



National Transportation Safety Board Aviation Accident Final Report

Location:	Apple Valley, CA	Accident Number:	WPR17FA161
Date & Time:	07/22/2017, 1500 PDT	Registration:	N331ST
Aircraft:	APPLEGATE PANZL S331E	Aircraft Damage:	Substantial
Defining Event:	Flight control sys malf/fail	Injuries:	1 Fatal
Flight Conducted Under:	Part 91: General Aviation - Personal		

Analysis

The private pilot was practicing her aerobatics routine. During the sixth figure of a nine-figure sequence, the pilot performed a snap roll to the right. Following the snap roll, the pilot performed a left roll as planned; however, rather than entering the next maneuver, the airplane continued to roll left. In-cockpit video indicated that, during the left roll, the right aileron exhibited a trailing-edge-down deflection consistent with a left turn. The pilot then moved her body toward the right side of the cockpit, consistent with a right control stick input. However, the airplane's rate of left roll increased, and the airplane continued to roll to the left as the pilot continued to lean toward the right. At this time, the right aileron indicated a trailing-edge-up deflection consistent with the pilot's right control stick input; the deflection of the left aileron could not be determined. The airplane continued to roll to the left until it impacted the ground.

Postaccident examination of the engine revealed no anomalies that would have precluded normal operation. Examination of the airframe revealed a break in the left aileron control assembly and one in the elevator control assembly. Both fracture surfaces of the left aileron control rod end exhibited relatively flat areas emanating from the inner diameter of the outer ring, which transitioned to angular planes adjacent to the outer diameter. One of fracture surfaces exhibited feathery features in the flat area consistent with fatigue cracking; the other fracture surface had smearing damage that obscured most of the finer features. The elevator control fracture exhibited features consistent with shear overstress.

The smearing damage indicated that the fatigue crack had been forming for some time. It is likely that the high stresses exerted on the airplane during aerobatic flight resulted in the final fracture of the left aileron control rod end due to fatigue.

Probable Cause and Findings

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

A fatigue failure of the left aileron control rod end during aerobatic flight, which resulted in the pilot's inability to maintain control of the airplane.

Findings

Aircraft	Aileron control system - Failure (Cause) Aileron control system - Fatigue/wear/corrosion (Cause) Lateral/bank control - Attain/maintain not possible (Cause)
Personnel issues	Aircraft control - Pilot

Factual Information

History of Flight

Maneuvering-aerobatics	Flight control sys malf/fail (Defining event) Collision with terr/obj (non-CFIT)
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On July 22, 2017, about 1500 Pacific daylight time, an Applegate Panzl S331E airplane, N331ST, impacted terrain while conducting aerobatic maneuvers near Apple Valley, California. The private pilot was fatally injured and the airplane sustained substantial damage. The airplane was registered to the pilot who was operating the airplane under the provisions of Title 14 *Code of Federal Regulations* Part 91. Visual meteorological conditions prevailed, and no flight plan was filed for the local personal flight, which originated from Apple Valley Airport (APV), Apple Valley, California, about 1445.

The pilot was practicing her aerobatics routine and was performing the sixth figure of a nine-figure routine when the accident occurred. A witness, who was familiar with the pilot's routine, reported that, as planned, the airplane entered a 45° descent and executed a right snap roll before entering a left roll. The airplane continued its descent, rolling at a slower rate, until it impacted the ground. The witness stated that, when she entered the maneuver, the pilot had adequate altitude to complete it.

An in-cockpit video from a camera mounted over the pilot's right shoulder captured the entirety of the accident flight. During the before takeoff engine run-up, the pilot confirmed flight control continuity; the video showed that the aileron surfaces moved accordingly. The pilot departed and began the aerobatic routine about 3 minutes into the flight. About 4 minutes into the routine, the pilot entered a 45° inverted downline and the airplane performed 1.5 snap rolls to the right. The pilot momentarily stopped the roll at 4,100 ft and started a roll to the left. The right aileron surface was observed trailing edge down, and the left aileron surface could not be seen in the video. The pilot moved her body toward the right of the cockpit, consistent with making a right control stick input; however, the airplane continued to roll left and the roll rate increased; the pilot continued to lean toward the right. About this time, the right aileron could be seen in the video with an upward deflection. The deflection of the left aileron could not be determined. The airplane continued to roll to the left until it impacted the ground. The pilot did not transmit any distress calls before the accident.

Pilot Information

Certificate:	Private	Age:	59, Female
Airplane Rating(s):	Single-engine Land; Single-engine Sea	Seat Occupied:	Single
Other Aircraft Rating(s):	None	Restraint Used:	5-point
Instrument Rating(s):	None	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 3 With Waivers/Limitations	Last FAA Medical Exam:	11/15/2016
Occupational Pilot:	No	Last Flight Review or Equivalent:	06/14/2017
Flight Time:	982 hours (Total, all aircraft), 189 hours (Total, this make and model)		

The pilot's most recent third-class Federal Aviation Administration (FAA) medical certificate was issued November 15, 2016. On the application for that certificate, she reported 982 total hours of flight experience, 39 hours of which were in the previous six months. The pilot had been flying aerobatics since 2006. The pilot purchased the airplane in 2015 and accrued about 189 flight hours in the airplane since that time, 45 hours of which were in the previous 12 months.

