



Aviation Investigation Final Report

Location:	El Paso, Texas	Accident Number:	DFW06FA056
Date & Time:	January 16, 2006, 09:05 Local	Registration:	N32626
Aircraft:	Boeing 737-524	Aircraft Damage:	Minor
Defining Event:		Injuries:	1 Fatal, 119 None
Flight Conducted Under:	Part 121: Air carrier - Scheduled		

Analysis

The flight crew of the Boeing 737-524 discovered a puddle of fluid on the tarmac under the number 2 (right) engine during the preflight inspection of a scheduled passenger airline flight. Airline station personnel had received authorization to call contract maintenance to investigate the oil leak from one of the airline's senior maintenance controllers. As a result, three mechanics from a fixed base operator (FBO) at the airport were called by the airline station personnel. The FBO had previously entered into an agreement with the airline to provide contract maintenance at the airport.

All of the airline's maintenance manuals were maintained at the airline's headquarters maintenance control base. According to the airline's procedures, extracts of those manuals with specific procedures were required to be transmitted prior to the contractor performing maintenance, and only after authorization by the airline's maintenance control.

After becoming concerned about the delay in hearing back regarding the investigation into the engine leak, a senior maintenance controller for the airline attempted to contact airline station personnel, and the FBO, several times to determine what instructions and authorizations would be needed. The investigation revealed that the FBO did not make contact with the airline to obtain the requested maintenance approval and required documentation to work on the engine.

Meanwhile, both sides of the engine fan cowl panels were opened by the mechanics to conduct the engine inspection and check for leaks. The mechanics made a request to the

captain (via ground-to-cockpit intercom system) for an engine run to check for the leak source. One mechanic positioned himself on the inboard side of the right engine and the other mechanic on the outboard side of the engine. The third mechanic was positioned clear of the engine because he was assigned to observe the procedure as part of his on-the-job training.

The engine was started and stabilized at idle RPM for approximately 3 minutes while the initial leak check was performed by the two journeymen mechanics that were working around the engine. One of these two mechanics then called the captain on the ground intercom system and reported that a small oil leak was detected, and he requested that the captain run the engine at 70 percent power for 2 minutes to conduct further checks. The captain complied with the request, after verifying with the mechanic that the area around the airplane was clear.

Witnesses on the ground and in the airplane stated that they saw the mechanic on the outboard side of the engine stand up, step into the inlet hazard zone, and become ingested into the intake of the engine. This occurred about 90 seconds into the 70-percent-power engine run. The mechanic was not wearing any type of safety equipment or lanyard to prevent the ingestion. Upon sensing a buffet, the captain immediately retarded the power lever back to the idle position. The first officer stated to the captain that something went into the engine and the captain immediately cut off the start lever to stop the engine run.

The mechanic who was fatally injured was hired by the FBO in November 1997, and had been a certified mechanic for 40 years. He received maintenance training from the airline regarding on-call maintenance procedures in March 2004, nearly two years prior to the accident. The airline provided training to contract maintenance stations in the form of classroom instruction, interactive computer based scenarios, and training videos. Specific training (either initial or recurrent) regarding ground engine runs and associated hazards was not provided to the contract mechanics by the airline.

According to the surviving contract mechanic that worked around the engine with the fatally injured mechanic, maintenance instructions were not needed for the engine run because engine oil leaks were a common occurrence, and because of his past experience as a mechanic.

Under the section entitled "Engine Run Rules - General" in the airline's general maintenance manual, the following procedure was cited: "Engines will not be operated above idle at terminal or gate positions for maintenance purposes, unless specifically authorized by the

local airport authority."

At the time of the accident, a letter of agreement, dated April 1996, was in effect between the airport's control tower and the airport operations office that restricted engine power to no more than idle RPM to one engine at a time for a maximum of 5-minutes "while on any parking or service apron areas, including the terminal ramp." Additionally, about 3 months prior to the accident, on October 19, 2005, the control tower reiterated this policy via a "Priority Briefing Item" cover memorandum that was addressed to "All Personnel" at the airport. However, the letter of agreement and priority memo had not been distributed to the airline's airport operations, the fixed based operator, or any of the tenants at the airport.

Following the accident, the airline developed and implemented numerous safety enhancements, including revised procedures and training regarding ground engine runs.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the mechanic's failure to maintain proper clearance with the engine intake during a jet engine run, and the failure of contract maintenance personnel to follow written procedures and directives contained in the airline's general maintenance manual. Factors contributing to the accident were the insufficient training provided to the contract mechanics by the airline, and the failure of the airport to disseminate a policy prohibiting ground engine runs above idle power in the terminal area.

