



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

# Aviation Investigation Final Report

<b>Location:</b>	Lake Worth, Florida	<b>Accident Number:</b>	ERA23FA247
<b>Date &amp; Time:</b>	May 26, 2023, 11:18 Local	<b>Registration:</b>	N3KV
<b>Aircraft:</b>	Cessna 172	<b>Aircraft Damage:</b>	Destroyed
<b>Defining Event:</b>	Flight control sys malf/fail	<b>Injuries:</b>	2 Fatal
<b>Flight Conducted Under:</b>	Part 91: General aviation - Instructional		

## Analysis

Airport security video recorded the accident takeoff and captured the airplane rolling right until it was in an approximate 90° right bank, then continued a right descending turn until it impacted the ground. A witness reported that the engine sounded like it was at full power from the time the airplane departed until it impacted the ground.

Examination of the wreckage revealed that there was a break in the aileron control cable system in the vicinity of the left upper door post right direct aileron cable pulley. A metallurgical examination of the break in the aileron control cable revealed that the mating fracture surfaces exhibited a woody appearance, shedding material, and pockmarks consistent with a corrosive attack. The angled fractured surfaces exhibited the same layered woody appearance, which indicated that those wires likely fractured in tension due to embrittlement and weakening from corrosive attack. If the cable was shedding material and becoming weaker, this process would have resulted in shedding material wire-by-wire and strand-by-strand over time. The remaining wires would have fractured from tensile overstress when there were no longer enough intact wires to carry the stress. It is likely that the overstress fracture occurred during the takeoff, which was consistent with the right roll as seen in the surveillance video.

According to maintenance records, the airplane was inspected in accordance with the manufacturer's maintenance manual and with Part 43 appendix D two times during the eight months before the accident. According to both inspection checklists the aileron control cable should have been inspected. The condition and degradation of the cables should have been apparent during those inspections. Therefore, it is likely that maintenance personnel overlooked the corroded aileron control cable during the most recent inspections.

## Probable Cause and Findings

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

Maintenance personnel’s failure to detect the corroded aileron cable during recent inspections, which resulted in the separation of the aileron control cable and a subsequent loss of airplane control during takeoff.

### Findings

Aircraft	Aileron control system - Fatigue/wear/corrosion
Aircraft	Aileron control system - Inadequate inspection
Personnel issues	Scheduled/routine inspection - Maintenance personnel

## Factual Information

### History of Flight

Initial climb	Flight control sys malf/fail (Defining event)
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On May 26, 2023, at 1118 eastern daylight time, a Cessna 172P, N3KV, was destroyed when it was involved in an accident at Palm Beach County Park Airport (LNA), Lake Worth, Florida. The flight instructor and student pilot were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* (CFR) Part 91 instructional flight.

According to airport security video, the airplane departed from runway 4, rotated and began to climb, descended, and began to climb again. The airplane then rolled right until it was in an approximate 90° right bank and continued in a right descending turn until it impacted the ground. A pilot who witnessed the accident reported that the airplane's engine "sounded like it was full throttle the entire time."

### Flight instructor Information

Certificate:	Airline transport; Commercial; Flight engineer; Flight instructor	Age:	77,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	Seat Occupied:	Right
Other Aircraft Rating(s):	None	Restraint Used:	Lap only
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	Airplane single-engine; Instrument airplane	Toxicology Performed:	Yes
Medical Certification:	Class 3 With waivers/limitations	Last FAA Medical Exam:	October 12, 2021
Occupational Pilot:	No	Last Flight Review or Equivalent:	September 30, 2021
Flight Time:	17755 hours (Total, all aircraft), 8950 hours (Pilot In Command, all aircraft), 205.8 hours (Last 90 days, all aircraft), 70.6 hours (Last 30 days, all aircraft)		

## Student pilot Information

<b>Certificate:</b>	Student	<b>Age:</b>	20,Female
<b>Airplane Rating(s):</b>	None	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	Lap only
<b>Instrument Rating(s):</b>	None	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	Yes
<b>Medical Certification:</b>	Class 1 Without waivers/limitations	<b>Last FAA Medical Exam:</b>	June 24, 2022
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>	48.4 hours (Total, all aircraft), 19.4 hours (Last 90 days, all aircraft)		

