National Transportation Safety Board
Aviation Accident Final Report

Location:	Modesto, CA	**Accident Number:**	WPR12LA057
Date & Time:	12/01/2011, 1339 PST	**Registration:**	N547UA
Aircraft:	BOEING 757-222	**Aircraft Damage:**	None
Defining Event:	Turbulence encounter	**Injuries:**	1 Serious, 151 None
Flight Conducted Under:	Part 121: Air Carrier - Scheduled		

Analysis

While en route at flight level (FL) 360, the captain of the commercial air carrier flight requested and was granted a lower altitude (FL 300) to minimize the effect that turbulence was having on the airplane. After the captain received pilot reports indicating that varying degrees of turbulence, mountain wave activity, and low-level windshear existed, he illuminated the seat belt sign and made an announcement for the passengers to be seated. The flight crew then advised the cabin crewmembers of possible turbulence and instructed them to prepare the cabin for landing, stay near their seats, and be seated immediately if turbulence was encountered. About 7 to 10 minutes later, while the airplane was at FL 300, the flight encountered moderate-to-severe turbulence. A flight attendant who was in the lavatory when the turbulence was encountered sustained a broken ankle after being thrown in the air twice.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The flight's encounter with known severe turbulence associated with mountain wave activity, which resulted in a flight attendant sustaining a broken ankle.

Findings

Environmental issues	Terrain induced turbulence - Effect on equipment (Cause)

Factual Information

On December 1, 2011, about 1339 Pacific standard time, a Boeing 757-222, N547UA, encountered turbulence at flight level (FL) 300, during the cruise phase of flight. United Airlines (UAL) operated flight 721 under the provisions of 14 Code of Federal Regulations Part 121 as a scheduled domestic passenger flight. One flight attendant sustained serious injuries; the 2 flight crew, 3 additional flight attendants, and 146 passengers were not injured. The airplane was not damaged. Visual meteorological conditions prevailed, and an instrument flight rules (IFR) flight plan had been filed. The flight departed the Denver International Airport (DEN), Denver, Colorado, at 1215, and was en-route to San Francisco International Airport (SFO), San Francisco, California, when the turbulence was encountered.

According to United Airlines, the Western United States was experiencing widespread moderate to severe turbulence on the day of the incident. The flight planned en route cruise altitude was FL360. While en route, the flight descended to FL300 at 13:17 PT because smoother conditions were reported. As the flight was nearing the Sierra Nevada Mountains on the Modesto 3 arrival into San Francisco, there were reports of turbulence up ahead. When the reports were received, the captain illuminated the seat belt sign and made an announcement for passengers to be seated with seat belts fastened.

The purser was contacted by the captain to discuss the approaching area of turbulence. The captain directed the purser to have the flight attendants wrap up cabin service, and stay near their seats and to be seated immediately if turbulence was encountered. The purser advised the cabin crew of the captain's directions. After the announcement was made, an aft galley flight attendant stated she went into the lavatory to brush her teeth. After approximately 7-10 minutes later, following the announcement, 2-3 jolts of moderate turbulence followed by a brief episode of severe turbulence was encountered. This occurred 22 minutes before landing. The flight, at the time, was on the Modesto Three Standard Terminal Arrival for SFO, in the vicinity of ELCAP intersection. The flight attendant, in the lavatory, reportedly was thrown twice in the air, and landed awkwardly on her right ankle. The flight continued to San Francisco and landed at 1401 local time.

The turbulence event was reported by United Airlines on December 5, 2011, after it was confirmed that one of the flight attendants had suffered a broken fibula.

A weather study was completed by a National Transportation Safety Board (NTSB) staff meteorologist; the complete study is attached to the public docket for this report. The area was favorable for mountain wave activity over the region due to an upper level low, and strong wind flow over the mountain ranges. The GOES-11 visible and infrared satellite images depicted clear skies over the accident area with no visual signs of potential turbulence.

Several pilot reports in the surrounding area and at varying altitudes around the time of the accident reported low-level wind shear, extreme turbulence, occasional to moderate chop, continuous light chop, and moderate to severe turbulence, along with mountain wave activity.

The flight data recorder (FDR) information was read out and analyzed by a flight data recorder specialist at the NTSB. The complete report is attached to the public docket for this accident. The FDR contained approximately 108 hours of recorded data, which included the turbulence event. The FDR data indicated that approximately 1 hour 34 minutes after takeoff, the vertical acceleration fluctuated between 0 g's and 2 g's peaking at a maximum of 1.91 g's during a 28-

second time period.

