations over many areas of the fracture surface inboard of the bolt hole. The fatigue crack initiation site was determined to be at or very near the inboard side of the bolt hole, in the approximate axial center of the hole. Evidence of fatigue striation pattern was found up to a total distance of 1.441-inches inboard of the hole with the striation pattern spacing gradually increasing closer to the terminus of the crack.

An X-ray energy dispersive spectroscopy (EDS) of fracture surface "1" and of the base material generated a spectrum consists with the specified forward rotating air seal material - Inconel 718 (Attachment 6). According to GEAE, the EDS analysis of the area around the fracture origin did not show any residual phosphorous particles that would indicate penetration of FPI fluid during past inspections.

Fracture surface "2" and the circumferential fracture contained features that were either badly damaged or were typical of overstress separations.

Fracture surface "1" was inspected using X-ray Computer Tomography (CT) and Ultrasound. No indications of a subsurface or internal defect were found.

The bolt holes were inspected by using an Eddy Current Inspection (ECI) technique. Fifteen of the holes were sufficiently damaged and distorted so that the ECI probe could not enter the hole. These holes were not ECI'd. Two of the ECI'd holes contained indications marks that were evaluated to be associated with surface damage. According to GEAE, the other ECI'd holes had varying amplitude indications which were all less than the reject criteria specified in standard practices manual task 70-32-07.

A segment of the forward rotating seal containing holes Nos. 3 through 6 was cut from the rest of the seal and sectioned along a circumferential plane through the bolt holes allowing a view of the hole ID. The machining lines in hole "1" appeared to be more distinctive than the machining lines in holes Nos. 3 through 6. All the holes exhibited light contact/rubbing marks in the area of the holes where the largest diameter of the bolt shaft would have been in contact with the hole.

A cross section through the axial length of bolt hole No. 1 was polished, then electrolytically etched with phosphoric acid in order to reveal the macrostructure. Examination of cross section showed the presence of a non-etched layer indicative of heat damaged material. This non-etched layer appeared white and was located in the middle of the axial length of the bolt hole. The maximum depth of the layer measured 0.030-inches in the middle. The depth of the layer tapered off away from the center of the hole and terminated 0.15-inches aft of the forward face of the web and 0.10-inches forward of the aft face.

A second cross section was made through hole No. 1 oriented radially through the origin area of the fatigue crack (transverse to the hole), approximately in the middle of the axial length of the bolt hole. The section was re-polished and etched with Kalling's reagent in order to bring out microstructural features. No evidence of grain growth was noted in the heat affected zone (HAZ). The HAZ contained cold work deformation about 0.012-inches deep into the material. In addition, shear deformation lines were noted from the hole surface to a depth of about 0.0024-inches and were only found within about 0.048-inches of the fracture plane. No evidence of grain growth was noted in the HAZ. High magnification of the section revealed that the surface of the bolt hole contained small steps associated with the deformation lines and that some of the small steps extended as cracks below the surface of the hole in the material. The maximum depth of the cracks were 0.0003-inches. Damage to the origin area prevented direct viewing of the condition of the bolt hole surface in the immediate vicinity of the initiation area of the fatigue crack.

Bolt holes Nos. 2 and 3 were evaluated in the same manner as bolt hole No. 1. No evidence of a HAZ was found on either hole.

A micro-hardness traverse was performed across the thickest portion of the HAZ on the section of bolt hole No. 1. The base material minimum hardness requirement is Rockwell hardness on the C scale (HRC) 39. The core hardness of the base material away from the HAZ measured HRC 47 (500 KHN). The hardness in the HAZ was lower than the core hardness and varied from 40 (403 KHN) to 45 HRC. The hardness quickly increased from HRC 40 directly adjacent to the surface to the bolt hole - the minimum hardness - to about HRC 44 to 45 slightly below the surface. The hardness then decreased to HRC 42 to 43 in the deepest portion of the HAZ (the portion without cold working), then increased to HRC 47 as the core microstructure was entered.

According to the CFM56-3 engine shop manual, HIGH PRESSURE TURBINE ROTOR FORWARD ROTATING AIR SEAL - INSPECTION, Task 72-52-03-200-001, effective at the time the forward rotating air seal was last inspected by GE Strother, FPI 70-32-14 was the only nondestructive inspection technique called out to detect cracks. The inspection limits state that cracks are not serviceable and not repairable on all surfaces except in the seal serrations.

On October 4, 1999, temporary revision No. 72-0673 was issued to change the inspection requirements for the forward rotating air seal in the CFM56-3 engine shop manual, task 72-52-03-200-001. The new instructions required a high sensitivity FPI 70-32-15 followed by eddy current inspection (ECI) 70-38-13 for the bolt holes, and FPI 70-32-14 for the remaining portion of the forward rotating air seal. The inspection limits remained the same as before with cracks not serviceable and not repairable on all surfaces except in the seal serration.

