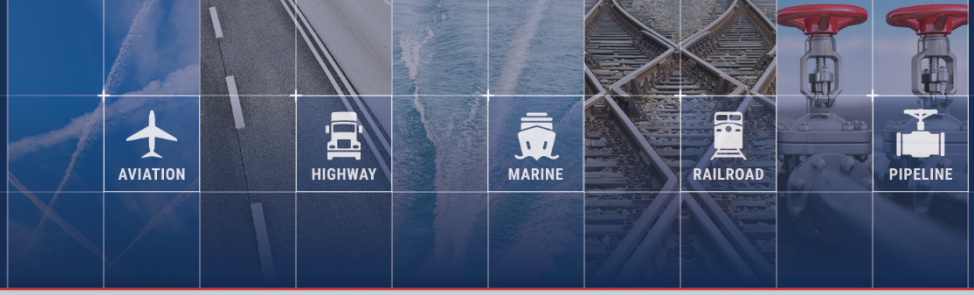

Aviation Investigation Factual Report

Location:	Memphis, Tennessee	**Accident Number:**	ATL03FA115
Date & Time:	July 2, 2003, 10:05 Local	**Registration:**	N36TL
Aircraft:	Beech 58P	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	2 Fatal, 2 Serious
Flight Conducted Under:	Part 91: General aviation - Personal		

Factual Information

HISTORY OF FLIGHT

On July 2, 2003, at 1005 central daylight time, a Beech 58P, N36TL, registered to private owners and co-owned and operated by the private pilot, collided with the ground during approach to land at the Memphis International Airport, Memphis, Tennessee. The personal flight was operated under the provisions of Title 14 CFR Part 91 with an instrument flight plan filed. Visual meteorological conditions prevailed. The private pilot and the front-seated passenger received fatal injuries, the two passengers seated in the second row received serious injuries, and the airplane sustained substantial damage. The flight departed Peter O. Knight Airport, Tampa, Florida, about 0758 eastern daylight time on July 2, 2003.

A review of air traffic control data revealed the flight was inbound from the southeast when the pilot contacted the Memphis Air Traffic Control Arrival Final East controller at 0954:55 and reported the flight was at 4,000 feet mean sea level (MSL). The controller stated the pilot could expect the ILS runway 36R approach, the pilot acknowledged, and the controller subsequently cleared the flight to descend and maintain 3,000 feet MSL. At 0958:11, the controller instructed the pilot to reduce speed to 170 knots, and the pilot acknowledged. The controller then stated, "... caution wake turbulence when on final you'll be operating four miles in trail of an e one forty five," and the pilot acknowledged. A review of radar data revealed an Embraer ERJ 145 regional jet was on approach to runway 36C, approximately four miles north of the pilot's position. At 0959:46, the controller provided the pilot a vector to join the localizer for runway 36R and instructed him to reduce speed to 160 knots. The pilot acknowledged, and the controller cleared the flight for the ILS runway 36R approach. At 1000:47, the controller stated, "... caution wake turbulence contact tower ...," and the pilot acknowledged . The pilot contacted the Memphis Air Traffic Control Local Two controller, and at 1000:59, the controller cleared the flight to land on runway 36R. The pilot acknowledged, and no further radio communication was received from the flight.

A witness in an airplane taxiing southbound between runways 36R and 36C observed the accident airplane on final approach. The witness stated the airplane descended to approximately 10 to 15 feet above the runway on 36R, and it "had the runway made." The witness stated the airplane then simultaneously and slowly yawed left and rolled left, and he stated he thought it looked like the pilot might be trying to make "a last minute play for the other runway." The witness stated the airplane then pitched up approximately 15-degrees, and then abruptly "snap rolled" to the left. He stated the airplane's left wing barely cleared runway, and the airplane "pancaked" onto the ground inverted. Another witness in an observation tower west of the runway reported the airplane appeared to be positioned off the left side of the runway during the approach, and it appeared to nose straight down toward the ground while turning to the left. Both witnesses stated they did not see any other airplanes on the ground

near the approach areas of the runways.

