Aviation Investigation Final Report

Location:	Travelers Rest, South Carolina	**Accident Number:**	ERA23LA162
Date & Time:	March 23, 2023, 18:30 Local	**Registration:**	N13612
Aircraft:	Cessna 177	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (total)	**Injuries:**	2 None
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

About 15 minutes after takeoff during an instructional flight, the engine backfired several times and 5 to 10 seconds later the engine lost total power. The flight instructor assumed control of the airplane, maintained a 75-knot glide speed, and attempted to restart the engine, but without success. The flight instructor landed in a recently plowed field and, while at a slow groundspeed, the nose wheel settled into the mud and the airplane nosed over, resulting in substantial damage to the fuselage and both wings.

The postaccident examination of the engine revealed that the single-drive dual magneto was not delivering power to the spark plugs. The examination of the magneto revealed that, while the left and right contact assemblies of the magneto were properly secured, neither of them opened during rotation of the rotating magnet assembly. Thus, with rotation of the magnet and the contact assembly points closed, the electrical path was shorting to ground, and not the normal path to the ignition leads, which likely resulted in the total loss of engine power. The left and right breaker cam followers, which would open each contact assembly after contacting a lobe of the breaker cam, was worn to less than the minimum specified for a new part and was insufficient to open the contact assembly points. Both cam followers exhibited accelerated wear and heat signatures consistent with lack of lubrication. Each felt pad, which provided lubrication to the oil-impregnated breaker cam, was dark and dry consistent with lack of lubrication.

The magneto had operated satisfactory for nearly 40 years and 1,362 hours and then underwent a 500-hour inspection about 112 hours and 3 years before the accident, during which each cam follower was in satisfactory condition and displayed no abnormal wear. During that inspection the mechanic likely improperly cleaned the breaker cam and used incorrect oil to lubricate the felt of each cam follower. Thus, the improper servicing of the

magneto likely resulted in the accelerated wear and heat signatures observed, both of which were consistent with lack of lubrication of each cam follower.

Probable Cause and Findings

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

Maintenance personnel’s improper servicing of the magneto, which resulted in its accelerated wear, failure, and the total loss of engine power.

Findings

Personnel issues	(general) - Maintenance personnel
Aircraft	Magneto/distributor - Damaged/degraded

Factual Information

History of Flight

Prior to flight	Aircraft maintenance event
Enroute	Loss of engine power (total) (Defining event)
Maneuvering	Off-field or emergency landing
Landing-landing roll	Nose over/nose down

On March 23, 2023, about 1830 eastern daylight time, a Cessna 177B, N13612, was substantially damaged when it was involved in an accident near Travelers Rest, South Carolina. The flight instructor and private pilot were not injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 instructional flight.

The pilot reported that about 15 minutes into the flight the engine "backfired a couple times" and 5 to 10 seconds later the engine lost total power, though the propeller continued to rotate. The flight instructor assumed control of the airplane, established a 75-knot glide speed, and attempted to restart the engine, but without success. The flight instructor reported that he chose a nearby field, notified air traffic control of his intention, and landed in the field. During the landing roll in the recently plowed field while at a slow groundspeed, the nose wheel settled into the mud and the airplane nosed over, resulting in substantial damage to the fuselage and both wings. The tachometer reading at the time of the accident was 1654.0. As a result of the nose over the owner reported warping of the fuselage and both wings, and a bent frame at the main landing gear.

Postaccident examination of the engine revealed that the single-drive dual magneto did not produce spark at any of the spark plugs during rotation of the engine using the starter, when the magneto was rotated using a tool following removal from the engine, or when it was operated on a test bench at the manufacturer's facility. Neither of the contact assemblies, which were properly secured, would open during hand rotation of the rotating magnet. Thus, with rotation of the magnet and the contact assembly points closed, the electrical path was shorting to ground, and not the normal path to the ignition leads. Disassembly inspection of the magneto revealed the left and right cam followers were worn about 0.022 inch and 0.020 inch less, respectively, than the minimum specification for a new part, which was insufficient to open the contact assembly points. The contact assembly gap when open was specified to be between 0.012 inch and 0.024 inch, with a median value of 0.018 inch. The examination revealed that both cam followers exhibited accelerated wear and heat signatures and both felts were blackened and dry.