Findings

Occurrence #1: PROPELLER BLAST OR JET EXHAUST/SUCTION

Phase of Operation: STANDING - ENGINE(S) OPERATING

Findings

1. FLUID,OIL - LEAK
2. (C) CLEARANCE - NOT MAINTAINED - OTHER MAINTENANCE PERSONNEL
3. (C) PROCEDURES/DIRECTIVES - NOT FOLLOWED - OTHER MAINTENANCE PERSONNEL
4. (F) INADEQUATE TRAINING - COMPANY/OPERATOR MANAGEMENT
5. (F) PROCEDURE INADEQUATE - AIRPORT PERSONNEL

Factual Information

HISTORY OF FLIGHT

On January 16, 2006, at 0905 mountain standard time, (unless otherwise noted, all times in this report are mountain standard time based on a 24-hour clock) a Boeing 737-524, N32626, operated by Continental Airlines as flight 1515, was parked at the gate in preparation for departure from El Paso International Airport, El Paso, Texas, when a mechanic was fatally injured while performing maintenance on the right engine. The right engine was substantially damaged. The scheduled domestic passenger flight was operated under the provisions of Title 14 Code of Federal Regulations (CFR) Part 121, and an instrument flight rules flight plan was filed. Visual meteorological conditions prevailed, and the flight's intended destination was Houston, Texas. The airline transport rated captain, first officer, 3 flight attendants, and 114 passengers reported no injuries.

During the preflight inspection conducted by the first officer, a puddle of fluid was noticed on the tarmac under the right engine. Both the captain and the first officer re-inspected the puddle of fluid under the right engine and agreed that it appeared to be an oil leak. The captain notified Continental El Paso Operations via radio from the cockpit to request authorization for contract maintenance to check for problems on the right engine.

Continental El Paso Operations contacted Continental Headquarters Maintenance Control and received authorization for contract maintenance to respond to the aircraft based on the captain's report. Three mechanics from Julie's Aircraft Services, Inc., a fixed based operation at the airport, arrived at the airplane and began to investigate the source of the reported oil leak. Both sides of the right engine fan cowl panels were opened for inspection, and the mechanics requested that the captain conduct an engine run to check for the oil leak.

Witnesses on the ramp and in the airplane observed one mechanic position himself on the inboard side of the right engine and another mechanic position himself on the outboard side of the right engine. The third mechanic was positioned several feet clear of the engine during the accident sequence; this mechanic was assigned by the lead mechanic to observe the maintenance procedure as part of his on-the-job training.

At this point in the accident sequence, the airplane was completely boarded with all passengers and crew via an air stair truck (the jetway was inoperative), except for one passenger in a wheel chair who was being prepared to be boarded on a lift truck. (The accident occurred prior to this passenger boarding the airplane).

The engine was started and stabilized at idle RPM for approximately three minutes while the initial oil leak check was performed. One of the mechanics called the captain on the ground

intercom system and reported that a small oil leak had been detected. The mechanic requested that the captain increase the engine power to 70 percent for three minutes. According to conversations recorded on the cockpit voice recorder (CVR) just prior to the accident, the captain asked the mechanic on the intercom: "clear back there?" and the mechanic replied "yeah, we're all clear." The captain then stated: " 'kay here goes."

Shortly after the engine power was increased, two witnesses on the ground (mechanics) and one witness in the airplane (passenger) observed the mechanic on the outboard side of the right engine stand up, step into the inlet hazard zone, and become ingested into the engine.

The captain stated that approximately one minute and 30 seconds after increasing the RPM to 70 percent, he sensed an engine buffet which increased in intensity, and this was followed by an engine compressor stall. The captain stated that he retarded the power lever back to the idle position. The first officer informed the captain that something went into the engine, and the captain immediately cut off the start lever.

PERSONNEL INFORMATION

The mechanic who was fatally injured, age 64, held a Federal Aviation Administration (FAA) airframe and power plant certificate, issued on July 13, 1966. In addition, the mechanic held a private pilot certificate with ratings for airplane single engine land, issued on July 6, 1962. The mechanic was hired by Julie's Aircraft Services in November 1997. According to Continental Airline training documents, the mechanic received line maintenance training from the Continental Airlines in on-call maintenance paperwork, policy, and procedures on March 2, 2004. The records also indicate that he received training regarding alternate fueling, auxiliary power unit operations, and contractor tow procedures for the B737, B757, and MD-80 series airplanes. He also received additional audiovisual training in extended operations (ETOPS) and CAT awareness. The documents did not indicate any specific training regarding ground engine runs.

AIRCRAFT INFORMATION

The Boeing 737-524 transport category airplane (serial number 27530), was manufactured in 1995 and was powered by two CFM-56 series engines. According to the airport operations manual for Continental Airlines, the ingestion danger zone for this type configuration covers a 13-foot radius around the front of each engine and extends to 5-feet behind the front of each engine. The maintenance practices manual for Boeing Aircraft defines a similar area as the inlet hazard zone and encompasses a 9-foot radius around the front of each engine and extends to five feet behind the front of each engine on the inboard side and four feet behind the engine on the outboard side of the engine.