The passenger seated in the second row right-side seat of the accident airplane stated the airplane approached the runway. The passenger looked down inside the airplane during the approach. He stated that when he looked back out the window, he could see the runway off to the right side of the airplane, that the airplane had turned. He stated the next thing he remembered was hearing the airplane hit the ground.

PERSONNEL INFORMATION

The pilot held a private pilot certificate issued August 16, 1969, with ratings for airplane single-engine land, airplane single-engine sea, airplane multi-engine land, airplane multi-engine sea, instrument airplane, and glider. The pilot held a third-class medical certificated issued July 11, 2001. A review of the pilot's logbook revealed he logged 3,211.9 total flight hours, which included 3,005.2 hours pilot-in-command and 923.6 hours in multi-engine airplanes. The pilot logged 95.3 hours in the accident airplane since July 28, 2002. The pilot's logbook contained entries and endorsements for the completion of a flight review in accordance with Title 14 CFR Part 61.56 on March 31, 2002, and an instrument proficiency check in accordance with Title 14 CFR Part 61.67 on May 10, 2003.

AIRCRAFT INFORMATION

The six-seat Beech 58P was manufactured in 1981 and was powered by two Teledyne Continental TSIO-520-WB, 325-horsepower engines. A review of maintenance logbooks for the airplane revealed a major overhaul was completed on the left engine February 8, 2001, and on the right engine March 6, 2001. The overhauled engines were installed on the airframe April 9, 2001. Each engine was equipped with a Hartzell PHC-J3YF-2UF propeller with three FC7663DR blades. A review of maintenance records revealed an overhaul of each propeller was completed July 3, 2002. The maintenance records revealed an annual inspection of the airplane was completed July 17, 2002 at a hobbs meter time of 707 hours; a 50-hour inspection was completed February 27, 2003, at a left engine time of 157 hours since major overhaul, a right engine time of 158 hours since major overhaul, and hobbs meter time of 815. The hobbs meter at the accident site displayed 0880.6 hours.

METEOROLOGICAL INFORMATION

The Memphis International Airport Automated Surface Observing System (ASOS) reported at 0953 wind 290 degrees at 5 knots, visibility 10 statute miles, sky condition scattered at 3,000 feet and broken at 3,800 feet above ground level (AGL), temperature 27 degrees centigrade, dew point 21 degrees centigrade, altimeter setting 29.95 inches. Reported conditions at 1013 were wind 330 degrees at 5 knots, visibility 10 statute miles, sky condition broken at 2,900 feet AGL, broken 3,800 feet AGL, and broken 4,500 feet AGL; temperature 26 degrees centigrade, dew point 21 degrees centigrade, altimeter setting 29.95 inches.

Examination of upper air data retrieved from two aircraft that arrived at Memphis International Airport within 20 minutes of the accident airplane revealed the data were consistent with the data reported by the ASOS station. The low-level wind and temperature information from the two aircraft and the ASOS station showed no evidence of significant directional shear or speed shear, and no evidence of instability.

WRECKAGE AND IMPACT INFORMATION

Examination of the accident site revealed the airplane was found inverted in a grassy area between runways 36C and 36R, north of the S1 taxiway. Wreckage debris was scattered on an approximate 310-degree magnetic heading along a path 187 feet long and 57 feet wide. The debris path originated on the S1 taxiway west of runway 36R in an area where paint smears, debris, and two series of slash marks were observed on the concrete. Fuel was observed leaking from the fuel tanks, and approximately 40 to 50 gallons of fuel was recovered by airport emergency response personnel. The main and nose landing gear were in the extended and locked position.

