National Transportation Safety Board
Aviation Accident Final Report

Location:	Tulsa, Oklahoma	**Accident Number:**	CEN10FA382
Date & Time:	July 10, 2010, 22:05 Local	**Registration:**	N88DF
Aircraft:	Cessna 421	**Aircraft Damage:**	Substantial
Defining Event:	Fuel exhaustion	**Injuries:**	3 Fatal
Flight Conducted Under:	Part 91: General aviation		

Analysis

During the 3.5-hour flight preceding the accident flight, the airplane used about 156 gallons of the 196 gallons of usable fuel. After landing, the airplane was topped off with 156 gallons of fuel for the return flight. During the preflight inspection, a line serviceman at the fixed based operator observed the right main fuel tank sump become stuck in the open position. He estimated 5 to 6 gallons of fuel were lost before the sump seal was regained, but the exact amount of fuel lost could not be determined. The lost fuel was not replaced before the airplane departed. Data from an onboard GPS unit indicate that the airplane flew the return leg at an altitude of about 4,500 feet mean sea level for about 4 hours. About 4 minutes after beginning the descent to the destination airport, the pilot requested to divert to a closer airport. The pilot was cleared for an approach to runway 18R at the new destination. While on approach to land, the pilot reported to the air traffic control tower controller, “we exhausted fuel.” The airplane descended and crashed into a forested area about 1/2 mile from the airport. Postaccident examination of the right and left propellers noted no leading edge impact damage or signatures indicative of rotation at the time of impact. Examination of the airplane wreckage and engines found no malfunctions or failures that would have precluded normal operation.

The pilot did not report any problems with the airplane or its fuel state before announcing the fuel was exhausted. His acceptance of the approach to runway 18R resulted in the airplane flying at least 1 mile further than if he had requested to land on runway 18L instead. If the pilot had declared an emergency and made an immediate approach to the closest runway when he realized the exhausted fuel state, he likely would have reached the airport.

Toxicological testing revealed cyclobenzaprine and diphenhydramine in the pilot’s system at or above therapeutic levels. Both medications carry warnings that use may impair mental and/or physical abilities required for activities such as driving or operating heavy machinery.

The airplane would have used about 186 gallons of fuel on the 4-hour return flight if the engines burned fuel at the same rate as the previous flight. The fuel lost during the preflight inspection and the additional 30 minutes of flight time on the return leg reduced the airplane's usable fuel available to complete the planned flight, and the pilot likely did not recognize the low fuel state before the fuel was exhausted due to impairment by the medications he was taking.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's inadequate preflight fuel planning and management in-flight, which resulted in total loss of engine power due to fuel exhaustion. Contributing to the accident was the pilot's use of performance-impairing medications.

Findings

Personnel issues	Prescription medication - Pilot
Personnel issues	Decision making/judgment - Pilot
Aircraft	Fuel - Fluid level

Factual Information

HISTORY OF FLIGHT

On July, 10, 2010, at 2205 central daylight time (CDT), a Cessna model 421/A airplane, N88DF, impacted trees and terrain following a dual loss of engine power during a visual approach to the Tulsa International Airport (TUL), Tulsa, Oklahoma. The private pilot and two pilot rated passengers were fatally injured. The airplane was owned and operated by the pilot, and the business flight was being conducted under the provisions of Title 14 Code of Federal Regulations Part 91 without a flight plan. The cross-country flight originated at the Oakland County International Airport (PTK), Pontiac, Michigan, and the intended destination was the Richard Lloyd Jones Jr. Airport (RVS), Tulsa, Oklahoma. The airplane had requested to land at TUL prior to the accident. Visual meteorological conditions prevailed at the time of the accident.

