Aviation Investigation Final Report

Location:	Denver, Colorado	**Incident Number:**	CEN12IA502
Date & Time:	July 31, 2012, 09:09 Local	**Registration:**	N37420
Aircraft:	Boeing 737-924ER	**Aircraft Damage:**	Minor
Defining Event:	Birdstrike	**Injuries:**	157 None
Flight Conducted Under:	Part 121: Air carrier - Scheduled		

Analysis

The flight crew reported that the airplane struck a bird while descending to land. Examination of the airplane after the event revealed a large hole in the radome and a portion of the broken radome lodged on the left pitot tube, which was also bent. The flight crew reported that following the bird strike, the captain's airspeed and altimeter were inoperative and the first officer's airspeed and altimeter indications were erratic. The captain eventually lost all instrument indications on his primary flight display (PFD). The crew referenced the standby instruments, but the readings did not make sense given the airplane altitude and power settings. As a result, the flight crew used power settings and aircraft configurations along with air traffic control (ATC) callouts of their ground speed to continue the flight to the intended destination, where they executed an uneventful landing.

The operator later reported that the standby airspeed indicator readings during the descent appeared to match the ground speed callouts provided by ATC. Data retrieved from the flight data recorder (FDR) for the left air data inertial reference unit (ADIRU), which references sensed data from the left pitot probe and static ports, confirmed a loss of airspeed information that would have resulted in an amber flag indicating "IAS DISAGREE" on the left and right primary PFD, as well as an amber flag indicating "SPD" on the left PFD. Data from the right ADIRU and the standby system were not recorded. Other air data parameters exhibited erroneous behavior that was consistent with the loss of airspeed information. The FDR continued to record altitude and attitude information throughout the remainder of the flight. Testing of the air data systems following replacement of the damaged pitot tube and cleaning of the system did not reveal any malfunctions or failures that would explain the total loss of indications on the left PFD.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this incident to be:

An in-flight collision with a bird during descent to land, which resulted in damage to the left pitot tube and loss of airspeed information to the left and right primary flight displays (PFD). The reason for the total loss of indications on the left PFD could not be determined based on available evidence.

Findings

Environmental issues	Animal(s)/bird(s) - Effect on operation

Factual Information

History of Flight

Enroute-descent	Birdstrike (Defining event)

On July 31, 2012, about 0909 mountain daylight time, a Boeing 737-924ER, N37420, struck a large bird while approaching to land at the Denver International Airport (DEN), Denver, Colorado. There were no injuries reported. The airplane sustained damage to the radome, pilot side pitot tube, and the vertical stabilizer. The flight crew declared an emergency and continued to DEN making an uneventful landing. The aircraft was registered to Continental Airlines, Inc., and operated by United Airlines as flight 1475 under the provisions of 14 Code of Federal Regulations Part 121 as a domestic passenger flight. Visual meteorological conditions prevailed for the flight, which operated on an instrument flight rules flight plan. The flight originated from the Dallas/Fort Worth International Airport (DFW), at 0818, and was bound for DEN.

The flight crew reported that during descent for landing, they heard a loud bang from the front of the airplane that was believed at the time to be the result of a bird strike. They reported that following the bird strike, the Captain's airspeed and altimeter were inoperative and the First Officer's airspeed and altitude were erratic. The crew referenced the standby instruments but the readings did not make sense to the crew given the aircraft altitude and power settings. The captain stated that he initially lost airspeed and altitude indication and eventually lost all instrument indications. As a result the flight crew used power settings and aircraft configurations along with air traffic control (ATC) call outs of their ground speed to continue the flight to DEN where an uneventful landing was made. It was later reported by the operator that the Captain reported that the standby airspeed indicator readings during the descent seemed to match the ground speed call outs provided by ATC.

Examination of the airplane after the incident revealed a large hole in the radome located on the nose of the airplane. The hole measured about 12 inches by 24 inches. A portion of the broken radome became lodged on the left pitot tube and the left pitot tube was bent. Bird remains were found within the left engine, and on the tail of the airplane. Subsequent examination of bird remains confirmed the species of bird as a White Faced Ibis.

