Aviation Investigation Final Report

Location:	Mena, Arkansas	**Incident Number:**	CEN13FA267
Date & Time:	May 4, 2013, 12:00 Local	**Registration:**	N44GC
Aircraft:	Beech 58	**Aircraft Damage:**	Minor
Defining Event:	Loss of engine power (total)	**Injuries:**	2 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot and the pilot-rated passenger were preparing to depart from an airport where the twin-engine airplane had just undergone refurbishment of the interior. The pilot stated that both engines started normally. They taxied to the runway and used the checklist to perform an engine run-up on both engines. The pilot said the engine run-up was normal. He then lined the airplane up on the runway, applied full power to each engine (red line is 2,700 rpm), and departed. Once airborne, the pilot initiated a right turn. The pilot said that, when the airplane was at an altitude of between about 1,200 and 1,400 feet, he brought the propeller controls back to 2,500 rpm and left the power on both engines at 30 inches of manifold pressure. The mixture controls remained full forward. Almost immediately after reducing the rpm, the pilot heard a "faint" and indistinguishable "pop" from the left engine. Both engines simultaneously went from "full power" to idle, but the manifold pressure remained at 30 inches. The pilot said he made an immediate turn back to the runway and landed gear-up on the grassy area adjacent to the departure runway threshold.

A postaccident examination of the airplane revealed only minor damage to the right wing, left horizontal stabilizer, and fuselage. The propeller blades also exhibited slight twisting, which was consistent with them rotating at the time of impact. Several slash marks made by the propellers were observed in the grass where the airplane made the forced landing. The measured distance between these marks was consistent with both engines operating between 1,570 and 1,890 rpm at the time the propellers contacted the ground.

Data from the onboard engine monitor, which recorded exhaust gas temperature (EGT), cylinder head temperature (CHT), and turbocharger turbine inlet temperature on each engine, were downloaded and plotted. The data revealed that the left engine lost power several seconds before the right engine. A rise in EGT was observed at this time as well. According to the engine manufacturer, if the mixture control were leaned, it would have decreased the mechanical fuel pumps' fuel flow and might have caused the smooth rise in EGT. However, the CHT continued to climb for several seconds after the decline of EGT on both engines. The data also indicated that the EGT appeared to rise again slightly before the data

ended. The pilot reported that he did not move the mixture control at any time during the short flight. Due to the engine monitor's limited parameters (no rpm or fuel flow data), a conclusive cause for the power loss could not be determined. Examination of the airplane's fuel, electrical, and flight control systems revealed no preincident mechanical deficiencies that would have led to a loss of engine power. Both engines were examined then test run on the airframe using the airplane's fuel system. No mechanical deficiencies were identified that would have contributed to a loss of engine power.

Probable Cause and Findings

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

A partial loss of power on both engines during takeoff for reasons that could not be determined because examination of the airframe and a test run of both engines revealed no mechanical anomalies that would have precluded normal operation.

Findings

Not determined	(general) - Unknown/Not determined
Aircraft	(general) - Malfunction

Factual Information

History of Flight

Initial climb	Loss of engine power (total) (Defining event)

HISTORY OF FLIGHT

On May 4, 2013, at 1200 central daylight time, N44GC, a Beech 58 twin-engine airplane, sustained minor damage during a forced landing shortly after takeoff from the Mena Intermountain Municipal Airport (MEZ), Mena, Arkansas. The commercial pilot and the pilot rated passenger were not injured. The airplane was registered to and operated by the pilot rated passenger. Visual meteorological conditions prevailed and no flight plan was filed for the personal flight that was destined for the Bill and Hillary Clinton International Airport (LIT), Little Rock, Arkansas, under the provisions of 14 Code of Federal Regulations Part 91.

The pilot stated that the airplane just had the interior refurbished in Mena, Arkansas, and he and the owner were flying the airplane back to their home base in Little Rock. The owner was not current and had hired the pilot to fly the airplane back with him.

According to the pilot, he completed a preflight inspection before departure. He used the airplane's checklist to start the engines and both engines started immediately. The pilot taxied about 10-15 minutes to runway 27, where he performed an engine run-up on each engine using the checklist. The run-up was "normal" for each engine.