The pilot and both passengers departed RVS for PTK about 0919 and arrived at PTK about 1251 for a business meeting. The airplane flew at 13,500 feet mean sea level (msl), resulting in a three hour and thirty-two minute flight. Prior to departing PTK the pilot requested the fixed base operator to "top it off, but nothing in the nacelles," and the plane was subsequently serviced with 156 gallons of 100 octane low lead (100LL) aviation fuel. A line serviceman for the fixed base operator providing the fuel observed the pilot performing a preflight inspection prior to departing PTK. During the preflight the lineman observed the right main tank sump become stuck open. He estimated that five to six gallons of fuel was lost before the sump seal was regained, but the exact amount of fuel lost could not be determined. The pilot was heard to say "Great, that's the side that burns more fuel." The fuel lost as a result of the fuel spill was not replaced. The airplane departed PTK for RVS about 1803 and flew the return flight at 4,500 feet msl.

At 2147:53 the pilot checked in with Tulsa Approach Control and was cleared direct RVS. At 2157:50 the pilot stated he'd like to land at TUL and was given direction to enter a left base to Runway 18 Right (18R). At 2201:44 the pilot was told to switch to the local tower control frequency, which he did at 2201:47. The pilot was given clearance to land at 2201:56. At 2204:23 the pilot stated "Tulsa, we've exhausted our fuel." The airplane was observed descending into a forested area, followed by a flash. The pilot did not inform either of the approach or tower controllers he had a fuel problem at any time prior to reporting the fuel exhaustion.

PERSONNEL INFORMATION

The pilot, age 51, held a private pilot certificate with ratings of airplane single-engine land, and airplane multi-engine land. His last biennial flight review was on November 3, 2009, and his last third class medical certificate was issued on December 22, 2009. The pilot's logbook indicated he had accumulated about 592 total flight hours, and about 67 hours in the accident airplane at the time of the accident.

PASSENGER INFORMATION

The front-seat passenger, age 43, held a private pilot certificate with a rating of airplane single engine land. His last FAA third-class medical certificate was issued on November 21, 2001, with no limitations.

No pilot's logbook was located for the pilot-rated passenger. According to his last FAA application for medical certification, November 21, 2001, he indicated 140 total hours and 15 hours in the last six months.

AIRCRAFT INFORMATION

The airplane was a twin engine, low wing aircraft, serial number 421A0084. It was powered by two Continental GTSIO-520-D engines driving McCauley three-blade propellers. The last regularly occurring airframe inspection was an annual type on November 20, 2009, at a Hobbs time of 576.3 hours. An annual type inspection was also performed on each engine on November 20, 2009.

The airplane was configured with an eight tank fuel system. It included left and right main tanks (50 gallons usable fuel each wing), left and right auxiliary fuel tanks (35 gallons usable fuel each wing), optional auxiliary fuel tanks (13 gallons usable fuel each wing), and optional wing locker tanks (26 gallons usable fuel each wing). The left wing locker tank was placarded "INOP", and the right wing locker tank was not used. This provided for a capacity of 196 gallons of usable fuel for the accident flight.

METEOROLOGICAL INFORMATION

Weather at TUL at 2153 was reported as 10 miles visibility, skies clear, and temperature 75 degrees Fahrenheit. Winds were calm.

WRECKAGE AND IMPACT INFORMATION

The airplane impacted trees and terrain about ½ mile north of TUL on the extended centerline of Runway 18R in Mohawk Park, property operated by the city of Tulsa, Oklahoma. The aircraft struck 50 to 60 foot tall trees on an approximate 180 degree magnetic heading. The debris field was approximately 200 feet long and 75 feet wide. The right main fuel tank was impact damaged, separated from the wing, and found near the base of the first tree strike. The fuselage came to rest inverted 200' to the south of the first tree strike.

The wings remained attached to the fuselage. The empennage was separated from the tailcone approximately 3 feet forward of the horizontal stabilizer leading edge. The engines remained attached to the wing by fragmented engine mount structure, control cables, hoses, wiring, and tubing. The left main gear was separated from the wings. The nose of the aircraft separated at the forward pressure bulkhead. A post-impact fire damaged the right wing, right engine cowling, right locker and locker tank structure.

The right locker fuel tank was breached at the impact site and did not contain fuel. The left locker tank was placarded as "INOP" and not fueled for the flight. It was not breached and did

not contain fuel. The main tanks were fragmented and separated from the wings due to tree impact. The outboard 13 gallon bladder style auxiliary tanks were breached by tree impact. No fuel contamination signatures were observed in the trees or ground vegetation in the wreckage path or debris field. The left outboard auxiliary tank did not contain fuel; and the right outboard auxiliary tank burned. The left inboard 35 gallon auxiliary tank was intact and did not contain fuel. The right inboard 35 gallon auxiliary tank was burned. It could not be determined if had been breached before the post-impact fire destroyed it.

