Aviation Investigation Final Report

Location:	TULSA, Oklahoma	**Accident Number:**	FTW99LA023
Date & Time:	November 10, 1998, 13:45 Local	**Registration:**	N24TH
Aircraft:	Beech 35-C33	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	1 Serious, 3 Minor
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The aircraft's engine lost power due to severe detonation shortly after takeoff. During the ensuing forced landing on a road, the airplane collided with trees and the road median. The pilot stated that he had leaned the mixture during climb to 30 gallons per hour because the fuel flow gauge was indicating 'red line of about 35 gallons per hour.' During the climb, the engine RPM started to 'over speed.' The pilot stated that he attempted to reduce engine RPM with the propeller control then subsequently with the throttle; however, the engine 'quit.' Examination of the engine revealed that all of the cylinders showed signs of severe overheating and characteristics of lean mixture operation and detonation. According to the performance charts, the fuel flow should have been set to approximately 20.5 gallons per hour. The complete engine fuel system was bench checked revealing no anomalies that would have prevented normal operation of the engine. Post-accident testing of the fuel flow gauge revealed that the gauge operated correctly and indicated fuel flow properly.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The loss of engine power due to detonation for undetermined reasons. A factor was the lack of suitable terrain for the forced landing.

Findings

Occurrence #1: LOSS OF ENGINE POWER(TOTAL) - MECH FAILURE/MALF
Phase of Operation: CLIMB - TO CRUISE

Findings
1. (C) MISC,ENGINE PRE-IGNITION AND/OR DETONATION
2. REASON FOR OCCURRENCE UNDETERMINED

Occurrence #2: FORCED LANDING
Phase of Operation: EMERGENCY DESCENT/LANDING

Occurrence #3: ON GROUND/WATER COLLISION WITH OBJECT
Phase of Operation: EMERGENCY LANDING

Findings
3. (F) TERRAIN CONDITION - NONE SUITABLE
4. OBJECT - TREE(S)
5. TERRAIN CONDITION - ROADWAY/HIGHWAY
6. TERRAIN CONDITION - ROUGH/UNEVEN

Factual Information

On November 10, 1998, approximately 1345 central standard time, a Beech 35-C33 airplane, N24TH, was substantially damaged during a forced landing following a loss of engine power near Tulsa, Oklahoma. The commercial pilot and his three passengers received minor injuries. The airplane was registered to a private individual and operated by the pilot. Visual meteorological conditions prevailed and a flight plan was not filed for the 14 Code of Federal Regulations (CFR) Part 91 personal flight. The flight originated from the Richard Lloyd Jones Jr. Airport near Tulsa, Oklahoma, at 1330, and was destined for Kansas City, Kansas.

During a telephone interview conducted by the investigator-in-charge, the pilot/aircraft mechanic stated that during cruise climb, the fuel flow gauge was indicating near "red line at about 35 gallons per hour." The pilot then leaned the mixture until the fuel flow gauge read 30 gallons per hour. The pilot stated that during his climb through 3,000 feet msl, "the engine started to vibrate and the engine RPM exceeded its limits." He then attempted to reduce the engine RPM with the propeller control and subsequently the throttle; however, the engine "quit." The pilot then made a forced landing on a downtown highway where the airplane impacted a road median and trees.

According to passenger statements, they noticed a "smoke" smell in the cockpit during climb out. During a conversation with the FAA inspector, the pilot stated that he had lost the cylinder head temperature indication soon after takeoff.

Examination of the aircraft by a FAA inspector revealed that the nose landing gear and the left main landing gear were separated from the airplane. The engine and cowling were bent down, the fire wall was buckled, and both the left and right wing leading edges were damaged.

The aircraft was originally certified with a Continental IO-470 series engine; however, the aircraft maintenance records indicated that on March 2, 1987, an IO-520-BB engine (serial number 560770) was installed in accordance with Supplemental Type Certificate (STC) SA686CG. Maintenance records indicated that the engine was overhauled on August 28, 1997, and was top overhauled on March 10, 1998. According to the FAA and the owner of the STC, no supplemental operating procedures come with the STC concerning leaning procedures. There is, according to the STC owner, no change in fuel flow or performance charts because the engine power is de-rated by limiting the manifold pressure with a red-line limit of 24.4 inches of mercury during takeoff and climb. The normal procedures to be followed for leaning during takeoff, cruise climb, and cruise are those originally stated in the pilot operating handbook.

A manifold pressure gauge and fuel flow gauge (two-in-one gauge, part number 6311, serial number 116896) designed for a turbo-charged engine was installed in the airplane. The

manifold pressure gauge was not red-line limited to 24.4 inches as the STC required. Instead, the red-line limit indicated 36 inches mercury. There was no entry in the maintenance logbooks indicating when the manifold pressure gauge/fuel flow gauge was installed.