Aircraft and Owner/Operator Information

Aircraft Make:	APLEGATE	Registration:	N331ST
Model/Series:	PANZL S331E	Aircraft Category:	Airplane
Year of Manufacture:	2005	Amateur Built:	Yes
Airworthiness Certificate:	Experimental	Serial Number:	001
Landing Gear Type:	Tailwheel	Seats:	1
Date/Type of Last Inspection:	12/08/2016, Condition	Certified Max Gross Wt.:	
Time Since Last Inspection:		Engines:	1 Reciprocating
Airframe Total Time:	318 Hours as of last inspection	Engine Manufacturer:	Lycoming
ELT:	Not installed	Engine Model/Series:	IO-540 EXP
Registered Owner:	On file	Rated Power:	290 hp
Operator:	On file	Operating Certificate(s) Held:	None

The airplane's most recent annual inspection was completed on December 8, 2016. The maintenance log entry for the inspection indicated that the airplane was disassembled and

reassembled. A new control stick was installed, and the ailerons and aileron hinges and attach points were inspected and all were recorded as satisfactory at this time.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	KVCV, 2885 ft msl	Distance from Accident Site:	12 Nautical Miles
Observation Time:	1455 PDT	Direction from Accident Site:	265°
Lowest Cloud Condition:	Scattered / 11000 ft agl	Visibility	10 Miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	6 knots /	Turbulence Type Forecast/Actual:	None / None
Wind Direction:	150°	Turbulence Severity Forecast/Actual:	N/A / N/A
Altimeter Setting:		Temperature/Dew Point:	38° C / 6° C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Apple Valley, CA (APV)	Type of Flight Plan Filed:	None
Destination:	Apple Valley, CA (APV)	Type of Clearance:	None
Departure Time:	1445 PDT	Type of Airspace:	

Airport Information

Airport:	Apple Valley (APV)	Runway Surface Type:	N/A
Airport Elevation:	3062 ft	Runway Surface Condition:	Unknown
Runway Used:	N/A	IFR Approach:	None
Runway Length/Width:		VFR Approach/Landing:	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Substantial
Passenger Injuries:	N/A	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Fatal	Latitude, Longitude:	34.603611, -117.132778

The airplane impacted sandy desert terrain in an approximate 45° nose down, upright attitude. The engine was mostly embedded in a 2-ft-deep crater; the wood propeller blades were fractured near the propeller hub and fragments were found at the bottom of the crater. The engine cowling, cabin, and both wing skins were heavily fragmented and completely separated from the underlying structure. Impact marks consistent with the leading edges of both wings were visible in the sand. The cabin area was heavily damaged. The skin was still attached to the aft fuselage but exhibited crush damage. The empennage was mostly intact and undamaged.

Control continuity was established throughout the airframe with two breaks, one in the left aileron control assembly and one in the elevator control assembly. The fracture surfaces of the left aileron control rod end and the elevator control were examined by the National Transportation Safety Board (NTSB) Materials laboratory. Both fracture surfaces of the left aileron control rod end exhibited relatively flat areas emanating from the inner diameter of the outer ring, which transitioned to angular planes adjacent to the outer diameter. One of the fracture surfaces exhibited smearing damage on much of its flat area that obscured most of the finer features. The other fracture surface exhibited feathery features in the flat area, consistent with fatigue cracking. The elevator control fracture exhibited features consistent with shear overstress.

The engine sustained significant crush damage to the oil sump, exhaust system, and induction system. The magnetos were heavily damaged and could not be tested; the ignition harness was destroyed. The top spark plugs were removed; their coloring varied but was consistent with normal operation when compared to the Champion check-a-plug chart. The fuel nozzles were clear of debris and blockages. Borescope examination of the cylinders revealed no mechanical damage or evidence of detonation or foreign object ingestion. The engine was rotated by hand and continuity was established throughout, thumb compression was obtained on all cylinders and the valves moved appropriately. Examination revealed no anomalies that would have precluded normal operation.

Medical And Pathological Information

The San Bernardino County Coroner, San Bernardino, California, performed an autopsy of the pilot. The cause of death was listed as multiple blunt force injuries.

The FAA Bioaeronautical Sciences Research Laboratory performed forensic toxicology on specimens from the pilot with negative results for carbon monoxide, and drugs. 85 mg/dL ethanol was detected in blood, which was likely the result of postmortem production.

Administrative Information

Investigator In Charge (IIC):	Samantha A Link	Report Date:	07/08/2019
Additional Participating Persons:	Ponch Ontiveros; FAA FSDO; Riverside, CA Mark Platt; Lycoming Engines; Williamsport, PA		
Publish Date:	07/08/2019		
Note:	The NTSB traveled to the scene of this accident.		
Investigation Docket:	http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=95636		

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).