The right propeller was found separated from the engine at the accident site. The blades remained secured in the propeller hub in the feathered position. One blade was unremarkable. The two other blades were bent aft approximately 15 degrees in small radius bends starting approximately 10 inches from the hub. No leading edge impact damage or signatures indicative of rotation were noted to the right propeller.

The left propeller remained attached to the left engine. All blades remained secured in the propeller hub in the feathered position. None of the blades on the left propeller displayed leading edge impact or rotational signatures.

The left engine was examined and continuity was verified by rotating the propeller flange by hand. Suction and compression were also verified at each cylinder. Cylinder numbers 1, 3, 5, 4, and 6 rocker arms exhibited continuity when the crankshaft was partially rotated by hand at the crankshaft flange. Cylinder no. 2 push rods exhibited damage. Both left and right magnetos were inspected for internal foreign object debris, which none was detected. Both left and right magneto breaker cover vents were clear of obstructions. Both left and right magneto drive shafts rotated freely when turned by hand. A cotter pin was observed on the magneto drive shafts, which were intact. A blue spark was observed at all ignition leads when the magneto drive shafts were turned by hand. No anomalies were noted with the left engine that would have prevented normal operation.

The right engine was examined and continuity was verified by rotating the propeller flange by hand. Suction and compression were verified at each cylinder and all cylinder rocker arms exhibited continuity when the crankshaft was partially rotated by hand at the crankshaft flange. Cylinder no. 2 push rods exhibited damage. Both left and right magnetos were inspected for internal foreign object debris, which none was detected. Both left and right magneto breaker cover vents were clear of obstructions. Both left and right magneto drive shafts rotated freely when turned by hand. A cotter pin was observed on the magneto drive shafts, which were intact. A blue spark was observed at all ignition leads when the magneto drive shafts were turned by hand. No anomalies were noted with the right engine that would have prevented normal operation.

TESTS AND RESEARCH

A Garmin GPSMAP 696 portable Global Positioning System (GPS) unit was recovered from the accident scene and sent to the NTSB recorder's laboratory for download. The data for the accident flight was recovered. The recovered data showed the airplane flew a mostly straight flight from PTK towards RVS at about 4,500 feet mean sea level until the pilot requested to land at TUL. The data after 2150 was consistent with the airplane maneuvering from northeast

of TUL to land on runway 18R at TUL. The flight path also depicted the airplane flying a minimum of one mile further distance to reach Runway 18R than if the airplane had proceeded directly to Runway 18L at TUL when the pilot first requested to divert to TUL when the airplane was northeast of TUL.

Two Electronic International UBG-16 panel mounted gauges, one for each installed engine, were sent to the NTSB vehicles recorder laboratory to attempt to recover flight data from the accident flight. It was determined these devices did not have the capability to retain data, and therefore did not contain recorded data from the accident flight.

One Shadin Avionics Digiflo-L™ fuel flow indicator was sent to the NTSB vehicles recorder laboratory to attempt to recover flight data from the accident flight. The Digiflo-L™ contains non-volatile memory that retains setup information, fuel remaining and fuel used information, if power is removed from the unit. Data was recovered from the unit that indicated for the accident flight the Full Fuel setting was 196 gallons, Fuel Used was 170.8 gallons, and fuel remaining (based on the manually set Full Fuel setting) was 25.1 gallons.

MEDICAL AND PATHOLOGICAL INFORMATION

The Office of the Chief Medical Investigator, Board of Medicolegal Investigations, located in Oklahoma City, Oklahoma, performed an autopsy on the pilot on July 11, 2010. The cause of death was attributed to internal injuries due to blunt force trauma.