METEOROLOGICAL INFORMATION

The 0851 surface weather observation at the El Paso International Airport reported wind from

110 degrees at 14 knots, gusting to 20 knots, visibility 10 miles, few clouds at 5,500 feet, scattered clouds at 12,000 feet, temperature 43 degrees F, dew point temperature 18 degrees F, and an altimeter setting of 29.92 inches of Mercury.

COMMUNICATIONS

There was no communication between the flight crew and El Paso air traffic control during the engine run and maintenance check. Communication was established between the flight crew and the maintenance personnel on the ground via the airplane's ground intercom system.

AERODROME INFORMATION

At the time of the accident, a Letter of Agreement (LOA) was in effect between the El Paso Air Traffic Control Tower and the El Paso International Airport, with an effective date of April 16, 1996. The subject of the LOA was "Engine Run-up Procedures". A cover letter was attached to the LOA. The letter was dated October 19, 2005, and titled "Priority Briefing Item." These documents outlined engine run-up procedures while aircraft are parked at the gate. The LOA states: "Except for power-up associated with beginning taxi, engine power is restricted to idle RPM on one engine at a time for a maximum of five minutes while on any parking or service apron areas, including the terminal ramp."

Neither Continental Airlines El Paso Operations nor the contract maintenance company had a copy of this document on file. A survey of all tenant aviation units at the airport revealed that this directive had not been distributed by the El Paso International Airport.

FLIGHT RECORDERS

The airplane was equipped with a Fairchild model A-100S, 30-minute, digital cockpit voice recorder (CVR), and a Honeywell Universal Flight Data Recorder (UFDR), Model 980-4100. The recorders were removed from the aircraft following the accident and shipped to the Vehicle Recorder Laboratories of the National Transportation Safety Board on January 18, 2006. The recorders arrived in working condition and data was recovered from both devices.

MEDICAL AND PATHOLOGICAL INFORMATION

The El Paso County Medical Examiner stated that neither an autopsy nor toxicological tests were possible due to the nature of the accident and the condition of the remains.

TESTS AND RESEARCH

Airline Maintenance Procedures.

Interviews with airline representatives, and review of airline procedures, indicate that contract maintenance is used frequently at airports where airline maintenance is not available. Once

the ground services support agreement was signed by the contract maintenance station, the airline provided training that was conducted by classroom, interactive computer based scenarios, and training videos.

According to the airline's General Maintenance Manual (GMM) that was in effect at the time of the accident, Julies Aircraft Services was listed as an "approved contract agency" that had "entered into a contractual agreement to provide on-call maintenance resources."

All maintenance manuals were maintained at Continental Headquarters Maintenance Control, and extracts of those manuals were transmitted to the contractor when specific maintenance was to be performed. This procedure was developed by the airline to insure that the most current procedures were used, and to eliminate the need for several airport contractors to maintain publications libraries.

According to the airline GMM that was in effect at the time of the accident, under the section entitled "Approved Contract Maintenance Arrangements", the following instructions are cited: "The Pilot-in-Command or the station personnel must make contact with approved contract maintenance personnel, however, maintenance is not to be performed on the aircraft until Maintenance Control is contacted by telephone and has approved the action to be taken." The GMM also states: "The [airline] Maintenance Controller will send a teletype message authorizing the mechanic to perform the maintenance and execute the required maintenance release."

According to the senior maintenance controller at Continental Airlines Maintenance Control who was working the accident flight, he was contacted by the airline's El Paso operations that the captain noticed the oil leak. The controller stated that he advised El Paso operations to notify Julies Aircraft Services to "investigate the pilot report." The controller further stated: "Some time went by and I heard nothing back from [Julies] or [El Paso] operations. As departure time became near, I tried to contact operations to find out the outcome of the problem, and still could not reach anybody." The controller then attempted to call Julies directly several times. He stated that when he finally contacted them, the accident had already occurred.

The investigation revealed that Julies Aircraft Services did not make contact with Continental Airlines Maintenance Control to obtain the required maintenance approval and required documentation.

In an interview with the surviving mechanic who was assisting in the troubleshooting of the engine, the mechanic was asked how and why he conducted the engine run with no maintenance procedures from the airline. The mechanic responded that engine oil leaks were a common occurrence, and that he continued without the instructions because of his past experience.

Airport Procedures.

There were no written procedures in place at the airport requiring the flight crew to contact either the Continental El Paso Operations or El Paso Airport Air Traffic Control prior to starting the engines.

Awareness of the Use of Lanyards.