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Cessna	<b>Registration:</b>	N3KV
<b>Model/Series:</b>	172 P	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>	1981	<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Normal; Utility	<b>Serial Number:</b>	17274768
<b>Landing Gear Type:</b>	Tricycle	<b>Seats:</b>	4
<b>Date/Type of Last Inspection:</b>	September 22, 2022 Annual	<b>Certified Max Gross Wt.:</b>	
<b>Time Since Last Inspection:</b>	55.1 Hrs	<b>Engines:</b>	1 Reciprocating
<b>Airframe Total Time:</b>	5025.5 Hrs at time of accident	<b>Engine Manufacturer:</b>	LYCOMING
<b>ELT:</b>	Installed, not activated	<b>Engine Model/Series:</b>	O-360-A4M
<b>Registered Owner:</b>	Airmax Charters, LLC	<b>Rated Power:</b>	180 Horsepower
<b>Operator:</b>	Airmax Charters, LLC	<b>Operating Certificate(s) Held:</b>	None

According to the owner of the flight school, the airplane was purchased on May 4, 2023. According to the prebuy inspection paperwork, under the visual inspection section, the mechanic "opened panels to inspect attached connections of cables" and checked the "free movement of flight control."

According to the airframe maintenance logbook, the airframe had accumulated 5,025.5 hours at the time of the accident. The most recent annual inspection was completed on September 19, 2022, at a tachometer time of 4,970.4 hours. The maintenance entry noted that the mechanic "lubricate[d] all flight control cables." There were no other remarks about flight control cables in the maintenance entry. Finally, the mechanic noted that the work was

completed in accordance with “the C-172 service manual section 2, 12, and FAR [Federal Aviation Regulations] 43 Appendix D.”

There was an affidavit from the previous owner that indicated the original maintenance logbooks were lost, and when they were located, they would be given to the new owner.

According to the manufacturer’s recommended inspection time limits, every 100 hours the “aileron structure, control rods, hinges, balance weights, bellcranks, linkage, bolts, pulleys, and pulley brackets – check condition, operation, and security of attachment.” Furthermore, it stated that the ailerons and cables were to be inspected every 200 hours to “check operation and security stops. Check cables for tension, routing, fraying, corrosion, and turnbuckle safety.”

The Cessna 172 Series Service Manual Section on Corrosion indicated under the Typical Corrosion Areas, section C – Steel Control Cable:

*Checking for corrosion on a control cable is normally accomplished during the preventative maintenance check. During preventative maintenance, broken wire and wear of the control cable are also checked.*

*If the surface of the cable is corroded, carefully force the cable open by reverse twisting and visually inspect the interior. Corrosion on the interior strands of the cable constitutes failure and the cable must be replaced. If no internal corrosion is detected, remove loose external rust and corrosion with a clean, dry, coarse weave rag or fiber brush.*

Federal Aviation Regulations Part 43 Appendix D – Scope and Detail of Items (as Applicable to the Particular Aircraft) To Be Included in Annual and 100-Hour Inspections, stated that:

*each person performing an annual or 100-hour inspection shall inspect (where applicable) the following components of the cabin and cockpit group: ... (5) Flight and engine controls – for improper installation and improper operation... (7) All systems – for improper installation, poor general condition, apparent and obvious defects, and insecurity of attachment.*

## Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Day
<b>Observation Facility, Elevation:</b>	PBI, 21 ft msl	<b>Distance from Accident Site:</b>	6 Nautical Miles
<b>Observation Time:</b>	10:53 Local	<b>Direction from Accident Site:</b>	352°
<b>Lowest Cloud Condition:</b>	Scattered / 2100 ft AGL	<b>Visibility</b>	10 miles
<b>Lowest Ceiling:</b>	Broken / 25000 ft AGL	<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	6 knots / None	<b>Turbulence Type Forecast/Actual:</b>	/
<b>Wind Direction:</b>	80°	<b>Turbulence Severity Forecast/Actual:</b>	/
<b>Altimeter Setting:</b>	29.83 inches Hg	<b>Temperature/Dew Point:</b>	28°C / 22°C
<b>Precipitation and Obscuration:</b>	No Obscuration; No Precipitation		
<b>Departure Point:</b>	Lake Worth, FL	<b>Type of Flight Plan Filed:</b>	None
<b>Destination:</b>	Lake Worth, FL	<b>Type of Clearance:</b>	None
<b>Departure Time:</b>		<b>Type of Airspace:</b>	Class G

