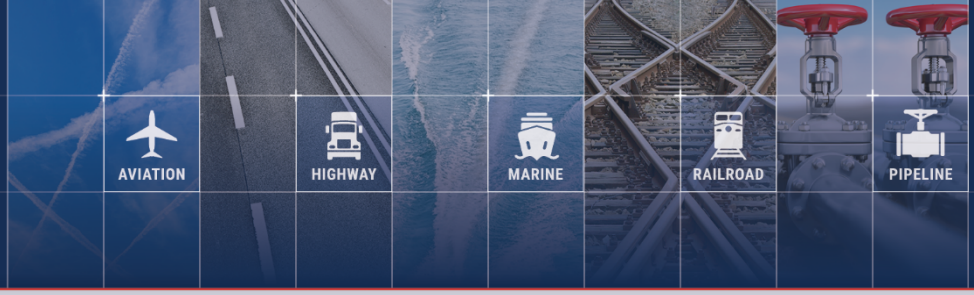

Aviation Investigation Final Report

Location:	Evansville, Indiana	**Incident Number:**	CEN22LA250
Date & Time:	June 8, 2022, 11:00 Local	**Registration:**	N78KL
Aircraft:	Beech 58	**Aircraft Damage:**	Minor
Defining Event:	Part(s) separation from AC	**Injuries:**	5 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The airplane was about 1 hour into the cross-country flight when the pilot heard a “boom” noise. The airframe began vibrating, and the airplane yawed to the left. The pilot contacted approach control and stated that he needed to land the airplane immediately. The pilot was directed to divert, and he landed the airplane without incident. After exiting the airplane, the pilot noticed that one of the aluminum propeller blades on the left engine had separated about midspan, resulting in minor damage. The “boom” that the pilot heard was likely the blade separating in flight.

Examination of the fracture surface revealed signatures consistent with high-cycle fatigue failure. The fatigue origin area was coincident with an area of damage that was covered with a thick black paint. The paint had a slightly different composition than the thinner layer of black paint on the rest of the blade. No evidence indicated any repair in the area of the damage and investigators were unable to determine when the damage was painted.

Although the investigation could not determine, based on the available evidence for this incident, when the damage that led to the fracture occurred, or when the damage was painted, it is likely the damaged area was present at the airplane’s most recent 100-hour inspection, which occurred 28 hours before the incident. The presence of the black paint could have made it difficult to detect the damage during the mechanic’s visual inspection of the blade surface during the airplane’s most recent 100-hour inspection. Had the damage been detected during the 100-hr inspection it should have triggered maintenance of the propeller blade.

The damage was also hidden but detectable during the preflight inspection conducted by the pilot before the accident flight. Had the damage been detected by the pilot, it should have triggered further examination and maintenance of the propeller blade.

Probable Cause and Findings

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

The failure of the propeller blade due to high-cycle fatigue that originated from damage that occurred at an unknown time. Contributing to the accident was the failure to identify the damage before the accident flight.

Findings

Personnel issues	Repair - Maintenance personnel
Personnel issues	Attention - Maintenance personnel
Personnel issues	Unauthorized maint/repair - Unknown/Not determined
Aircraft	Propeller blade section - Failure
Aircraft	Propeller blade section - Inadequate inspection
Aircraft	Propeller blade section - Fatigue/wear/corrosion
Aircraft	Propeller blade section - Incorrect service/maintenance

Factual Information

History of Flight

Prior to flight	Aircraft maintenance event
Enroute	Part(s) separation from AC (Defining event)
Enroute	Attempted remediation/recovery
Emergency descent	Off-field or emergency landing

On June 8, 2022, about 1100 central daylight time, a Beech 58 airplane, N78KL, sustained minor damage when it was involved in an incident near Evansville, Indiana. The pilot and four passengers were not injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

The pilot reported that no anomalies were noted during the preflight inspection of the airplane. The airplane departed from Kirk Field Airport (PGR), Paragould, Arkansas, with a destination of James M. Cox Dayton International Airport (DAY), Dayton, Ohio. When the airplane was about 1 hour into the flight, while at an altitude of about 9,000 ft mean sea level and an airspeed of about 180 knots, the pilot heard a “boom” noise. The airframe began vibrating, and the airplane yawed to the left. The pilot contacted approach control and reported that he needed to land the airplane immediately. The pilot was directed to divert to Evansville Regional Airport (EVV), Evansville, Indiana.

The pilot then reduced the power on the right engine and maneuvered the airplane for landing on runway 18 at EVV. The pilot was able to land the airplane without incident. After the pilot exited the airplane, he noticed that one of the aluminum propeller blades on the left engine had separated about mid-span. The separated blade segment was not recovered. No other damage was observed on the propeller, engine, or airframe.

The airplane had two Hartzell Propeller model HC-C4YF-2E/FC7063Q propellers that each had four blades. The propellers were installed on the airplane via Federal Aviation Administration (FAA) Supplemental Type Certificate SA1762SO on November 12, 2002.

The fractured blade was manufactured on September 6, 2000. Airplane registration records indicate that the airplane was sold on May 13, 2021. The airplane’s previous 100-hour inspection, completed before the airplane was sold, occurred on December 17, 2020, when the propeller had accumulated 1,097 hours of time since overhaul (TSO). The most recent 100-hour inspection of the propeller occurred on January 10, 2022, when the propeller had accumulated 1,172 hours of TSO. The propeller had accumulated 1,200 hours of TSO at the time of the incident.

