



# National Transportation Safety Board Aviation Accident Final Report

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<b>Location:</b>	GOLDSBY, OK	<b>Accident Number:</b>	FTW99FA123
<b>Date &amp; Time:</b>	04/27/1999, 0916 CDT	<b>Registration:</b>	N819BW
<b>Aircraft:</b>	Cessna 402C	<b>Aircraft Damage:</b>	Destroyed
<b>Defining Event:</b>		<b>Injuries:</b>	1 Fatal
<b>Flight Conducted Under:</b>	Part 135: Air Taxi & Commuter - Non-scheduled		

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## Analysis

The twin-engine airplane impacted the ground in an uncontrolled descent following the in-flight separation of the right wing during a normal descent. The airplane had accumulated a total time of 20,457 hours and had been flown 52 hours since the most recent annual inspection, which was performed by the current operator 3 weeks prior to the accident. Available maintenance records indicated that since 1988, maintenance personnel had made numerous repairs to the right wing, including repairing skin cracks, working rivets, wing stub spar straps, and the right main landing gear. Metallurgical examination revealed that the right wing's front spar failed due to fatigue that started at an area of mechanical damage and rough machining marks. The presence of primer covering the mechanical damage strongly suggests that the damage was produced during the manufacturing process. It could not be determined whether the mechanical damage or the machining, acting alone, could have caused the fatigue cracking to initiate. Fatigue cracking found on the rear spar and the forward auxiliary spar is most likely secondary fatigue due to load shedding as the crack grew in the front spar.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The fatigue failure of the right wing spar as a result of inadequate quality control during manufacture of the spar. A factor was the inadequate inspection of the right wing by maintenance personnel, which failed to detect the crack.

## Findings

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Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION

Phase of Operation: DESCENT - NORMAL

### Findings

1. (C) WING,SPAR - FATIGUE
2. (C) INADEQUATE QUALITY CONTROL - MANUFACTURER
3. (F) MAINTENANCE,INSPECTION - INADEQUATE - COMPANY MAINTENANCE PERSONNEL
4. (F) MAINTENANCE,INSPECTION - INADEQUATE - OTHER MAINTENANCE PERSONNEL
5. WING - SEPARATION

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Occurrence #2: IN FLIGHT COLLISION WITH TERRAIN/WATER

Phase of Operation: DESCENT - UNCONTROLLED

### Findings

6. TERRAIN CONDITION - GROUND

## Factual Information

### HISTORY OF FLIGHT

On April 27, 1999, at 0916 central daylight time, a Cessna 402C, twin-engine airplane, N819BW, was destroyed by terrain impact following an in-flight separation of the right wing during descent, near Goldsby, Oklahoma. The commercial pilot, sole occupant, received fatal injuries. The airplane was operated as Flight 818 by Texas Air Charters, Inc., of Denton, Texas, under 14 Code of Regulations (CFR) Part 135 as an on-demand cargo flight from Dallas, Texas, to Oklahoma City, Oklahoma. The flight departed Dallas Love Field Airport about 0816 on an instrument flight rules (IFR) flight plan.

During interviews, conducted by the NTSB investigator-in-charge (IIC), witnesses, located approximately 1/2 mile from the accident site, reported observing the airplane level at approximately 1,000 feet agl, when the wing departed the aircraft. The aircraft then turned right, entered a spiral, and nose dived to the ground. Upon ground impact, the airplane bounced into the air approximately 10 to 12 feet before coming to rest in the wheat field. The wing descended rapidly at first and then slowed and "drifted" to the ground. Some witnesses reported hearing high rpm engine sounds. Witnesses reported that they did not see any other airplanes in the area at the time of the wing separation.

### PERSONNEL INFORMATION

A review of FAA records revealed that the pilot was issued a first class medical certificate on March 24, 1999, with a limitation for corrective lenses. The commercial pilot held airplane single-engine land, multiengine land, and instrument ratings. He was a certificated flight instructor for the airplane single-engine land and instrument ratings.

The pilot was employed by Texas Air Charter, Inc., in September 1998, and he completed their training program for all Cessna 400 series aircraft operated by the company. He satisfactorily completed the CFR Part 135 airman competency/proficiency check in a Cessna 401B aircraft on September 22, 1998, given by the company chief pilot/check airman.