According to Teledyne Continental Service Bulletin (SB) M89-18, the Exhaust Gas Temperature (EGT) gauge should be referenced for the purpose of leaning the engine. The SB states that "take-off and climb power settings are normally performed at full rich mixture to enhance cylinder cooling compensating for limited available cooling air flow... Some leaning is permissible but only to avoid engine roughness or power loss while still keeping the fuel flow within full rich limits." The SB continues with a statement that reads, "Take-off and climb power settings on normally aspirated engines, use full rich mixture." However, the SB continues to read, "In specific installations where aircraft manufacturers have provided specific instructions, those instructions should be followed."

The instructions in the Pilot Operating Handbook (POH) for the Beech Model 35-C33 state the mixture during a climb should be set using "Fuel Flow." The only time the POH calls for leaning procedures using the EGT gauge is during cruise operations. Using the performance charts in the POH and the weather reports at the time of the accident, the fuel flow should have been set to approximately 20.5 gallons per hour (approximately 10 gallons per hour leaner than what the pilot states the fuel flow gauge was reading just prior to the engine quitting).

A post accident examination of the engine was performed by a representative from Teledyne Continental Motors under the supervision of the FAA inspector. According to the manufacturer representative and the FAA inspector, all cylinders showed signs of "lean mixture operation" and "severe overheating" as indicated by a blue tint on the cylinder skirts. Cylinder number one had impact damage on the dome and on the walls of the barrel. Cylinders number two and three had "very light deposits" in the domes and valves. Cylinder number four contained "heat and impact damage" in the dome. The number five and six cylinders could not be removed from the crankcase nor could the respective pistons be removed from the cylinders. The number one and six cylinder spark plugs were heavily fouled with melted aluminum. The cylinder head temperature probe connector was found melted and disconnected from the cylinder.

The number one piston exhibited "heavy erosion" on the sides down to the top compression ring and a small hole was noted in the side of the piston near the top. On the number two and three pistons, "heavy wear" was found on the sides and on the head. The number four piston indicated "light" wear on the sides and "heat damage" to the head.

Heat damage was evident near the rear of the crankshaft. No bearing shift was noted on the crankshaft and the journals and crankpins were lightly coated with oil. Oil was noted on the interior of the crankcase halves and on the main bearings.

Moderate scoring was noted on all of the camshaft lobes and they were coated with a small amount of oil. Connecting rods one, two, three, four and five were in place and free to rotate.

Connecting rod number six had heavy impact damage and was separated from the crankpin.

The fuel found in the engine and tanks was consistent in color and odor with 100 Low Lead aviation fuel. Examination of the fuel system components under the supervision of the FAA inspector revealed no anomalies. The fuel flow gauge was bench tested in the presence of the FAA inspector and noted to indicate fuel flow in gallons per hour properly. The magnetos were disassembled and inspected under the supervision of the FAA inspector and were found to contain no anomalies which would have prevented their normal operation. See the enclosed powerplant inspection and engine tear down report for further details.

Pilot Information

Certificate:	Commercial	**Age:**	48,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	September 1, 1998
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	4400 hours (Total, all aircraft), 200 hours (Total, this make and model), 3025 hours (Pilot In Command, all aircraft), 46 hours (Last 90 days, all aircraft), 15 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N24TH
Model/Series:	35-C33 35-C33	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	CD-911
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	October 11, 1998 Annual	**Certified Max Gross Wt.:**	3050 lbs
Time Since Last Inspection:	15 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:		**Engine Manufacturer:**	Continental
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	IO-520-BB
Registered Owner:	HENRY ADAMS	**Rated Power:**	285 Horsepower
Operator:	WALTER R BROWN	**Operating Certificate(s) Held:**	None
Operator Does Business As:		**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	RVS ,638 ft msl	**Distance from Accident Site:**	2 Nautical Miles
Observation Time:	12:53 Local	**Direction from Accident Site:**	180°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	12 knots / 17 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	300°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	12°C / -4°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	, OK (RVS)	**Type of Flight Plan Filed:**	None
Destination:	KANSAS CITY , KS (MKC)	**Type of Clearance:**	VFR
Departure Time:	13:30 Local	**Type of Airspace:**	Class D

Airport Information

Airport:		**Runway Surface Type:**	
Airport Elevation:		**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:	3 Minor	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Serious, 3 Minor	**Latitude, Longitude:**	36.050136,-96.020027(est)

Administrative Information

Investigator In Charge (IIC):	Lupino, Nicole
Additional Participating Persons:	RICHARD FLETCHER; OKLAHOMA CITY , OK
Original Publish Date:	March 31, 2000
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=45286