The fractured blade (design number FC7063Q and serial number J51843) was removed from its hub and was provided to the National Transportation Safety Board Materials Laboratory for further examination. The examination of the fracture surface revealed signatures consistent with high-cycle fatigue failure. The blade fractured was about 16.9 inches from the blade butt. The deice boot was severed at the fracture and was partially debonded on both the camber and face sides.

The fatigue origin area was coincident with an area of damage that was covered with a thick black paint that had a slightly different composition than the thinner layer of black paint on the rest of the blade. No evidence indicated any repair in the area of the damage.

The pilot reported that he was not aware of any paint work performed on the blades or any previous propeller blade impacts. The mechanic who performed the most recent 100-hour inspection reported that he performed a visual examination of the blades and recalled that only normal damage was observed on the blades, such as small nicks, which he dressed. He did not remember if he did any paint work on the blades.

FAA Advisory Circular 20-37E, Aircraft Propeller Maintenance, discusses propeller blade failures and states in part the following:

> *A propeller is one of the most highly stressed components on an aircraft. During normal operation, 10 to 25 tons of centrifugal force pull the blades from the hub while the blades are bending and flexing due to thrust and torque loads and engine, aerodynamic and gyroscopic vibratory loads. A properly maintained propeller is designed to perform normally under these loads, but when propeller components are damaged by corrosion, stone nicks, ground strikes, etc., an additional unintended stress concentration is imposed, and the design margin of safety may not be adequate. The result is excessive stress and the propeller may fail.*
>
> *Additional causes of overstress conditions are exposure to overspeed conditions, other object strikes, unauthorized alterations, engine problems, worn engine vibration dampers, lightning strike, etc. Most mechanical damage takes the form of sharp-edged nicks and scratches created by the displacement of material from the blade surface and corrosion that forms pits and other defects in the blade surface. This small-scale damage tends to concentrate stress in the affected area and eventually, these high-stress areas may develop cracks. As a crack propagates, the stress becomes increasingly concentrated, increasing the crack growth rate. The growing crack may result in blade failure.*
>
> *Many types of damage cause propellers to fail or become unairworthy. FAA data on propeller failures indicates that the majority of failures occur in the blade at the tip region, usually within several inches from the tip and often due to a crack initiator such as a pit, nick, or gouge. However, a blade failure can occur along any*

portion of a blade, including the mid-blade, shank, and hub, particularly when nicks, scratches, corrosion, and cracks are present. Therefore, during propeller inspection and routine maintenance, it is important to inspect the entire blade.

FAA Special Airworthiness Bulletin NE-08-22, Propeller Search Inspection (General Visual Inspection), discusses cosmetic repairs and states in part the following:

For exposed aluminum surfaces, an exposed defect can be inspected while a hidden defect cannot be inspected. A cosmetic repair that creates a hidden defect in an exposed surface is an unacceptable practice.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	61,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	January 25, 2021
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	March 21, 2021
Flight Time:	(Estimated) 3734 hours (Total, all aircraft), 270 hours (Total, this make and model), 3178 hours (Pilot In Command, all aircraft), 120 hours (Last 90 days, all aircraft), 35 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N78KL
Model/Series:	58 Undesignated Series	**Aircraft Category:**	Airplane
Year of Manufacture:	1990	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	TH-1578
Landing Gear Type:	Retractable - Tricycle	**Seats:**	5
Date/Type of Last Inspection:	January 10, 2022 Annual	**Certified Max Gross Wt.:**	5100 lbs
Time Since Last Inspection:	27.8 Hrs	**Engines:**	2 Reciprocating
Airframe Total Time:	2969.6 Hrs at time of accident	**Engine Manufacturer:**	Continental Motors
ELT:	Installed, not activated	**Engine Model/Series:**	IO-550 Series
Registered Owner:	NEA INDUSTRIAL LLC	**Rated Power:**	300 Horsepower
Operator:	NEA INDUSTRIAL LLC	**Operating Certificate(s) Held:**	None
Operator Does Business As:	None	**Operator Designator Code:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KEVV,402 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	10:54 Local	**Direction from Accident Site:**	73°
Lowest Cloud Condition:		**Visibility**	9 miles
Lowest Ceiling:	Broken / 1600 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	11 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	170°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	29.82 inches Hg	**Temperature/Dew Point:**	25°C / 21°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Paragould, AR (PGR)	**Type of Flight Plan Filed:**	IFR
Destination:	Dayton, OH (DAY)	**Type of Clearance:**	IFR
Departure Time:	10:00 Local	**Type of Airspace:**	Class E

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Minor
Passenger Injuries:	4 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	5 None	**Latitude, Longitude:**	38.045357,-87.534105(est)

Administrative Information

Investigator In Charge (IIC):	Hodges, Michael
Additional Participating Persons:	Cory Irwin; FAA Indianapolis FSDO; Indianapolis, IN Les Doud; Hartzell Propeller; Piqua, OH
Original Publish Date:	January 30, 2024
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this incident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=105266

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, "accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties … and are not conducted for the purpose of determining the rights or liabilities of any person" (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB's statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available here.