Aviation Investigation Final Report

Location:	ATLANTIC OCEAN, Atlantic Ocean	**Accident Number:**	IAD99FA052
Date & Time:	July 8, 1999, 14:10 Local	**Registration:**	N12221
Aircraft:	Boeing 737-824	**Aircraft Damage:**	Minor
Defining Event:		**Injuries:**	1 Serious, 71 Minor, 89 None
Flight Conducted Under:	Part 121: Air carrier - Scheduled		

Analysis

The airplane was in cruise flight at 29,000 feet in smooth air with the seat belt sign turned off. The crew reported two jolts, and the airplane descended 600 feet. Due to possible injuries, the crew diverted to Bermuda (BDA) and landed. Readout of the flight data recorder indicated cruise flight at 29,000 feet with no change in heading, airspeed, or altitude for several minutes approaching the accident sequence. The altitude graph showed a slight climb before the airplane descended to 28,400 feet. The graph line indicated a slow recovery to 29,000 feet with no oscillations. The elapsed time between the first altitude excursion to recovered cruise flight was approximately 75 seconds. Of the 155 passengers on board, one passenger received serious injuries and 67 received minor injuries. The flight was scheduled for Flight Level 330 to Flight Level 370. Therefore, no information concerning forecast turbulence at Flight Level 290 was available to the flight crew. The High Level Significant Weather Prognosis chart for that period revealed that no significant weather was shown in the area where the turbulence was encountered.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the aircrew's inadvertent encounter with unforecast clear air turbulence.

Findings

Occurrence #1: IN FLIGHT ENCOUNTER WITH WEATHER
Phase of Operation: CRUISE - NORMAL

Findings
1. (C) WEATHER CONDITION - TURBULENCE,CLEAR AIR

Factual Information

HISTORY OF FLIGHT

On July 8, 1999 at 1410 eastern daylight time, a Boeing 737-824, N12221, operated by Continental Airlines, sustained minor damage during a clear air turbulence encounter, while in cruise flight at 29,000 feet, approximately 180 miles south of Bermuda. The airline transport rated flight crew was not injured and the four cabin attendants received minor injuries. Of the 155 passengers on board, one passenger received serious injuries, 67 received minor injuries and 87 passengers were not injured. Visual meteorological conditions prevailed for the scheduled passenger flight that originated at Newark, New Jersey (EWR), approximately 1220. An instrument flight rules flight plan was filed for the flight destined for San Juan, Puerto Rico, and conducted under 14 CFR Part 121.

In a telephone interview, a safety official for Continental Airlines reported the airplane was in cruise flight at 29,000 feet in smooth air with the seat belt sign turned off. He said the crew reported one jolt, and the airplane descended 500 feet. Due to possible injuries, the crew diverted to Bermuda (BDA) and landed at 1604.

In a written statement, the captain said:

"Approximately ten miles north of Pruit intersection on A523 at 29,000 ft. in clear air we encountered two severe jolts (turbulence). Our aircraft lost approximately 400 ft. and was descending at 2,000 ft. per minute. Speed was approaching MMO (Maximum Mach Operating Speed). I made a slow recovery back to 29,000, bottoming out our descent at 28,400. The seat belt sign was off and during recovery I placed it back on. When the aircraft was level we attempted to reach the flight attendants via the inter-phone, no response. I instructed my F.O. (First Officer) to go into the cabin and assess damages. He quickly informed me of numerous injuries, at that time I declared an emergency and diverted to Bermuda. Turning direct to BDA our location was 160 miles SSW...No reports of turbulence were reported by ATC (Air Traffic Control) along our route of flight or in our dispatched flight paper work."

In a written statement, the first officer said:

"We were level at FL 290 [29,000 feet]...It had been smooth for 30 minutes [and] the seat belt sign was off, there were no visual cues to an adverse ride. Both radars were on (we had deviated to avoid weather earlier in the flight) when the aircraft was hit by two severe jolts in quick succession. The Captain (Pilot Flying) recovered the aircraft from a nose down attitude, when the aircraft was once again level and on course the autopilot, L [lateral] nav and V [vertical] nav were re-selected."