The pilot then lined the airplane up on the runway, applied "full power" to each engine, and departed. Once airborne, he initiated a right turn. The pilot said that when the airplane was about 1,200-1,400 feet, he brought the propeller levers back to 2,500 RPM and left the power on both engines at 30 inches Hg of manifold pressure (MP). Almost immediately after, the pilot heard a "faint" and indistinguishable "pop" from the left engine. Then both engines simultaneously went from "full power" to idle. The pilot was unable to maintain altitude and made an immediate turn back to runway 27.

The pilot said the mixture controls were full forward the entire flight. Each fuel tank was 3/4-full and the fuel selector was in the "on" position. The pilot said the MP gauge read 30 inches Hg and the fuel flow on the digital fuel gauge was "positive", about 25 gallons per hour per side. He did not recall looking at any of the other engine gauges because he was concentrating on making a safe landing.

The pilot landed the airplane gear-up on the grassy area just short of runway 27.

PERSONNEL INFORMATION

The pilot held a commercial pilot certificate for airplane single and multi-engine land, and instrument airplane. He also held a certified flight instructor certificate for airplane single and multi-engine land and instrument airplane. His last Federal Aviation Administration (FAA) first class medical certificate was

issued on April 4, 2013, with no waivers or limitations. The pilot reported a total of 1,381 flight hours, of which 250 hours were in multi-engine airplanes and 32.6 of those hours were in a Beech 58. He also reported a total of 29 hours in a Beech 55.

AIRCRAFT INFORMATION

The airplane was a 1974 Beech 58 twin-engine airplane (serial number TH-453). The airplane had several modifications that were installed under specific FAA approved Supplemental Type Certificates (STC). These modifications included Continental Motors, Inc. IO-550-C engines, a 4-bladed Hartzell propeller, TurboGAMIjector fuel injectors and a Merlyn Products Inc. turbo-normalizing system.

An FAA approved airplane flight manual supplement was issued as a result of the Merlyn STC. A review of the supplement revealed an operating limitation for manifold pressure, which was not to exceed 30 inches. In addition, a placard had to be installed on the instrument panel. (This placard was found in the accident airplane above the manifold and fuel pressure gauges).

A review of the airplane's maintenance logbooks revealed the last 100-hour inspection was completed in April 2013 at an aircraft total time of 7,785.2 hours.

The left engine (serial number 684606) underwent a 100-hour inspection on April 11, 2013. At that time the engine had a total time of 973.3 hours and at the time of the accident it had a total of 974.2 hours.

The right engine (serial number 684609) underwent a 100-hour inspection on April 11, 2013. At that time the engine had a total time of 973.3 hours and at the time of the accident it had a total of 974.2 hours.

WRECKAGE EXAMINATION

On May 5, 2013, a Federal Aviation Administration (FAA) inspector performed a visual examination of the airplane. He reported that several propeller blades were damaged and there was some damage to the landing gear doors. No structural damage was noted. The inspector also sumped each fuel tank and the fuel was absent of debris and water.

The airplane, both engines, and the area where the airplane made the forced landing were examined May 29-30, 2013, by the National Transportation Safety Board (NTSB) Investigator-in-Charge (IIC). Also present for the examination were representatives from the Federal Aviation Administration (FAA), Continental Motors, Incorporated (CMI), Beechcraft Corporation, Hartzell Industries Inc., and Merlyn Products, Inc.

AIRFRAME

Examination of the airframe revealed the main entrance step had separated at the fuselage wall. The left elevator counter-balance horn was separated and the left elevator was buckled mid-span. The fuselage belly fairing that houses an air conditioning line was also separated. The fuselage belly skins exhibited evidence of minor buckling to internal structure. The nose landing gear doors were buckled. There was a small dent on the leading edge of the right wing just outboard of the engine.

Examination of the fuel system revealed no mechanical anomalies. The fuel selector had distinct detents in all positions and fuel flow was confirmed when the fuel selector was turned on and confirmed to stop flowing when turned to off. The operation of the boost pump (both hi/low) was confirmed when the engines were test run. Mid wing fuel sight gauges were examined. The left wing indicated less than 60 gallons of fuel, and the right wing indicated 55 gallons, which was adequate fuel to sustain flight. Both of the wing fuel tanks sump strainers were removed and were absent of debris.

RIGHT ENGINE

The 4-bladed Hartzell propeller was still installed on the engine and all four propeller blades were bent aft mid-span with some indications of twisting. There was leading edge to trailing edge scoring at the tips and span-wise scoring along the length of the bent section of the blades. Two blades exhibited leading edge gouging near the tip of blades. The propeller was removed from the engine and a 2-bladed constant speed/counter-weighted-fully feathering McCauley propeller was installed.

