Aviation Investigation Final Report

Location:	Parker, Colorado	**Accident Number:**	CEN21FA272
Date & Time:	June 16, 2021, 13:45 Local	**Registration:**	N704AK
Aircraft:	ANTENOR VELAZCO LANCAIR EVOLUTION	**Aircraft Damage:**	Destroyed
Defining Event:	Flight control sys malf/fail	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot and copilot were established on an instrument approach to the destination airport in visual meteorological conditions. About 3 miles from the end of the runway, the airplane began a left descending turn, during which the controller queried if the pilot was performing a 360° turn. The copilot replied that the airplane's autopilot had failed. The airplane continued the left turning descent until ground impact. Several witnesses near the accident site saw the airplane flying low before the left wing impacted powerlines. The airplane came to rest on a hillside and was mostly consumed by postcrash fire.

Examination of the airplane revealed that the left flap control rod end and associated attachment bolt were missing from the assembly. The threads for fastening the missing flap control rod attachment bolt were intact in the attachment bracket. The area around the threaded hole was rubbed, consistent with off-axis contact with the outboard end of the flap control rod attachment bolt. Corresponding off-axis contact deformation was observed at the edge of the control rod attachment bolt through-hole on the inboard side of the bracket. A piece of the right flap control rod remained attached to the bracket with an intact control rod attachment bolt. Like the left attachment bracket, the aft attachment bolts for the right flap control attachment bracket were secured with safety wire. While the head for the right flap control rod attachment bolt was drilled for use with safety wire, no safety wire was observed attached to the control rod attachment bolt.

A review of maintenance records showed that paint work was performed on the airframe about 2 years before the accident, during which the flight control surfaces were removed. A follow-up entry noted that, "flight controls were balanced and installed with new hardware." The airplane's most recent condition inspection was completed about 8 months before the accident.

Based on the available evidence, it is likely that when the flight controls were reinstalled after the paint work, the left flap and right flap control rod attachment bolts were not installed with safety wire. The use of safety wire on these bolts is mandated per the airplane build manual. These anomalies were not detected by the mechanic following the reinstallation or during the subsequent condition inspection nor were they detected during multiple preflight inspections by the pilot.

The undamaged threads in the attachment for the left flap control rod indicated that the bolt likely backed out due to vibrations and the lack of the required safety wire. With that attachment lost, only the right flap would have deployed when the pilot was preparing to land, causing a flap asymmetry and the resulting turn to the left. It is likely the pilot was distracted by the misdiagnosis of the handling issue as an autopilot anomaly. During the subsequent turn away from the approach path, the pilot failed to maintain altitude, which resulted in impact with powerlines and terrain.

Probable Cause and Findings

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

The pilot's diversion of attention following an asymmetric flap deployment, which resulted in a descent and collision with powerlines. Contributing to the accident was maintenance personnel's failure to properly secure the flap control rod attachment bolts, their failure to identify that the bolts were improperly secured during the subsequent condition inspection, and the pilot's inadequate preflight inspections.

Findings

Aircraft	TE flap control system - Malfunction
Aircraft	TE flap control system - Inadequate inspection
Aircraft	Altitude - Not attained/maintained
Personnel issues	Preflight inspection - Pilot
Personnel issues	Post maintenance inspection - Maintenance personnel
Personnel issues	Scheduled/routine inspection - Maintenance personnel
Personnel issues	Monitoring equip/instruments - Pilot

Factual Information

History of Flight

Prior to flight	Aircraft maintenance event
Prior to flight	Aircraft inspection event
Prior to flight	Preflight or dispatch event
Approach	Flight control sys malf/fail (Defining event)
Approach	Attempted remediation/recovery
Approach	Collision during takeoff/land

On June 16, 2021, about 1345 mountain daylight time, a Lancair Evolution airplane, N704AK, was destroyed when it was involved in an accident near Parker, Colorado. The private pilot and copilot sustained fatal injuries. The airplane was operated as a Title 14 *Code of Federal Regulations Part* 91 personal flight.

Air traffic control (ATC) information showed that the airplane was established on the RNAV (GPS) runway 35R approach to APA about 7 miles south of the airport in visual meteorological conditions when the copilot contacted the tower controller. The controller issued the wind conditions and cleared the airplane to land on runway 35R. The airplane was about 3 miles from the end of the runway when it began turning left and descended. The descending left turn continued to the accident site. When the airplane was about 2.6 miles from the end of the runway, the controller queried the pilot if she was executing a 360° turn, to which the copilot advised that the autopilot had failed. During this turn, the airplane descended below the minimum altitude for that segment of the instrument approach.