According to an excerpt from the Federal Aviation Administration (FAA) Air Traffic Control (ATC) package, at 1242, UAL flight 721 checked into sector 34, and was told to expect occasional light chop. The flight crew was also told that AIRMETs for the western United States were available on HIWAS, flight watch, or flight service frequencies. The flight crew was then issued a frequency change. Upon check in with the new sector (sector 47), the flight crew was advised that their ride would deteriorate in about 20 minutes. The UAL flight crew was instructed to advise when that happened. The sector controller told them to plan on a lower altitude. About 15 minutes later, the UAL flight crew requested a lower altitude. UAL flight 721 was issued another frequency change. After checking in with the new sector controller the flight crew was advised of "bad rides over the Sierra Nevada Mountain Range, but that FL300 and FL320 were not bad." When queried how their ride was, the flight crew responded that they had experienced light chop. About 10 minutes later, the flight crew reported that they had encountered moderate to severe at FL 300 and asked for a lower altitude. UAL flight 721 was cleared to FL270, and the sector controller asked them to verify that they had encountered severe turbulence, to which the pilot replied that he wouldn't quite call it severe turbulence, but it was a bad ride. The detailed report is attached to the public docket for this report.

The flight continued to its destination and landed without further incident.

History of Flight

Approach-IFR initial approach	Turbulence encounter (Defining event)

Pilot Information

Certificate:	Airline Transport	**Age:**	54
Airplane Rating(s):	Multi-engine Land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**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 Medical Exam:**	06/23/2011
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	09/01/2011
Flight Time:	11290 hours (Total, all aircraft), 3823 hours (Total, this make and model)		

Co-Pilot Information

Certificate:	Airline Transport	**Age:**	51
Airplane Rating(s):	Multi-engine Land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 Unknown	**Last Medical Exam:**	03/21/2011
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	9469 hours (Total, all aircraft), 6782 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Manufacturer:	BOEING	**Registration:**	N547UA
Model/Series:	757-222	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Transport	**Serial Number:**	25368
Landing Gear Type:		**Seats:**	178
Date/Type of Last Inspection:	12/01/2011, Continuous Airworthiness	**Certified Max Gross Wt.:**	
Time Since Last Inspection:		**Engines:**	2 Turbo Jet
Airframe Total Time:	74780 Hours	**Engine Manufacturer:**	P & W
ELT:	Not installed	**Engine Model/Series:**	PW2040
Registered Owner:	WELLS FARGO BANK NORTHWEST NA TRUSTEE	**Rated Power:**	40900 lbs
Operator:	United Airlines	**Air Carrier Operating Certificate:**	Flag carrier (121)
Operator Does Business As:	United Airlines	**Operator Designator Code:**	UAL

Meteorological Information and Flight Plan

Observation Facility, Elevation:	MOD, 99 ft msl	**Observation Time:**	1353 PDT
Distance from Accident Site:	62 Nautical Miles	**Condition of Light:**	Day
Direction from Accident Site:	262°	**Conditions at Accident Site:**	Visual Conditions
Lowest Cloud Condition:	Clear	**Temperature/Dew Point:**	19°C / -7°C
Lowest Ceiling:	None	**Visibility**	10 Miles
Wind Speed/Gusts, Direction:	24 knots/ 29 knots, 340°	**Visibility (RVR):**	
Altimeter Setting:	30.02 inches Hg	**Visibility (RVV):**	
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	DENVER, CO (DEN)	**Type of Flight Plan Filed:**	IFR
Destination:	SAN FRANCISCO, CA (SFO)	**Type of Clearance:**	IFR
Departure Time:	1215 MDT	**Type of Airspace:**	Class A

Wreckage and Impact Information

Crew Injuries:	1 Serious, 5 None	**Aircraft Damage:**	None
Passenger Injuries:	146 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Serious, 151 None		

Administrative Information

Investigator In Charge (IIC):	Tealeye Cornejo	**Adopted Date:**	08/11/2015
Additional Participating Persons:	Kathryn Reneau; FAA Denver CMO; Denver, CO Jeff Plantz; United Airlines; Chicago, IL Gerry Hartmann; Airline Pilots Association; Sacramento, CA		
Publish Date:	08/11/2015		
Investigation Docket:	http://dms.ntsb.gov/pubdms/search/dockList.cfm?mKey=82481		