## Airport Information

<b>Airport:</b>	PALM BEACH COUNTY PARK LNA	<b>Runway Surface Type:</b>	Asphalt
<b>Airport Elevation:</b>	14 ft msl	<b>Runway Surface Condition:</b>	Dry
<b>Runway Used:</b>	04	<b>IFR Approach:</b>	None
<b>Runway Length/Width:</b>	3256 ft / 75 ft	<b>VFR Approach/Landing:</b>	None

## Wreckage and Impact Information

<b>Crew Injuries:</b>	2 Fatal	<b>Aircraft Damage:</b>	Destroyed
<b>Passenger Injuries:</b>	N/A	<b>Aircraft Fire:</b>	On-ground
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	2 Fatal	<b>Latitude, Longitude:</b>	26.590402,-80.084633(est)

The airplane impacted the ground about 200 ft from runway 16/34. The debris path was oriented on a 006° heading and the airplane came to rest about 140 ft from the initial impact point at an elevation of 16 ft mean sea level. All major components of the airplane were located within the vicinity of the main wreckage.

The engine remained partially attached to the fuselage through the engine mounts. Crankshaft and valvetrain continuity were confirmed by rotating the crankshaft by turning the vacuum pump drive gear. Compression was confirmed on all cylinders. The cylinders were examined with a lighted borescope and no anomalies were noted. The magnetos were rotated by hand and produced spark on all leads. The carburetor was examined and no anomalies were noted. No debris was noted in the oil filter or the oil pickup screen. There were no anomalies found with the engine that would have precluded normal operation.

The fixed-pitch propeller remained attached to the crankshaft flange and the two blades remained attached to the hub. One propeller blade was bent forward about mid-span and exhibited chordwise scratching and the other propeller blade was twisted and exhibited chordwise scratching.

The cockpit was impact-crushed aft and multiple instruments were separated from the panel and damaged. The empennage remained partially attached to the fuselage. Elevator and rudder control continuity were confirmed from the flight control surfaces to the flight control yoke in the cockpit. The left wing was impact-separated from the fuselage. The outboard 6-foot section of the left wing was impact-crushed aft and the wing tip was impact-separated and located along the debris field. The right wing was impact-separated from the fuselage. The outboard 5-foot section of the wing tip was bent in the positive direction and crushed aft. The wing tip was impact-separated from the right wing and located along the debris path. The right wing tip light lens cap was located at the initial impact point.

Aileron control continuity was not confirmed. A separation was noted in the aileron control system in the vicinity of the left upper door post right direct aileron cable pulley (see figure 1). The pulley was removed, examined, and exhibited corrosion. The pulley did not move freely. The right upper door post left direct aileron over pulley was removed and examined. The pulley did not rotate freely and corrosion was noted. Several other breaks noted in the aileron control system were consistent with tension overload failures.