The top cowl had already been removed prior to the team's arrival, but the bottom cowl was still installed. The bottom cowl was removed. A crankshaft-propeller flange run-out was conducted and also checked for end-play. The test revealed no measurable results.

The top spark plugs were removed and appeared dark in color. The No.1 plug was black and carbon-fouled. The gaps also appeared very close. The top plugs were placed on a test bench and all produced normal spark. After the propeller was installed, a thumb compression check via manual rotation of the propeller was conducted. Compression was established on each cylinder.

LEFT ENGINE

The 4-bladed Hartzell propeller was still installed on the engine and all four propeller blades were bent aft mid-span with some indications of twisting. There was leading edge to trailing edge scoring at the tips and span-wise scoring along the length of the bent section of the blades. The propeller was removed from the engine and a 2-bladed constant speed/counter-weighted-fully feathering McCauley propeller was installed.

The top cowl had already been removed prior to the team's arrival, but the bottom cowl was still installed. The bottom cowl was removed. A crankshaft-propeller flange run-out was conducted and also checked for end-play. The test revealed no measurable results.

The top spark plugs were removed and appeared dark in color. The top plugs were placed on a test bench and all produced normal spark. After the propeller was installed a thumb compression check via manual rotation of the propeller was conducted. Compression was established on each cylinder.

ENGINE TEST-RUN

A calibrated 0-100 PSI gauge was installed on the left engine to measure metered fuel pressure at the outlet of the fuel transducer and fuel manifold. The airplane was then towed to a secure area on the airport where a dual engine run was conducted.

The left and right engines were started and warmed for approximately 6 minutes at idle (1000-1200 RPM) to allow the engines to achieve normal operating temperatures. Then the engines were shut down

for a visual inspection of leaks. No leaks were noted. The engines were then re-started and brought to 1700 RPM and a magneto check was performed on each engine. Both magnetos checks were about 75 RPM drop, which was within limits. The propeller levers were then exercised from the full increase position toward a decrease position to the point where an RPM drop was detected. The lever was then placed back in the full increase position. The left throttle was then increased to an RPM of about 2650 RPM. The throttle was then advanced to the full throttle position (2700 RPM) and about 34 inches of manifold pressure was obtained (Both engines were equipped with a pressure relief valve, which maintains a maximum manifold pressure around 33 inches. It was not determined as to why the engines were able to achieve 34 inches of manifold pressure). Throttle position was then decreased to reach about 30 inches of manifold pressure. The throttle was then reduced to 1700 RPM. Then the right throttle was increased to obtain 2650 RPM and 30 inches of MP. Then both throttles were reduced to idle, and a 2 minute cool down was performed. Then each engine was secured by placing the fuel selector valves in the off position. Both engines shut down within 5-7 seconds after the fuel selector was placed in the "off" position. Another leak check was performed and the calibrated 0-100 PSI gauge was removed and installed on the right engine. The fuel selectors were placed back to the "on" position, and both engines were re-started and brought to an idle position. Both engine throttles were advanced to 1700 RPM. The right throttle was brought to 2650 RPM and 30 inches of manifold pressure. Both engines were then brought back to idle and a 2 minute cool down was performed. The right engine was secured by bringing the mixture to the idle cutoff position. The left engine was brought to 1700 RPM and the left boost pump was placed in "hi." Fuel flow on the electronic fuel flow gauge was noticed to increase. The throttle was then retarded to about 1400 RPM, and engine roughness was detected. At that point, the mixture was leaned and engine roughness cleared. The mixture was placed back to full rich and engine roughness returned. The throttle was advanced and at that point the engine quit. Both engines were then secured and the fuel selectors were placed in the "off" position.

Upon completion of the test run, the airplane was towed back to a hanger and the No. 3 and No.4 top plugs from both engines were removed for inspection. The left plugs appeared darker than the right engine spark plugs. The darker plugs on the left engine were attributed to the fact the boost pump was being activated at various throttle and mixture settings on that side during the test run.

Both engines started and ran smoothly throughout the test protocol with the exception of when the throttles were retarded from a high power position. When the throttles were retarded, outside observers noted black smoke coming from the exhaust. No leaks were observed at any time during the engine test runs and no mechanical deficiencies were noted that would have precluded normal operation of either engine.