Examination of the fuselage revealed the top of nose compartment was crushed, the cabin roof was crushed inward to the cockpit, the windscreen was fragmented and separated, and the fuselage forward of the wing roots was buckled and displaced downward approximately 25 degrees. Dirt and grass were embedded in the cabin roof and the windscreen area. The empennage and wings were attached to the fuselage. The instrument panel was crushed, the cockpit flight control yokes were attached and free to move, and the rudder pedals were attached and free to move. The control console was damaged and displaced with the powerplant control levers free to move; the propeller levers were approximately mid-range, the throttle levers were slightly aft of mid-range with the "go around" button on the left throttle lever dislodged, and the mixture levers were approximately mid-range.

The right wing was attached to the fuselage, and the engine and nacelle were separated. The right wing 88 inches outboard of the root was crushed from the leading edge aft and bent downward from that location outboard to the tip. The leading edge displayed fore-to-aft gouges and scratches through the de-ice boot and the paint. The upper surface of the wing tip was separated at the rivet line and attached to the wing by the lower skin panels. The flap and aileron were attached to wing, and control continuity was established from control surfaces to the cockpit controls. The flap was in the 30-degrees down position.

The left wing was attached to the fuselage, and the engine and nacelle were attached. The left wing was scratched and damaged on the upper skin of the wing tip and on top of the engine nacelle, and dirt and grass were embedded in the wing tip. The underside of the wing skin showed a series of 45-degree wrinkles across the surface from the wing spar to the trailing edge. The flap, aileron, and aileron trim tab were attached, and control continuity was established from the control surfaces to the cockpit controls. The flap was in the 30-degrees down position.

The top of vertical stabilizer and rudder were crushed with dirt and grass embedded, and the rudder was separated from the upper and middle hinges. The bottom of the rudder was attached to the rudder horn, and the rudder trim tab was attached. The right and left sides of the horizontal stabilizer were attached, and the right and left elevators and trim tabs were attached. Control continuity was established from the rudder, elevator, and trim control surfaces to the cockpit controls.

The left engine was found with the propeller assembly separated from the crankshaft flange, and the flange was bent. The aft side of the oil sump was damaged, and the No. 6 cylinder head, fins, and valve cover were damaged. The exhaust system was attached, and the turbocharger was free of obstruction. Examination of the engine revealed compression developed on all six cylinders when the crankshaft was rotated; movement of all valves and movement of the accessory drive gears were observed. The vacuum pump was attached, the shear drive was intact, and the pump vanes rotated when turned at the drive. The magnetos were removed for examination, and both magnetos produced spark through all leads when rotated. Examination of the top spark plugs revealed deposits and wear consistent with the "normal" condition on the Champion AV-27 comparison chart for massive electrode plugs. The fuel manifold valve, fuel injector lines, and the Nos. 2, 5, and 6 fuel injector nozzles were damaged. The throttle arm, mixture arm, and link rod were intact on the fuel servo. Fuel was observed in the fuel pump, and the pump functioned when rotated.

The right engine was found with the propeller assembly attached. The accessory section was damaged. The exhaust system was attached, and the turbocharger was damaged and free of obstruction. Examination of the engine revealed compression developed on all six cylinders when the crankshaft was rotated; movement of all valves and movement of the accessory drive gears were observed. The vacuum pump was separated, the shear drive was intact, and pump vanes rotated when turned at the drive. The magnetos were removed for examination. The Nos. 1, 3, and 5 ignition leads were damaged, the Nos. 1, 3, and 5 top spark plugs were damaged, and the right magneto case was fractured. The right magneto could not be rotated, and the left magneto produced spark on all towers when rotated. Examination of the top spark plugs revealed deposits and wear consistent with the "normal" condition on the Champion AV-27 comparison chart for massive electrode plugs. The Nos. 1, 3, and 5 fuel injector nozzles and lines were damaged. The fuel servo was fractured. Fuel was observed in the fuel pump, and the pump functioned when rotated.