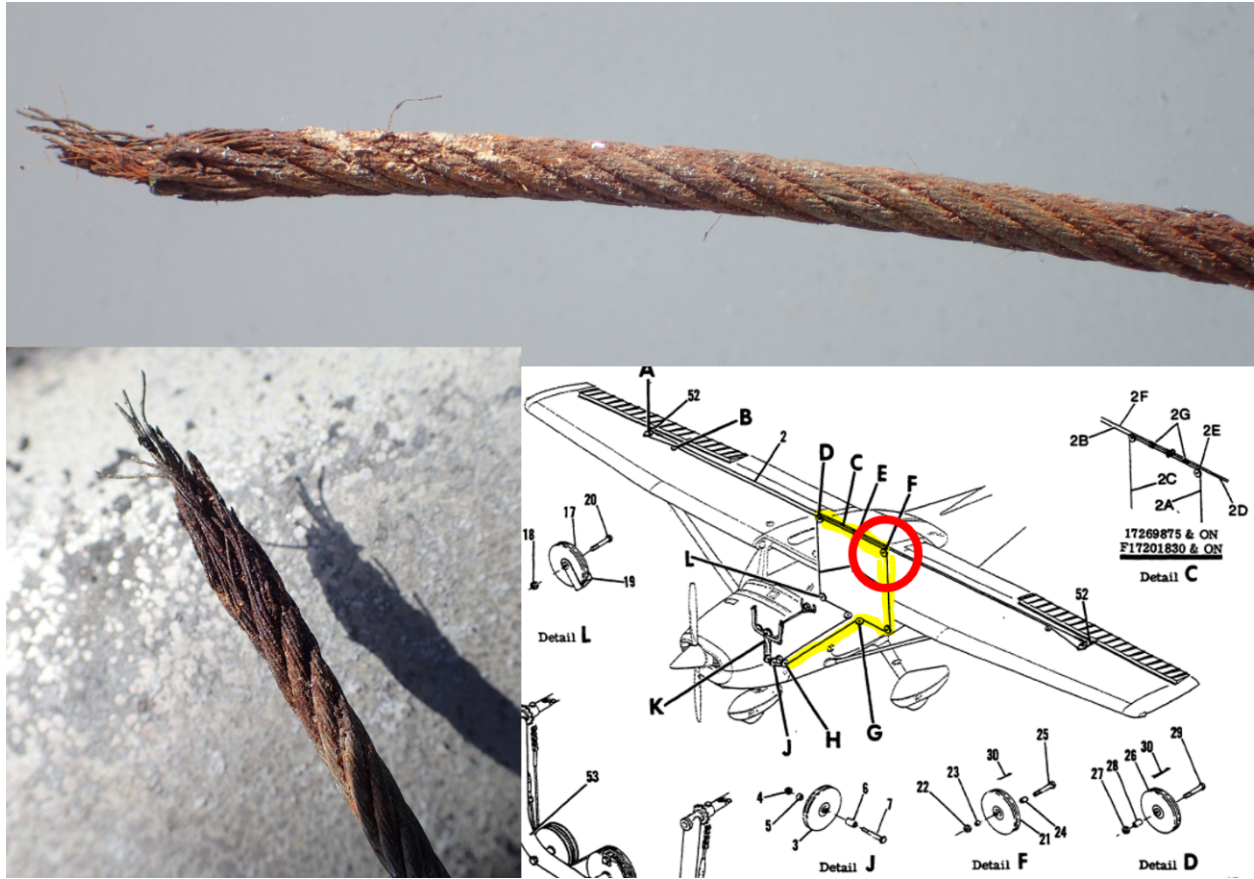


Figure 1. Close up view of the separated aileron cable sections. The red circle indicates the approximate location of the broken portion of cable. The highlighted portion of aileron cable in the diagram indicates the section of cable sent to the NTSB Materials Laboratory.

Examination of the aileron control cables at the NTSB Materials Laboratory revealed that several wires exhibited uneven, localized thinning either at the separated ends or along the length of the wire. Pockmarks consistent with corrosive attack were observed on the surfaces of numerous wires. Some of the wire ends had necked down, with cup-cone fractures visible, while other wires had no thinning and angled fractures at the ends. The cable ends tapered to points and localized thinning of wires and shedding of material was noted, as well as pockmarks. The woody appearance of the cables, the shedding of material, and the pockmarks were consistent with a corrosive attack. Angled fracture surfaces were noted on some wires that also exhibited a woody appearance. Cup-cone fractures were noted on necked-down wires that had dimpled features consistent with ductile tensile overstress.

## Medical and Pathological Information



Autopsies of the flight instructor and student pilot were performed by the Office of the District Medical Examiner in West Palm Beach, Florida. Both autopsy reports stated that the cause of death was blunt force injuries.

Administrative Information

Investigator In Charge (IIC):	Kemner, Heidi
Additional Participating Persons:	Derrick Mayberry; FAA/FSDO; Miramar, FL Kurt Gibson; Textron Aviation; Wichita, KS Troy Helgeson; Lycoming Engines; Williamsport, PA
Original Publish Date:	June 20, 2024
Last Revision Date:	
Investigation Class:	<a href="#">Class 3</a>
Note:	
Investigation Docket:	<a href="https://data.nts.gov/Docket?ProjectID=192246">https://data.nts.gov/Docket?ProjectID=192246</a>

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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](#).