FORCED LANDING AREA

Examination of the forced landing area revealed impact marks were still identifiable in the ground. The distance from the first visible ground scar to the last visible ground scar was about 280 yards. Near the beginning of the wreckage path were visible slash-marks made by both engine propellers. The marks indicated that the left propeller contacted the ground first followed by the right propeller. The distance between the propeller slash marks were measured. The distance between the left propeller blade strikes were 0-16-32-67 inches and the distance between the slash marks on the right propeller blade were 0-16-32-48-72-107 inches respectively. After the last propeller blade strike for each propeller there was a long gouge in the grass that was consistent with a propeller that had stopped rotating. One runway threshold

light at the southwest corner of the runway was struck by the airplane, which likely caused the damage observed to the right wing leading edge, outboard of the right engine nacelle.

Utilizing an accepted mathematical formula to determine propeller RPM, and applying various ground speeds and the measured distances between propeller blade strikes to that formula, yielded the following calculated propeller RPM information:

· At an 83 knots (stall speed) touchdown the propeller RPM would have been about 1,570 RPM.

· At a 90 knots (landing speed) touchdown the propeller RPM would have been about 1,700 RPM.

· At a 100 knots (blue line-best single engine climb speed) touchdown the propeller RPM would have been about 1,890 RPM

TESTS AND RESEARCH

A Graphic Engine Monitor (GEM) 1200 data logging system was installed on the airplane. It recorded the accident flight in addition to the engine test runs. The monitor was removed and sent to the NTSB's Recorder Laboratory in Washington DC for download.

The GEM 1200 engine monitor only records exhaust gas temperature (EGT), cylinder head temperature (CHT) and turbocharger turbine inlet temperature (TIT) on each engine. It does not record RPM, fuel flow or MP. These items were plotted on a graph. Interpolation of the data indicated that the left engine lost power several seconds before the right engine. A rise in EGT was observed at this time as well. According to the engine manufacturer, if the mixture control was leaned out, it would have decreased the mechanical fuel pumps fuel flow which would have leaned the mixture and may have caused the smooth rise in EGT. However, the CHT continued to climb for several seconds after the decline of EGT on both engines. The graphic information also indicated that EGT appeared to rise again slightly before the data ended. The pilot reported that he did not move the mixture control at any time during the short flight.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	24
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	April 1, 2013
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	January 11, 2013
Flight Time:	1381 hours (Total, all aircraft), 32 hours (Total, this make and model), 716 hours (Pilot In Command, all aircraft), 120 hours (Last 90 days, all aircraft), 49 hours (Last 30 days, all aircraft)		

Pilot-rated passenger Information

Certificate:	Private	**Age:**	63
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:			

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N44GC
Model/Series:	58	**Aircraft Category:**	Airplane
Year of Manufacture:	1974	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	TH-453
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	April 11, 2013 100 hour	**Certified Max Gross Wt.:**	
Time Since Last Inspection:	1 Hrs	**Engines:**	2 Reciprocating
Airframe Total Time:	7785 Hrs as of last inspection	**Engine Manufacturer:**	CONT MOTOR
ELT:	Installed, not activated	**Engine Model/Series:**	IO 550 (33B)
Registered Owner:	Keet Management Company	**Rated Power:**	285 Horsepower
Operator:	Keet Management Company	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	MEZ,1080 ft msl	**Distance from Accident Site:**	
Observation Time:	11:00 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:		**Visibility**	10 miles
Lowest Ceiling:	Overcast / 7500 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	11 knots / 17 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	260°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.87 inches Hg	**Temperature/Dew Point:**	12°C
Precipitation and Obscuration:			
Departure Point:	Mena, AR (MEZ)	**Type of Flight Plan Filed:**	IFR
Destination:	Little Rock, AR (LIT)	**Type of Clearance:**	None
Departure Time:	11:00 Local	**Type of Airspace:**	

Airport Information

Airport:	Mena Intermountain Airport MEZ	**Runway Surface Type:**	Grass/turf
Airport Elevation:	1080 ft msl	**Runway Surface Condition:**	Wet
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Minor
Passenger Injuries:	1 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 None	**Latitude, Longitude:**	34.540554,-94.201385

Administrative Information

Investigator In Charge (IIC):	Yeager, Leah
Additional Participating Persons:	
Original Publish Date:	October 30, 2014
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=86850

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