Review of the engine maintenance records revealed that a factory overhauled magneto was installed on December 31, 1979, at tachometer time 180. The magneto remained in service

after installation until July 24, 2019, when at tachometer time 1,542.3, a 500-hour service was performed. According to the logbook entry, all parts were reused. The magneto remained in service from that date until the accident. The airplane's last annual inspection was performed on December 12, 2022, at tachometer time 1635.0.

The mechanic who performed the 500-hour inspection of the magneto reported that at the time of the inspection both cam followers were in satisfactory condition. He initially indicated that during the inspection he cleaned the oil impregnated breaker cam using electrical contact cleaner; but later indicated that he just wiped it using a clean cloth. As part of the magneto inspection, he lubricated each cam follower felt with a mixture of "STP" and heavy weight engine oil. He did notice a drift of the magneto to engine timing before the service, but he did not notice any drift of the magneto to engine timing during 2 subsequent annual inspections after the service was performed.

The mechanic who performed the airplane's last annual inspection reported he did not recall whether there was any drift of the magneto to engine timing. As part of the engine inspection, he did not remove the cover of the magneto or access any internal components of it.

A review of the manual that the mechanic used to perform the 500-hour service of the magneto revealed that the oil impregnated breaker cam was specified to be cleaned using a clean, dry, lint-free cloth, and each cam follower felt was specified to be lubricated using 2 or 3 drops of 10-86527 lubricant (a high-temperature lubricant for breaker cams).

Continental Aerospace Technologies (formerly Continental Motors, Inc.) Service Bulletin (SB) 643C, revised on July 21, 2017, specified that magnetos are electro-mechanical devices using rotating parts subjected to the same service treatment, environmental conditions, and wear as the engine. The SB also specified that magnetos older than June 1, 2015 (accident magneto) must be overhauled or replaced at the expiration of five years since the date of original manufacture or last overhaul, or four years since the magneto was placed in service, whichever occurs first, without regard to operating hours. Service bulletins are not mandatory for Part 91 operators.

Pilot Information

Certificate:	Private	**Age:**	60,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	September 23, 2021
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	175 hours (Total, all aircraft), 50 hours (Total, this make and model)		

Flight instructor Information

Certificate:	Airline transport; Commercial; Flight instructor	**Age:**	68,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Glider	**Restraint Used:**	3-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Glider; Instrument airplane	**Toxicology Performed:**	
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	March 5, 2022
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	October 1, 2021
Flight Time:	20000 hours (Total, all aircraft), 20 hours (Total, this make and model), 19000 hours (Pilot In Command, all aircraft), 15 hours (Last 90 days, all aircraft), 8 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N13612
Model/Series:	177 B	**Aircraft Category:**	Airplane
Year of Manufacture:	1976	**Amateur Built:**	
Airworthiness Certificate:	Normal; Utility	**Serial Number:**	17702443
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	December 12, 2022 Annual	**Certified Max Gross Wt.:**	2500 lbs
Time Since Last Inspection:	17 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	1652 Hrs at time of accident	**Engine Manufacturer:**	Lycoming
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	O-360-A1F6D
Registered Owner:	On file	**Rated Power:**	180 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KAVL,2170 ft msl	**Distance from Accident Site:**	20 Nautical Miles
Observation Time:	18:54 Local	**Direction from Accident Site:**	348°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	290°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	30.09 inches Hg	**Temperature/Dew Point:**	23°C / 9°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Pickens, SC (LQK)	**Type of Flight Plan Filed:**	None
Destination:	Hendersonville, NC (0A7)	**Type of Clearance:**	None
Departure Time:	18:15 Local	**Type of Airspace:**	

Wreckage and Impact Information

Crew Injuries:	2 None	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	2 None	**Latitude, Longitude:**	35.1109,-82.4533(est)

Administrative Information

Investigator In Charge (IIC):	Monville, Timothy
Additional Participating Persons:	Cornelius "Neil" J. Baker; FAA/FSDO; West Columbia, SC
Original Publish Date:	June 5, 2024
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=106949