The airplane was equipped with three separate and independent air data systems: Left, right, and a standby system. Each air data system used independent sensors and displays except that various comparative display messages relied on data from both the left and right systems. The airspeed and altitude recorded by the Flight Data Recorder (FDR) was computed by the left ADIRU based on sensed data from the left pitot probe and static ports. The airspeed and altitude computed by the right ADIRU was based on sensed data from the right pitot probe and static ports. The airspeed and altitude from the right ADIRU and the standby system were not recorded by the FDR.

The FDR data showed a rapid loss of airspeed while descending through approximately 11,500 feet pressure altitude travelling at a computed airspeed of approximately 290 knots. Many of the air data parameters exhibited erroneous behavior consistent with a loss of airspeed, including a decrease of

airspeed to 45 knots, a decrease of wind data to a value of zero, and an increase of pressure altitude. Additionally, the left angle of attack measurement split from that of the right by about 0.5 degrees. The FDR continued to record altitude and attitude information throughout the remainder of the flight and the loss of attitude reference described by the captain could not be verified through system testing following the incident. The rapid drop in computed airspeed to the "no computed data" (NCD) value of 45 knots was consistent with a complete loss of airspeed reference (pitot pressure) on the left air data system. According to the airplane manufacturer, the rapid drop in computed airspeed would have been consistent with the display of an amber "SPD" flag on the left primary flight display.

Testing of the airplane's air data systems after replacement of the left pitot tube and system cleaning did not reveal any anomalies that would explain the loss of all instrument indications described by the captain or the reported unreliability of the First Officer's airspeed and altitude indications.

Pilot Information

Certificate:	Airline transport; Flight engineer	**Age:**	51
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):	Airplane single-engine; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	June 7, 2012
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	20000 hours (Total, all aircraft), 10000 hours (Pilot In Command, all aircraft), 220 hours (Last 90 days, all aircraft), 80 hours (Last 30 days, all aircraft), 8 hours (Last 24 hours, all aircraft)		

Co-pilot Information

Certificate:	Airline transport; Commercial; Flight engineer; Military	**Age:**	47
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	June 12, 2012
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	June 1, 2012
Flight Time:	9000 hours (Total, all aircraft), 3000 hours (Pilot In Command, all aircraft), 70 hours (Last 90 days, all aircraft), 70 hours (Last 30 days, all aircraft), 8 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Boeing	**Registration:**	N37420
Model/Series:	737-924ER	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Transport	**Serial Number:**	33457
Landing Gear Type:	Retractable - Tricycle	**Seats:**	191
Date/Type of Last Inspection:		**Certified Max Gross Wt.:**	
Time Since Last Inspection:		**Engines:**	2 Turbo fan
Airframe Total Time:		**Engine Manufacturer:**	CFM INTL
ELT:		**Engine Model/Series:**	CFM56-7B26
Registered Owner:	CONTINENTAL AIRLINES INC	**Rated Power:**	26300 Lbs thrust
Operator:	UNITED AIR LINES INC	**Operating Certificate(s) Held:**	Flag carrier (121)
Operator Does Business As:		**Operator Designator Code:**	UALA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	DEN,5434 ft msl	**Distance from Accident Site:**	45 Nautical Miles
Observation Time:	08:53 Local	**Direction from Accident Site:**	330°
Lowest Cloud Condition:	Few / 12000 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	Broken / 20000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	19 knots / 26 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	220°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.17 inches Hg	**Temperature/Dew Point:**	23°C / 11°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Dallas, TX (DFW)	**Type of Flight Plan Filed:**	IFR
Destination:	Denver, CO	**Type of Clearance:**	IFR
Departure Time:	08:18 Local	**Type of Airspace:**	Class E

Airport Information

Airport:	Denver International Airport DEN	**Runway Surface Type:**	Concrete
Airport Elevation:	5434 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	26	**IFR Approach:**	Visual
Runway Length/Width:	12000 ft / 150 ft	**VFR Approach/Landing:**	Straight-in

Wreckage and Impact Information

Crew Injuries:	6 None	**Aircraft Damage:**	Minor
Passenger Injuries:	151 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	157 None	**Latitude, Longitude:**	39.861667,-104.673057

Administrative Information

Investigator In Charge (IIC):	Brannen, John
Additional Participating Persons:	Thomas Sully; United Airlines; Chicago, IL Keith A Frable; FAA - United Airlines CMO; Chicago, IL
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Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=84541