In the pilot's logbook, the accumulated flight time logged as of April 15, 1999, was 1,754.2 hours. According to company flight/duty records for 1999, the pilot had flown 478.3 hours of charter flights in the Cessna 400 series multiengine aircraft from January through March 1999.

### AIRCRAFT INFORMATION

The FAA records and available maintenance records were reviewed by the NTSB IIC. The Cessna 402C aircraft Type Certification Data (A7CE) was issued under Part 3 of the Civil Air Regulations (CAR) dated May 15, 1956. The original delivery documents for the Cessna 402C aircraft, serial number 402C0423, showed a December 1980, FAA airworthiness certification. Records included the following registration history for the aircraft: N67827, 1981, Casper Air Service, Inc., Casper, Wyoming; N67827, 1984, Stowers Aircraft, Pond Creek, Oklahoma; N104GP, 1986, Wrangler Air, Inc., Ft. Lauderdale, Florida; N104GP 1989, GP Express Airlines., Grand Island, Nebraska; N819AN, 1993, Abbeymere, Inc., Las Vegas, Nevada; N819AN [N819BW], 1998, Balter Worldwide, Corp., Van Nuys, California; N819BW, 1998, Hyannis Air Service, Inc., Hyannis, Massachusetts; N819BW, 1998, Balter Worldwide Corporation, Van Nuys, California; N819BW, 1999, Sunshine Air, Inc., Van Nuys, California. On April 6, 1999, N819BW was purchased by Texas Air Charters, Inc., of Denton, Texas.

There were no maintenance records showing the complete history on the accident aircraft. Available records indicated that the aircraft sustained substantial damage and the right main landing gear separated from the aircraft during an accident in Dickerson, North Dakota, in 1981. Maintenance repair records following the North Dakota accident were not located by the NTSB IIC. Records did indicate that the aircraft was repainted in 1990 (N104GP) and in 1998 (N819BW).

There were maintenance flight logs dating from 1991 to 1999 and aircraft discrepancy logs that revealed the following maintenance history for the right wing area. On July 9, 1988, GP-Express Airlines, at 7781.8 hours, found both left and right wing main spar webs cracked and complied with Cessna Service Bulletin ME84-12. On October 23, 1992, Air Nevada Airlines, at 13,863.0 hours, found the right lower landing gear well skin cracked at W.S. 86.19, stop drilled the crack and fabricated a doubler and surface patch. On July 28, 1996, Air Nevada Airlines, at 18,589.9 hours, found the left and right wing stub lower spar straps loose and replaced and re-torqued the screws. On August 20, 1996, Air Nevada Airlines found and repaired a loose patch on the inboard side of the right main landing gear door. On October 9, 1996, Air Nevada Airlines, at 18,901.3 hours, replaced rivets for the right engine cowl. On January 8, 1997, at 19,157.0 hours, under Air Nevada Airlines FAA Approved Aircraft Inspection Program (AAIP), the left and right wing special inspections (Type A and Type B according to Cessna Maintenance Manual Chapter 57) were performed for the wings. An FAA Major Repair and Alteration Form 337 signed by Aeroshear Aviation, Van Nuys, California, and dated May 27, 1998, showed a repair of a crack on the right wing lower skin panel. An Air Nevada Airlines aircraft discrepancy log for January 2, 1998, at 20,144.4 hours, indicated the right main landing gear up-locks were replaced. On August 26, 1998, working rivets were repaired on both wings, and a crack was repaired on the right wing.

A pre-purchase report was issued by Pacific Continental Engines, Inc., of Van Nuys, California, on March 31, 1999, at an accumulated aircraft time of 20,399.3 hours. The president of Texas Air Charters, Inc., stated to the NTSB IIC that he reviewed the report prior to purchasing the aircraft. He further stated that he had personally flown the aircraft from California to Texas.

The airplane was maintained under CFR Part 135.411 (a)(1) by Texas Air Charters, Inc., at the time of the accident. The last annual inspection was performed on April 6, 1999, by Texas Air Charters, Inc., at a total aircraft time of 20,404.7 hours. The maintenance release stated that the annual inspection was completed using maintenance manual P/N D2527-5-13. The Texas Air Charters, Inc., Director of Maintenance certified that this "airframe has been inspected in accordance with a[n] annual inspection and was determined to be in an airworthy condition" and returned the aircraft to service. The accumulated time on the aircraft at the time of the accident was 20,457.2 hours (52.3 hours since the last annual inspection).