The left propeller blades were present in the hub, and the spinner dome was attached. The spinner dome was dented, and the front and one side were crushed and scraped. Examination of the left propeller assembly revealed the pitch change rod was bent between the fork and piston, and the rod displayed a mark 9 5/8 inches from the aft end of the rod consistent with contact with the hole in the front hub half. The mark was measured at a location consistent with the blades at approximately 14.3 degrees blade angle. According to installation data for the propeller, low pitch is 15.3 +/- 0.1 degrees. The low pitch stop displayed an impression mark, and the feather pitch stop and the start locks were intact with no abnormalities. Two blades were twisted with spiral bending and were bent aft approximately 70 degrees, and the

third blade was bent and twisted. All three blades had chordwise gouges on the camber side of the blade.

The right propeller blades were present in the hub, and the spinner dome was attached. The spinner dome was crushed and scraped on one side. Examination of the right propeller assembly revealed the pitch change rod displayed a mark 9 1/2 inches from the aft end of the rod consistent with contact with the hole in the front hub half. The mark was measured at a location consistent with the blades at approximately 16.3 degrees blade angle. According to installation data for the propeller, low pitch is 15.3 +/- 0.1 degrees. The low pitch stop displayed an impression mark, and the feather pitch stop and the start locks were intact with no abnormalities. One blade was twisted with spiral bending, and the other two blades were twisted. All three blades had chordwise gouges on the camber side of the blade.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy was performed on the pilot by the Office of the County Medical Examiner, Shelby County, Memphis, Tennessee, on July 3, 2003. The report stated the cause of death was "injuries ... as a result of direct blunt trauma." Forensic toxicology was performed on specimens from the pilot by the Federal Aviation Administration Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma. The report stated no carbon monoxide and no cyanide were detected in the blood, and no ethanol and no drugs were detected in the urine.

TESTS AND RESEARCH

Runway 36R is 9,000 feet long and 150 feet wide with a threshold elevation of 335 feet above mean sea level (MSL). Runway 36C is 11,120 feet long and 150 feet wide with a threshold elevation of 341 feet MSL. The runways are 972 feet apart, and their thresholds are parallel at the same latitude.

Examination of radar data revealed runways 36R and 36C were active for inbound aircraft at the time of the accident. Radar data for aircraft landing on both runways during the 20 minutes prior to the accident were examined. The last recorded radar returns for aircraft landing on each runway showed each aircraft aligned with the approach end of the respective landing runway at the Mode C altitude of 500 feet MSL.

On runway 36R, the accident airplane's last radar return was observed at 1004:47. Radar data showed the two previous aircraft to land on runway 36R were both Airbus Industrie A306 airplanes, of which the last radar returns were observed at 0950:42 and 0946:52, respectively. On runway 36C, the three aircraft to land previous to the time of the accident were an Embraer ERJ 145, an Embraer ERJ 135, and a McDonnell Douglas DC-9, of which the last radar returns were observed at 1002:48, 1001:09, and 0953:28, respectively.

Target separation analysis of the radar data for the Beech 58P approach to 36R and the Embraer ERJ 145 approach to runway 36C showed at 1001:53, the Beech 58P was at an

altitude of 2,500 feet MSL, the Embraer ERJ 145 was at an altitude of 1,100 feet MSL, and the horizontal separation between the two airplanes was 4.02 nautical miles. At 1002:48 (the time of the last recorded radar position for the Embraer ERJ 145), the Beech 58P was at an altitude of 1,700 feet MSL, the Embraer ERJ 145 was at an altitude of 500 feet MSL, and the horizontal separation between the two airplanes was 3.53 nautical miles.