The airline reported that interviews were conducted with aircraft mechanics at their main maintenance facility in Houston, Texas, to determine the use and awareness of the Boeing recommended safety lanyard while performing maintenance related functions in the vicinity of running engines. Nearly all of the mechanics indicated they never use lanyards and expressed concerns with quick release and escape during an emergency.

Post-Accident Airline Safety Efforts.

Following the accident, Continental Airlines developed the following safety enhancements:

- An interface system requiring coordination and communication with the appropriate Maintenance Control Center by mechanics and the airline's System Operations Control Center by pilots prior to engine runs.
- A series of checklists to coordinate communication and documentation between flight crew pilots, mechanics, and the System Operations Control Center prior to performing any required engine run.
- Requirements and a maintenance training system to include an enhanced Contract Maintenance training syllabus utilizing Computer Based Training (CBT) technology.
- An Enhanced Engine Safety Training Video to highlight the hazards of running engines. This video was made mandatory viewing for all maintenance providers.
- Evaluation and audit checklists for contract and on-call maintenance providers. The checklists were included in the GMM.
- Policies and procedures for Flight Operations in support of engine run procedures at non-maintenance stations.
- The airline purchased an additional 23 safety lanyards following the accident and reinforced procedures for their optional use.

Pilot Information

Certificate:	Airline transport; Flight engineer	Age:	54, Male
Airplane Rating(s):	Multi-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):		Restraint Used:	
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	No
Medical Certification:	Class 1 With waivers/limitations	Last FAA Medical Exam:	September 1, 2005
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	May 1, 2005
Flight Time:	23650 hours (Total, all aircraft), 10200 hours (Total, this make and model), 9000 hours (Pilot In Command, all aircraft), 250 hours (Last 90 days, all aircraft), 85 hours (Last 30 days, all aircraft), 6 hours (Last 24 hours, all aircraft)		

Co-pilot Information

Certificate:	Airline transport; Commercial; Flight instructor	Age:	41, Male
Airplane Rating(s):	Single-engine land; Multi-engine land	Seat Occupied:	Right
Other Aircraft Rating(s):	None	Restraint Used:	
Instrument Rating(s):		Second Pilot Present:	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine	Toxicology Performed:	No
Medical Certification:	Class 1 Without waivers/limitations	Last FAA Medical Exam:	September 1, 2005
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	
Flight Time:	13518 hours (Total, all aircraft), 7000 hours (Total, this make and model), 975 hours (Pilot In Command, all aircraft), 242 hours (Last 90 days, all aircraft), 71 hours (Last 30 days, all aircraft), 6 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Boeing	Registration:	N32626
Model/Series:	737-524	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	
Airworthiness Certificate:	Transport	Serial Number:	27530
Landing Gear Type:	Retractable - Tricycle	Seats:	149
Date/Type of Last Inspection:	January 1, 2006 Continuous airworthiness	Certified Max Gross Wt.:	130000 lbs
Time Since Last Inspection:		Engines:	2 Turbo jet
Airframe Total Time:	29773 Hrs at time of accident	Engine Manufacturer:	CFM International
ELT:	Installed, not activated	Engine Model/Series:	CFM56-391
Registered Owner:		Rated Power:	20000 Lbs thrust
Operator:		Operating Certificate(s) Held:	Flag carrier (121)
Operator Does Business As:	Continental Airlines	Operator Designator Code:	CALA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	KELP,3958 ft msl	Distance from Accident Site:	0 Nautical Miles
Observation Time:	08:51 Local	Direction from Accident Site:	0°
Lowest Cloud Condition:	Few / 5500 ft AGL	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	21 knots / 25 knots	Turbulence Type Forecast/Actual:	/
Wind Direction:	10°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29.87 inches Hg	Temperature/Dew Point:	5°C / -8°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	El Paso, TX	Type of Flight Plan Filed:	IFR
Destination:	Houston, TX (IAH)	Type of Clearance:	None
Departure Time:		Type of Airspace:	

Airport Information

Airport:	El Paso International Airport KELP	Runway Surface Type:	
Airport Elevation:	3958 ft msl	Runway Surface Condition:	
Runway Used:		IFR Approach:	None
Runway Length/Width:		VFR Approach/Landing:	None

Wreckage and Impact Information

Crew Injuries:	5 None	Aircraft Damage:	Minor
Passenger Injuries:	114 None	Aircraft Fire:	None
Ground Injuries:	1 Fatal	Aircraft Explosion:	None
Total Injuries:	1 Fatal, 119 None	Latitude, Longitude:	

Administrative Information

Investigator In Charge (IIC):	Gamble, William
Additional Participating Persons:	J D Huss; FAA Flight Standards District Office; Albuquerque, NM Eugene A Carroll; Continental Airlines; Houston, TX
Original Publish Date:	January 31, 2008
Note:	
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=63103

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. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).