CFMI also issued temporary revisions for the CFM56-2, -5, and -7 models. The CFM56-2 temporary revision, No. 72-0523 and the CFM56-2A/-2B temporary revision, No 72-065, have the same inspection requirements as the CFM56-3 - high sensitivity FPI 70-32-15, followed by ECI 70-38-13, for the bolt holes, and FPI 70-32-14 for the remaining portion of the forward rotating air seal. The temporary revisions for the CFM56-5 models (No. 72-0344, 72-0074, and 72-0140) and for the CFM56-7 model (No. 72-0014) included the high sensitivity FPI for the bolt holes and the normal FPI for the remaining portion of the forward rotating air seal but did not require an ECI because the -5 and -7 models have shaped bolt holes, not round holes, so ECI with current tooling would not be possible.

The forward rotating air seal is a single forged piece with fifty-two machined, evenly spaced bolt holes. All the holes are produced by a two step drilling process, drilling followed by reaming. The holes are drilled to a nominal diameter of 0.375-inches. The drilling is performed from the aft side and counterclockwise sequentially with no defined starting point. After drilling, the holes are reamed to a diameter of 0.397-inches, thus nominally removing 0.011-inches from each side of the hole. Parameters such as drill speed, feed rate, nominal hole size, and surface finish were, when the accident rotating air seal was machined (1986), specified on operations sheets at the machining source. NCI operation sheets did not specify tool change points for either the drilling or reaming operations. Tool changes were left to the discretion of the operator and no power monitoring of the process was required.

In 1993, GEAE introduced Hole Making Specification P11TF12 to provide process requirements for hole making in critical and pressurized casing parts, such as disks, forward rotating air seals, and pressurized cases. Since the release of P11TF12, the forward rotating air seal bolt holes have been machined in accordance with this specification. P11TF12 classifies holes and provides requirements, such as tool change points, feed rates, drill speeds, and whether power monitoring is required, based on the hole dimensions and its classification.

ADDITIONAL INFORMATION

The airplane was released by NTSB to Continental Airlines, Inc., on September 12, 1999. The No. 1 engine assembly was released by NTSB to Continental Airlines. Inc., on September 22, 1999. The CVR, DFDR, and No. 1 engine HPT Rotating Air Seal, was released by NTSB to Continental Airlines, Inc., on June 1, 2000.

Pilot Information

Certificate:	Airline Transport; Flight Engineer	**Age:**	52, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	**Seat Occupied:**	Left
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--w/ waivers/lim.	**Last Medical Exam:**	06/24/1999
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:	10500 hours (Total, all aircraft), 6500 hours (Total, this make and model), 10100 hours (Pilot In Command, all aircraft), 149 hours (Last 90 days, all aircraft), 58 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Manufacturer:	Boeing	**Registration:**	N17356
Model/Series:	B737-300 B737-300	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Transport	**Serial Number:**	23942
Landing Gear Type:	Retractable - Tricycle	**Seats:**	134
Date/Type of Last Inspection:	08/18/1999, Continuous Airworthiness	**Certified Max Gross Wt.:**	135000 lbs
Time Since Last Inspection:	222 Hours	**Engines:**	2 Turbo Fan
Airframe Total Time:	34602 Hours	**Engine Manufacturer:**	Cfm
ELT:	Not installed	**Engine Model/Series:**	CFM56-3B1
Registered Owner:	ICX CORPORATION	**Rated Power:**	20100 lbs
Operator:	CONTINENTAL AIRLINES	**Air Carrier Operating Certificate:**	Flag carrier (121)
Operator Does Business As:	CONTINENTAL AIRLINES	**Operator Designator Code:**	CALA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Day
Observation Facility, Elevation:	PBI, 19 ft msl	**Observation Time:**	0653 EDT
Distance from Accident Site:	1 Nautical Miles	**Direction from Accident Site:**	270°
Lowest Cloud Condition:	Scattered / 20000 ft agl	**Temperature/Dew Point:**	27°C / 23°C
Lowest Ceiling:	None / 0 ft agl	**Visibility**	10 Miles
Wind Speed/Gusts, Direction:	3 knots, 30°	**Visibility (RVR):**	0 ft
Altimeter Setting:	29 inches Hg	**Visibility (RVV):**	0 Miles
Precipitation and Obscuration:			
Departure Point:	(PBI)	**Type of Flight Plan Filed:**	IFR
Destination:	HOUSTON, TX (IAH)	**Type of Clearance:**	IFR
Departure Time:	0711 EDT	**Type of Airspace:**	Class D

Wreckage and Impact Information

Crew Injuries:	5 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	84 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	89 None	**Latitude, Longitude:**	

Administrative Information

Investigator In Charge (IIC):	JEFFREY L KENNEDY	**Adopted Date:**	08/03/2000
Additional Participating Persons:	EDDIE MORALES; FORT LAUDERDALE, FL LESLIE MCVEY; CINCINNATI, OH KEVIN COLLINS; HOUSTON, TX PAMELA S ROSNIK; SEATTLE, WA		
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/.		