The FAA, Toxicology Accident Research Laboratory, located in Oklahoma City, Oklahoma, conducted toxicological testing on the pilot. Testing for carbon monoxide and cyanide were negative. The following Volatiles and Drugs were detected:

- 22 (ug/ml, ug/g) acetomenophine detected in urine
- 0.082 Cyclobenzaprine detected in blood
- Cyclobenzaprine detected in urine
- 0.07 (ug/ml, ug/g) Diphenhydramine detected in blood
- Diphenhydramine detected in urine
- Ibuprofen detected in urine
- 0.291 (ug'ml, ug/g) Phentermine detected in blood
- Phentermine detected in urine

Cyclobenzaprine is a prescription tricyclic muscle relaxant and carries this warning: "Warnings - may impair mental and/or physical ability required for the performance of potentially hazardous tasks (e.g., driving, operating heavy machinery)." Diphenhydramine, also known by the trade name Benadryl, is a sedating antihistamine available over the counter; and it is also the active ingredient in most over the counter sleep aids. It carries the identical warning and is known to impair the performance of drivers at routine doses. Phentermine is a medication that reduces hunger and is used as an aid to weight loss, but is chemically a stimulant similar to amphetamine. Phentermine is not a medication approved for use among pilots by the Federal Aviation Administration.

The Office of the Chief Medical Investigator, Board of Medicolegal Investigations, located in

Oklahoma City, Oklahoma, performed an autopsy on the pilot-rated passenger on July 12, 2010. The cause of death was attributed to internal injuries due to blunt force trauma.

The FAA, Toxicology Accident Research Laboratory, located in Oklahoma City, Oklahoma, conducted toxicological testing on the pilot-rated passenger. Testing for carbon monoxide and cyanide were negative. The following Volatiles and Drugs were detected:

- Dextrorphan detected in urine
- Dextrorphan not detected in blood

According to the NTSB Medical Officer, Dextrorphan is a component in many over-the-counter cough medicines and is not considered impairing.

History of Flight

Prior to flight	Miscellaneous/other
Prior to flight	Aircraft servicing event
Approach-VFR pattern final	Fuel exhaustion (Defining event)
Approach-VFR pattern final	Loss of engine power (total)

Pilot Information

Certificate:	Private	**Age:**	51,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	December 22, 2009
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	November 3, 2009
Flight Time:	592 hours (Total, all aircraft), 67 hours (Total, this make and model)		

Information

Certificate:		**Age:**	
Airplane Rating(s):		**Seat Occupied:**	
Other Aircraft Rating(s):		**Restraint Used:**	
Instrument Rating(s):		**Second Pilot Present:**	Yes
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:			

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N88DF
Model/Series:	421 A	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	421A0084
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	November 20, 2009 Annual	**Certified Max Gross Wt.:**	7450 lbs
Time Since Last Inspection:		**Engines:**	2 Reciprocating
Airframe Total Time:	640 Hrs at time of accident	**Engine Manufacturer:**	CONTINENTAL
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	GTSIO520
Registered Owner:		**Rated Power:**	
Operator:		**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Night
Observation Facility, Elevation:	TUL,677 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	21:53 Local	**Direction from Accident Site:**	180°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	140°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.88 inches Hg	**Temperature/Dew Point:**	27°C / 23°C
Precipitation and Obscuration:			
Departure Point:	Pontiac, MI (PTK)	**Type of Flight Plan Filed:**	None
Destination:	Tulsa, OK (RVS)	**Type of Clearance:**	Unknown
Departure Time:	19:03 Local	**Type of Airspace:**	

Airport Information

Airport:	Tulsa International Airport TUL	**Runway Surface Type:**	
Airport Elevation:	677 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	18R	**IFR Approach:**	Visual
Runway Length/Width:	6101 ft / 150 ft	**VFR Approach/Landing:**	Straight-in

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	
Total Injuries:	3 Fatal	**Latitude, Longitude:**	36.215557,-95.898612

Administrative Information

Investigator In Charge (IIC):	Baker, Daniel
Additional Participating Persons:	Michael Kout; FAA; Oklahoma City, OK Steve Miller; Cessna Aircraft Company; Wichita, KS Rodney Martinez; Teledyne Continental Motors; Mobile, AL
Original Publish Date:	September 5, 2013
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=76572