The left engine, a Continental TSIO-520-VB (2), serial number 278478-R, was a factory remanufactured engine sold to Sierra Nevada Airways, Las, Vegas, Nevada, in June 1992. This engine, at occurrence, had accumulated 287.7 hours since major overhaul (SMOH). The left propeller had accumulated 618.8 hours SMOH.

The right engine, a Continental TSIO-520-VB (1), serial number 278310-R, was a factory remanufactured engine sold to Lynns Aircraft, El Monte, California, in December 1990. This engine had accumulated 1,197.7 hours SMOH. The right propeller had accumulated 1,912 hours SMOH.

## METEOROLOGICAL INFORMATION

At 0856, the surface weather observation for Oklahoma City (located about 14 nautical miles north-northwest of the accident site), indicated clear skies; visibility 10 statute miles; temperature 59 degrees Fahrenheit; dew point 54 degrees Fahrenheit; winds from 320 degrees at 7 knots; altimeter setting 29.87 inches of mercury.

Upper air data from Norman, Oklahoma (located about 4 nautical miles north-northeast of the accident site), at 0700, showed northwest winds at 25 to 30 knots from 3,000 to 6,000 feet msl. Satellite visibility data for 0902 and 0915 showed generally clear skies in the accident area. A review of pilot weather reports (PIREPS) showed no turbulence within about a 50 nautical mile radius of the accident site for the time period 0800 to 1000. There were no in-flight weather advisories in effect for the time and location of the accident.

## COMMUNICATIONS

The air traffic control data and transcripts were reviewed. The pilot called the Fort Worth Automated Flight Service Station (AFSS) at 0639 and received a standard weather briefing for the flight from Love Field Airport, Dallas, Texas, to Will Rogers International Airport, Oklahoma City, Oklahoma.

Following the departure from the Love Field Airport, Flight 818 was cleared by the regional departure controller to climb to 8,000 feet msl and to contact the Fort Worth (ZFW) Center controller. At 0900, the ZFW controller instructed Flight 818 to descend to 6,000 feet msl. At 0906, the ZFW controller transferred communication to Oklahoma City Approach Control.

At 0912, air traffic control data indicated that the airplane was level at 6,000 feet msl, and the pilot had visual contact with traffic that was going to pass Flight 818. At 0912:16, Flight 818 was cleared to descend from 6,000 feet to 4,000 feet. At 0912:28, the pilot acknowledged the clearance and that he was beginning the descent. At 0916:14, radar contact was lost and there were no further communications with Flight 818.

## WRECKAGE AND IMPACT INFORMATION

The accident site at 35.1578 degrees north latitude and 097.4883 degrees west longitude was approximately 14 nautical miles southeast of the destination airport. The terrain at the accident site was level and consisted of soft, wet dirt in an open field. The wreckage distribution path was on a measured magnetic heading of 330 degrees for a distance of 1 1/4 mile. The initial component found was a portion of the right wing engine cowling, followed in order, by the wing locker baggage door and portions of the right engine nacelle. The right wing and engine came to rest inverted 1/2 mile beyond the wing locker baggage door. About 1/2 mile further along the distribution path was a crater in which the left engine, left propeller blades, and portions of the left wing were found. The main wreckage, which included portions of the fuselage structure, the cockpit/cabin area and portions of the left wing, was found adjacent to the northwest side of the crater. The cockpit and fuselage were destroyed, and there were no complete systems intact at the accident site.

The right wing separation occurred just inboard of the right engine nacelle. The lower main spar cap of the right wing exhibited a dark discoloration. The right engine and propeller remained with the right wing. All three blades of the right propeller were found in the feathered position with the actuating arm pulled out of the governor unit. See the test and research section of this report for additional details.

The left engine and propeller were found about 6 feet deep in the impact crater. The left propeller was found separated from the engine. All three of the propeller blades were separated from the propeller hub and the hub was separated into multiple pieces. Two of the propeller blades exhibited bending, and one blade was twisted.

An examination of the aircraft was conducted in May 1999, at Air Salvage of Dallas, Lancaster, Texas, under the supervision of the NTSB IIC. All flight control surfaces had been recovered from the accident site; however, in-flight separation and impact damage precluded verification of flight control continuity. Fracture surfaces examined from the left wing, the right horizontal stabilizer and the right elevator, exhibited angled, rough surfaces consistent with overstress separations.