The National Transportation Safety Board, Office of Research and Engineering, Washington, D. C., utilized the radar data, wind data, and wake vortex characteristics to develop a ground track and wake vortex profile for the Embraer ERJ 145 and the Beech 58P in a Study of Wake Vortex Encounter. According to the study, "the wake vortex of the ... [Embraer ERJ 145], in particular the right wing tip (downwind counterclockwise rotating) vortex, could have migrated toward the ... [Beech 58P's] flight path. An airplane's typical response to a counterclockwise rotating wake vortex would be a roll to the left ... ." The study also states, "The possibility that the wake vortex had dissipated ... was also explored. [Federal Aviation Administration (FAA)] ... guidance suggests that a separation of 120 sec[onds] is sufficient for the wake to dissipate or move away from the runway. Furthermore, wake dissipation is enhanced in ground effect."

According to the FAA Advisory Circular 90-23F, "Aircraft Wake Turbulence," "Flight tests have shown that the vortices from larger (transport category) aircraft sink at a rate of several hundred feet per minute, slowing their descent and diminishing in strength with time and distance behind the generating aircraft."

ADDITIONAL INFORMATION

According to the definitions for "Aircraft Classes - For the purposes of Wake Turbulence Separation Minima" outlined in the Pilot/Controller Glossary in FAA Order 7110-65P Air Traffic Control, the Beech 58P is classified as "small," and the Embraer ERJ 145 is classified as "large."

FAA Order 7110-65P Air Traffic Control states in Section 5-5-4, Minima, Wake Turbulence Application: "f. TERMINAL. ... separate an aircraft landing behind another aircraft on the same runway ... by ensuring the following minima will exist at the time the preceding aircraft is over the landing threshold: NOTE - Consider parallel runways less than 2,500 feet apart as a single runway because of the possible effects of wake turbulence. 1. Small behind large - 4 miles."

The wreckage was released to a representative of International Loss Management, Inc., on February 26, 2004.

This report was modified on May 13, 2005.

Pilot Information

Certificate:	Private	**Age:**	51,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land; Multi-engine sea	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Glider	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	July 11, 2001
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	March 31, 2002
Flight Time:	3212 hours (Total, all aircraft), 95 hours (Total, this make and model), 3005 hours (Pilot In Command, all aircraft), 36 hours (Last 90 days, all aircraft), 5 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N36TL
Model/Series:	58P	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	TJ396
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	July 17, 2002 Annual	**Certified Max Gross Wt.:**	6200 lbs
Time Since Last Inspection:	172.4 Hrs	**Engines:**	2 Reciprocating
Airframe Total Time:	2948.9 Hrs at time of accident	**Engine Manufacturer:**	Teledyne Continental
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	TSIO-520-WB
Registered Owner:	Daniel Greenwald / Wind Dancer DSC, Inc.	**Rated Power:**	325 Horsepower
Operator:	David W. Cahill (president Wind Dancer DSC, Inc.)	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KMEM,341 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	10:13 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:		**Visibility**	10 miles
Lowest Ceiling:	Broken / 2900 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	330°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.95 inches Hg	**Temperature/Dew Point:**	26°C / 21°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Tampa , FL (KTPF)	**Type of Flight Plan Filed:**	IFR
Destination:	Memphis, TN (KMEM)	**Type of Clearance:**	IFR
Departure Time:	07:58 Local	**Type of Airspace:**	Class B

Airport Information

Airport:	Memphis International Airport KMEM	**Runway Surface Type:**	Concrete
Airport Elevation:	341 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	36R	**IFR Approach:**	ILS
Runway Length/Width:	9000 ft / 150 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Fatal, 2 Serious	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal, 2 Serious	**Latitude, Longitude:**	35.027778,-89.973892

Administrative Information

Investigator In Charge (IIC):	Powell, Phillip
Additional Participating Persons:	Roy H Derryberry; FAA Memphis FSDO - 25; Memphis, TN Timothy D Rainey; Raytheon Aircraft Company; Wichita, KS Albert P Butler; Teledyne Continental Motors, Inc.; Mobile, AL Tom McCreary; Hartzell Propeller, Inc.; Piqua, OH
Report Date:	April 25, 2005
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=57430