In a written statement, a cabin attendant said:

"The crew had just completed the meal service and I was in the back of ...the main cabin approximately row 29 picking up trays from the meal service. The seat belt sign was off and we were flying through smooth air with no sign of turbulence. Then all of a sudden, the aircraft dropped abruptly, which caused my body to fly upward hitting my head on the ceiling. I fell back to the floor on my knees. Approximately 10 seconds later, the aircraft dropped again causing my head to hit the ceiling once again. At that point I lost consciousness. When I awoke, I was very dazed noticing my head bleeding, arms cut and bruised, and back and shoulders sore."

In a detailed written statement, a second cabin attendant described a similar sequence of events. She said people, carts, and equipment were tossed about and that she came to rest under a row of seats. The cabin attendant further described the crew coordination involved in treating and calming the passengers and the communication from the cockpit to the cabin about the egress and treatment of passengers upon arrival at Bermuda.

The captain arranged through ATC to have medical teams meet the airplane at BDA. Sixty-four passengers and 4 cabin attendants were examined at the hospital. One passenger suffered a head laceration and a fractured rib.

The accident occurred during the hours of daylight approximately 30 degrees 20 minutes north latitude, 066 degrees 43 minutes west longitude.

PERSONNEL INFORMATION

The captain held an airline transport pilot's certificate with ratings for airplane multi-engine land. He held a commercial pilot's certificate with ratings for airplane single-engine land, rotorcraft helicopter and instrument helicopter. The captain held a flight instructor's certificate with ratings for airplane single-engine land and a mechanic's certificate with ratings for airframe and powerplant.

The captain's most recent FAA first class medical certificate was issued June 8, 1999.

The captain reported 14,800 hours of flight experience, 3,300 hours of which were in the Boeing 737. He reported 215 hours of flight experience in the previous 90 days, 76 hours of which were in the previous 30 days. All flight time reported in the previous 90 days was in the Boeing 737.

The first officer held an airline transport pilot's certificate with ratings for airplane multi-engine land. He held a commercial pilot's certificate with ratings for airplane single-engine land. The first officer held a flight engineer's certificate with a rating for turbojet powered.

The first officer's most recent FAA first class medical certificate was issued May 24, 1999.

The first officer reported 10,000 hours of total flight experience, 5,000 hours of which were in the Boeing 737. He reported 203 hours of flight experience in the previous 90 days, 18 hours of which were in the previous 30 days. All flight time reported in the previous 90 days was in the Boeing 737.

DAMAGE TO AIRCRAFT

Inspection of the airplane revealed no structural damage and the airplane was returned to service. Entries in the airplane's maintenance log reflected completion of the turbulence inspection and damage to interior ceiling panels in Row 25, 29, and in the aft galley.

AIRCRAFT INFORMATION

The airplane was a 1998 Boeing 737-824, and the airworthiness certificate was issued December 2, 1998. The airplane was on a continuous airworthiness inspection program and had accrued 3,639 hours of total flight time. The last inspection was performed July 3, 1999, and the airplane accrued 51 hours of flight time since that date.

METEOROLOGICAL INFORMATION

A Safety Board Operational Factors investigator interviewed the captain by telephone. According to the interview summary:

"[The captain] stated that the flight departed Newark on schedule. The flight encountered weather at cruise altitude near KWINN intersection, about 300 miles north of the point where the turbulence encounter occurred. Clearance was requested by the flight crew and approved by air traffic control to deviate around the weather. The seatbelt sign was on.

"The flight proceeded around the thunderstorms and broke out into the clear with only some high clouds visible. [The captain] stated that the ride was 'not all that bad' and this was the 'only major weather we saw.' For about 45 minutes before the turbulence encounter, the ride was smooth. The seatbelt sign was turned off during this time.

"At the time of the turbulence encounter, the flight was in contact with New York Center via the VHF radio. [The captain] stated that there were two 'major jolts that came out of nowhere.' The flight attendants were called on the interphone but there was no answer. [The captain] then sent the first officer to the cabin to assess the situation.