Right wing repairs found in the area of the wing fracture included a lower skin external repair under the front spar lower cap at approximately W.S. 88.3 and outboard 13 inches. The repair was 4 3/4 inches wide with the center of the repair under the spar cap. A forward auxiliary spar lower cap splice repair 13 3/8 inches long existed over a lower cap failure at approximately W.S. 89. This repair existed on the aft side of the auxiliary spar cap.

The fractures from the right wing main spar, rear spar, forward auxiliary spar, and aft auxiliary spar of the right wing were removed and transported to the Safety Board Materials Laboratory for further examination. An additional piece of the forward auxiliary spar, which had not fractured, was removed and transported to the Safety Board Materials Laboratory for examination of a splice that it contained. Sections of the right wing front and rear spar, respectively, inboard and outboard of the separation fracture, were forwarded to the FAA Wichita Aircraft Certification Office at Wichita, Kansas, for examination by the Cessna Aircraft Company, under the surveillance of the FAA. See the test and research section for additional information.

#### MEDICAL AND PATHOLOGICAL INFORMATION

The autopsy was performed by the Office of the Chief Medical Examiner at Oklahoma City, Oklahoma. The FAA Civil Aeromedical Institute (CAMI) Forensic Toxicology and Accident Research Center at Oklahoma City, Oklahoma, examined the specimens taken by the medical examiner. The toxicological findings were negative.

#### TEST AND RESEARCH

Examination of the fractures from the right wing main spar, rear spar, forward auxiliary spar, and aft auxiliary spar of the right wing by the NTSB metallurgist revealed the following data. The lower cap of the front [main] spar was separated perpendicular to its length, near wing station 87. The fracture surface on the horizontal flange of the spar cap revealed crack arrest markings consistent with fatigue crack propagation. The curvature of the arrest markings was consistent with a fracture that originated at the upper corner of the horizontal flange, on the forward leg, and that propagated nearly the entire length of both the horizontal and vertical flanges. An area of mechanical damage was noted on the outboard half of the fracture in the origin location, and deep machining marks were noted on the forward face of the horizontal flange on both sides of the fracture.

The mechanical damage at the origin was roughly triangular in shape and covered by an undisturbed layer of yellow-green primer that was consistent in color with the primer on other areas of the right front spar. The primer was removed and the fracture examined with scanning electron microscopy (SEM). The deformation of the material in the origin area was

consistent with the mechanical damage being present prior to the formation of the fatigue crack. Original machining lines progressed into the mechanical damaged area, and a deep machining mark was found at the origin area. Numerous fracture origins centered around the area where the corner of the mechanical damage and the machining mark intersected.

An elemental analysis of the primer near the right wing fracture was performed using energy-dispersive spectroscopy (EDS). This was compared to a similar analysis performed on the primer from an area of the lower cap of the left wing front spar. Both primers contained the same elements, in roughly the same proportions.

Surface roughness measurements were made on the front face of the horizontal flange on the front spar after removal of most of the primer. Measurements showed an average surface roughness near the top of the flange, close to the origin, of 370 micro inches. The surface roughness value for this surface is specified by the manufacturer as 125 micro inches root mean square.

The lower cap of the right wing rear spar was fractured near wing station 103, at the location where the two-part spar was spliced together. The horizontal and vertical flange of the aft angle contained areas of beach marks and striations consistent with fatigue.

With the exception of a small area on the top and bottom caps, the forward auxiliary spar failed through the attachment fittings that secure the auxiliary spar to the front spar. The horizontal flange of the aft-most angle was fractured. Scanning electron microscopy of this area revealed fatigue striations, but severe oxidation prevented examination of the actual origin area.

A second portion of the forward auxiliary spar, outboard of the separation, was removed to examine a splice on the aft side. Two angled members were found butted up end-to-end next to the web. These members were nested around another angle attached over the top. Disassembly showed that the ends that had been butted together both contained evidence of saw cuts and extra rivets. Additional examinations showed that the portion of the forward auxiliary spar contained a crack on the forward side. Examination of the fracture faces after disassembly showed that the fracture features of a crack on the forward side were rough and angled, consistent with an overstress separation.

The aft auxiliary spar separated at approximately wing station 103, in line with the rear spar separation. With the exception of the flat surfaces where rivets had pulled out of their holes, all of the fractures were rough and oriented along a shear plane.