Several construction workers near the accident site saw the airplane flying low and its left wing impact powerlines. They described seeing the airplane “explode” after the impacting the powerlines. The airplane came to rest on a hillside. A postimpact fire ensued that consumed most of the composite airplane.

Co-pilot Information

Certificate:	Private	**Age:**	73,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	Unknown
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	June 14, 2020
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	July 29, 2020
Flight Time:	(Estimated) 1083.4 hours (Total, all aircraft)		

Pilot Information

Certificate:	Private	**Age:**	65,Female
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Unknown
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	June 14, 2020
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	November 16, 2020
Flight Time:	(Estimated) 901.1 hours (Total, all aircraft), 245.1 hours (Total, this make and model), 693.6 hours (Pilot In Command, all aircraft)		

The pilot and copilot were a married couple. According to the couple's daughter, her mother was the pilot who sat in the left seat and her father was the copilot who sat in the right seat and would assist the pilot and would also perform the various radio calls.

The pilot owned a company that provided training for Lancair Evolution airplanes. The president and chief pilot of the company signed off the pilot to fly the accident airplane. He classified her as a great pilot who had good stick-and-rudder skills, decision-making skills, and instrument flight rules (IFR) skills. He further stated she was one of the best pilots he had trained.

The company training records for the pilot and copilot were not available during the investigation. The chief pilot stated that the pilot and copilot had flown into APA multiple times over the years and were familiar with the airport, the instrument approaches, and the operating area.

Aircraft and Owner/Operator Information

Aircraft Make:	ANTENOR VELAZCO	**Registration:**	N704AK
Model/Series:	LANCAIR EVOLUTION NO SERIES	**Aircraft Category:**	Airplane
Year of Manufacture:	2017	**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	EVO - 070
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	October 30, 2020 Annual	**Certified Max Gross Wt.:**	4550 lbs
Time Since Last Inspection:		**Engines:**	1 Turbo prop
Airframe Total Time:	304 Hrs as of last inspection	**Engine Manufacturer:**	Pratt & Whitney Canada
ELT:	Installed	**Engine Model/Series:**	PT6A-135A
Registered Owner:	On file	**Rated Power:**	750 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None
Operator Does Business As:	On file	**Operator Designator Code:**	None

The Lancair Evolution is classified as a high-performance airplane. The airplane was equipped with a primary flight display, a multifunction display (MFD) (including an instrument-certified GPS with traffic and terrain graphics), and a fully integrated autopilot. The builder-developed checklist for the accident airplane was not available during the investigation.

A review of maintenance records showed that paint work was performed on the airframe in June 2019. During this work, it was noted that all flight controls were removed for the paint work. A follow-up entry was noted that, "flight controls were balanced and installed with new hardware." The airplane's most recent condition inspection was completed in October 2020.

The Lancair Evolution Pilot's Operating Handbook (POH) and Airplane Flight Manual (AFM) stated:

The wing flaps are electrically operated. The flaps are actuated with the flap control switch located on the lower middle of the instrument panel. It is a three position switch. Turning the switch fully up will retract the flaps to 0°. Turning the switch to the middle position will extend the flaps to the takeoff/approach position of 24°. Turning the switch fully down will lower the flaps to the landing position of 48°.

Flap position is indicated on the MFD.

The Lancair Evolution POH and AFM provides a preflight checklist. This document states that during the preflight check, the flaps are to be lowered from the cockpit and then the left and right flap attachment points and subsequent movement are to be checked by the pilot.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KAPA,5883 ft msl	**Distance from Accident Site:**	4 Nautical Miles
Observation Time:	13:53 Local	**Direction from Accident Site:**	4°
Lowest Cloud Condition:		**Visibility**	10 miles
Lowest Ceiling:		**Visibility (RVR):**	
Wind Speed/Gusts:	9 knots / None	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	350°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	30.21 inches Hg	**Temperature/Dew Point:**	34°C / 1°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Neosho, MO (EOS)	**Type of Flight Plan Filed:**	None
Destination:	Parker, CO	**Type of Clearance:**	IFR
Departure Time:	11:37 Local	**Type of Airspace:**	Class D

The estimated density altitude at the time of the accident was 9,534 ft above mean sea level (msl).

Airport Information

Airport:	CENTENNIAL APA	**Runway Surface Type:**	Asphalt
Airport Elevation:	5884 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	17L/35R	**IFR Approach:**	RNAV
Runway Length/Width:	10001 ft / 100 ft	**VFR Approach/Landing:**	Full stop

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	N/A	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	Both in-flight and on-ground
Total Injuries:	2 Fatal	**Latitude, Longitude:**	39.507794,-104.85518(est)

The airplane impacted two east/west-oriented transmission static lines strung between two transmission towers. The tops of the transmission towers were equipped with flashing lights and the powerlines between the towers were marked with multi-colored marker balls. The accident site was at an elevation of 6,270 ft msl. The airplane came to rest about 200 ft due north of the powerlines at an approximate 50° incline, and 3.4 miles from the approach end of runway 35R on a heading of 336°. The airplane was destroyed by postimpact fire.