"[The captain] said that Continental Airlines uses a 'shear rating indicator' to estimate the degree of turbulence that is anticipated along the route of flight. The shear rating indicator (SR) is shown on the flight plan and expressed as a number from zero to five, with five indicating the worst turbulence. During the first part of the flight, twos and threes were shown along the flight-planned route. Starting about GABES intersection, the SR was zero. The SR at

PRUIT intersection was zero. [The captain] stated that 'nothing else indicated severe turbulence; no other ride reports; the sky was wide open.' [The captain] stated that he made a conscious effort to change the route about KWINN intersection to get around the weather to the east and to get into smooth air. At PRUIT intersection, he stated that they were in the clear with high clouds in view to the west. There were no towering cumulus clouds, nothing to indicate the existence of turbulence."

According to flight papers, the flight altitude was planned for FL 330 to FL 370. Therefore, no information concerning forecast turbulence at FL 290 was available to the flight crew.

The High Level Significant Weather Prognosis chart prepared by the Aviation Weather Center (AWC) at Kansas City, Missouri, valid for 1400, revealed that no significant weather was shown in the area where the turbulence was encountered.

FLIGHT RECORDERS

The airplane's flight data recorder (FDR) was forwarded to the Safety Board for examination. Examination of the data retrieved revealed a sequence of events consistent with that described in the crew statements.

A graph of several flight parameters indicated cruise flight at 29,000 feet with no change in heading, airspeed, or altitude for several minutes approaching the accident sequence. The altitude graph showed a slight climb before the airplane descended to 28,400 feet. The graph line indicated a slow recovery to 29,000 feet with no oscillations. Vertical g-forces sustained during the sequence varied in amplitude between a positive 2-g's and a negative 1-g. The elapsed time between the first altitude excursion to recovered cruise flight was approximately 75 seconds.

ADDITIONAL INFORMATION

The airplane was returned to service by Continental Airlines on July 9, 1999.

Pilot Information

Certificate:	Airline transport; Commercial	**Age:**	43,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane single-engine; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	June 8, 1999
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	14800 hours (Total, all aircraft), 3300 hours (Total, this make and model), 12000 hours (Pilot In Command, all aircraft), 215 hours (Last 90 days, all aircraft), 76 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Boeing	**Registration:**	N12221
Model/Series:	737-824 737-824	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Transport	**Serial Number:**	28770
Landing Gear Type:	Retractable - Tricycle	**Seats:**	155
Date/Type of Last Inspection:	July 3, 1999 Continuous airworthiness	**Certified Max Gross Wt.:**	173000 lbs
Time Since Last Inspection:	51 Hrs	**Engines:**	2 Turbo fan
Airframe Total Time:	3639 Hrs	**Engine Manufacturer:**	Cfm
ELT:	Not installed	**Engine Model/Series:**	CFM 56-7B26
Registered Owner:	FIRST SECURITY BANK	**Rated Power:**	26300 Lbs thrust
Operator:	CONTINENTAL AIRLINES, INC	**Operating Certificate(s) Held:**	Flag carrier (121)
Operator Does Business As:	CONTINENTAL AIRLINES	**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	TXK ,12 ft msl	**Distance from Accident Site:**	180 Nautical Miles
Observation Time:	13:55 Local	**Direction from Accident Site:**	180°
Lowest Cloud Condition:	Scattered / 2000 ft AGL	**Visibility**	3 miles
Lowest Ceiling:	Broken / 5000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	14 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	220°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	28°C / 25°C
Precipitation and Obscuration:	N/A - None - Fog		
Departure Point:	NEWARK , NJ (EWR)	**Type of Flight Plan Filed:**	IFR
Destination:	SAN JUAN , PR (SJU)	**Type of Clearance:**	IFR
Departure Time:	12:21 Local	**Type of Airspace:**	Class A

Airport Information

Airport:		**Runway Surface Type:**	
Airport Elevation:		**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	
Runway Length/Width:		**VFR Approach/Landing:**	

Wreckage and Impact Information

Crew Injuries:	4 Minor, 2 None	**Aircraft Damage:**	Minor
Passenger Injuries:	1 Serious, 67 Minor, 87 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Serious, 71 Minor, 89 None	**Latitude, Longitude:**	

Administrative Information

Investigator In Charge (IIC):	Rayner, Brian
Additional Participating Persons:	STAN BATOR; GARDEN CITY , NY TOBY CARROL; HOUSTON , TX
Original Publish Date:	April 6, 2001
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=46938