Additional portions of the right wing, inboard and outboard of the separation, were examined by Cessna under the supervision of the FAA. The wing spar sections were inspected with eddy current, before, during, and after disassembly. Two cracks were detected in the vertical flange of the forward spar lower cap, at approximately wing station (WS) 67.3 and WS 107. These cracks, which extended from rivet holes, contained fracture surface features consistent with fatigue.

On July 28, 1999, both propellers were examined by McCauley Propeller Systems at Vandalia, Ohio, under the supervision of a NTSB investigator. The right propeller piston rod was found in the feathered position, and the feather stop had markings in it. The left propeller piston rod, with spring, was attached at the piston, and the rod was bent. According to the manufacturer representative, the right propeller was in feather at impact, and the left propeller was rotating. See the enclosed report for additional details.

## ADDITIONAL INFORMATION

Parties to the investigation were the FAA; Cessna Aircraft Company; Teledyne Continental Motors; and McCauley Propeller Systems.

The airplane was released to the registered owner.

### Pilot Information

<b>Certificate:</b>	Flight Instructor; Commercial	<b>Age:</b>	31, Male
<b>Airplane Rating(s):</b>	Multi-engine Land; Single-engine Land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	Airplane Single-engine; Instrument Airplane	<b>Toxicology Performed:</b>	Yes
<b>Medical Certification:</b>	Class 1 Valid Medical--w/ waivers/lim.	<b>Last FAA Medical Exam:</b>	03/24/1999
<b>Occupational Pilot:</b>		<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>	1754 hours (Total, all aircraft)		

### Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Cessna	<b>Registration:</b>	N819BW
<b>Model/Series:</b>	402C 402C	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>		<b>Amateur Built:</b>	No
<b>Airworthiness Certificate:</b>	Normal	<b>Serial Number:</b>	402C0423
<b>Landing Gear Type:</b>	Retractable - Tricycle	<b>Seats:</b>	2
<b>Date/Type of Last Inspection:</b>	04/06/1999, Annual	<b>Certified Max Gross Wt.:</b>	7190 lbs
<b>Time Since Last Inspection:</b>	52 Hours	<b>Engines:</b>	2 Reciprocating
<b>Airframe Total Time:</b>	20457 Hours	<b>Engine Manufacturer:</b>	Continental
<b>ELT:</b>	Installed	<b>Engine Model/Series:</b>	TSIO-520-VB
<b>Registered Owner:</b>	TEXAS AIR CHARTERS, INC	<b>Rated Power:</b>	325 hp
<b>Operator:</b>	TEXAS AIR CHARTERS, INC	<b>Operating Certificate(s) Held:</b>	On-demand Air Taxi (135)
<b>Operator Does Business As:</b>		<b>Operator Designator Code:</b>	G07A



## Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	OKC, 1295 ft msl	Distance from Accident Site:	14 Nautical Miles
Observation Time:	0856 CDT	Direction from Accident Site:	324°
Lowest Cloud Condition:	Clear / 0 ft agl	Visibility	10 Miles
Lowest Ceiling:	None / 0 ft agl	Visibility (RVR):	0 ft
Wind Speed/Gusts:	7 knots /	Turbulence Type Forecast/Actual:	/
Wind Direction:	320°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29 inches Hg	Temperature/Dew Point:	15° C / 12° C
Precipitation and Obscuration:			
Departure Point:	DALLAS, TX (DAL)	Type of Flight Plan Filed:	IFR
Destination:	OKLAHOMA CITY, OK (OKC)	Type of Clearance:	IFR
Departure Time:	0816 CDT	Type of Airspace:	Class D

## Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:	N/A	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Fatal	Latitude, Longitude:	

## Administrative Information

Investigator In Charge (IIC):	JOYCE ROACH	Report Date:	12/05/2000
Additional Participating Persons:	DON COOK; OKLAHOMA CITY, OK BUCK WELCH; WICHITA, KS JOHN KENT; MOBILE, AL THOMAS M KNOPP; VANDALIA, OH		
Publish Date:			
Investigation Docket:	NTSB accident and incident docket serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at <a href="mailto:pubinq@ntsb.gov">pubinq@ntsb.gov</a> , or at 800-877-6799. Dockets released after this date are available at <a href="http://dms.nts.gov/pubdms/">http://dms.nts.gov/pubdms/</a> .		

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](#).