The right and left flaps sustained fire and impact damage. The left flap control rod end and associated attachment bolt were missing from the assembly; however, threads for fastening the missing flap control rod attachment bolt were intact in the attachment bracket. The area around the threaded hole was rubbed consistent with off-axis contact with the outboard end of the flap control rod attachment bolt. Corresponding off-axis contact deformation was observed at the edge of the control rod attachment bolt through-hole on the inboard side of the bracket. The aft attachment bolts for the flap control attachment bracket were secured with safety wire.

A piece of the right flap control rod remained attached to the bracket with an intact control rod attachment bolt. Like the left attachment bracket, the aft attachment bolts for the right flap control attachment bracket were secured with safety wire. While the head for the right flap control rod attachment bolt was drilled for use with safety wire, no safety wire was observed attached to the control rod attachment bolt.

The Lancair Evolution Build Manual instructs the airplane builder and maintenance personnel to safety wire the flap control rod attachment bolt to prevent loss of the bolt and corresponding flap control.

There were no preimpact mechanical malfunctions or failures noted with the engine and the propeller.

In October 2021, Evolution Aircraft Company issued Service Advisory SA016-0036 regarding inspection of Evolution airplane attach points. Service Advisory SA016-0036 includes an illustration of the flap control system from the Lancair Evolution Build Manual that states, “safety wire bolt through bearing” associated with arrows pointing to the right and left flap control attachment brackets. The service advisory also shows a photograph of a proper flap control rod attachment with safety wire securing the control rod attachment bolt to the upper aft attachment bolt for the bracket. The document further states:

Owners are additionally reminded to ensure critical safety of flight items are included in their preflight inspections.

Tests and Research

LOBO conducted a postaccident evaluation with X-Plane, a flight simulator program developed by Laminar Research, to assess an asymmetric flap deployment scenario using an aerodynamic model of the Lancair Evolution.

A left flap failure was induced, causing the left flap to remain retracted. At 90 knots with the left flap at zero and the right flap at the takeoff setting, full right aileron and almost 20% right rudder were required to hold the wings level in the roll. At 90 knots with the left flap at zero and the right flap fully extended, there was no control input that would hold the wings level and the roll was classified as “extremely quick.”

Additional Information

The Lancair Evolution POH and AFM and the Lancair Evolution Training Manual, developed by the Lancair Owner and Builders Organization (LOBO), both provided guidance on a flap system malfunction and stated in part:

Airspeed - 140 to 160 KIAS

Flap circuit breaker - Check in

Check that flap indicator and flap position agree. If there is an asymmetry and/or rolling moment - Retract flaps

The FAA Pilot’s Handbook of Aeronautical Knowledge FAA-H-8083-25B discusses advanced avionics and states in part:

It is a paradox of automation that technically advanced avionics can both increase and decrease pilot awareness.

In advanced avionics aircraft, proper automation management also requires a thorough understanding of how the autopilot interacts with the other systems.

The advanced avionics aircraft adds an entirely new dimension to the way general aviation aircraft are flown. The electronic instrument displays, GPS, and autopilot reduce pilot workload and increase pilot situational awareness. While programming and operation of these devices are fairly simple and straightforward, unlike the analog instruments they replace, they tend to capture the pilot's attention and hold it for long periods of time. To avoid this phenomenon, the pilot should plan in advance when and where the programming for approaches, route changes, and airport information gathering should be accomplished, as well as times it should not. Pilot familiarity with the equipment, the route, the local ATC environment, and personal capabilities vis-à-vis the automation should drive when, where, and how the automation is programmed and used.

The pilot should also consider what his or her capabilities are in response to last minute changes of the approach (and the reprogramming required) and ability to make large-scale changes (a reroute for instance) while hand flying the aircraft. Since formats are not standardized, simply moving from one manufacturer's equipment to another should give the pilot pause and require more conservative planning and decisions.

Administrative Information

Investigator In Charge (IIC):	Hodges, Michael
Additional Participating Persons:	Matthew Cady; FAA Denver FSDO; Denver, CO Jeffrey Edwards; Lancair Owner & Builders Organization; St. Louis, MO Nora Vallée; Transportation Safety Board of Canada (Accredited Representative); Gatineau, OF Leslie Ederer; Pratt & Whitney Canada Corporation (Technical Advisor); St-Hubert, OF
Original Publish Date:	August 12, 2022
Last Revision Date:	December 13, 2024
Investigation Class:	Class 3
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=103276

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