Aviation Investigation Final Report

Location:	Rio Linda, California	**Accident Number:**	WPR17FA179
Date & Time:	August 3, 2017, 15:03 Local	**Registration:**	N420M
Aircraft:	Michaelian Lancair IV-TP	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (total)	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot departed on a visual flight rules cross-country flight in his turboprop-equipped experimental airplane. Onboard data indicated that, upon reaching about 6,500 ft mean sea level, about 5 minutes after takeoff, the airplane pitched down about 25° and entered an approximate 35° left bank; the engine power reduced to idle with a simultaneous decrease in fuel flow. Several seconds later, the voltage began to slowly decrease, consistent with the generator turning off. The airplane continued to descend toward the nearest airport and ultimately impacted powerlines and terrain about 1.3 nautical miles from the approach end of the runway. The pilot made no radio transmissions that indicated that he was experiencing an emergency.

Examination of the fuel system and engine revealed no mechanical malfunctions or failures, and the reason for the reduction of engine power could not be determined. The propeller was found in a low pitch position. The propeller was not equipped with a feathering pump; therefore, unless the propeller control was moved to the feather position immediately following a loss of engine power, the speed of the counterweights and the aerodynamic loads on the blades would quickly degrade to a point where feathering would become impossible. It is likely that, had the pilot immediately placed the propeller control into the feather position following the loss of engine power, significantly less drag would have been produced by the propeller and the airplane would likely have been able to reach the intended runway.

The first responders reported that the pilot stopped breathing shortly after being extricated from the wreckage. Given that the pilot diverted the airplane and initially survived the impact, it is unlikely that he experienced sudden incapacitation during the flight.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:
A loss of engine power for reasons that could not be determined based on available evidence.

Findings

Not determined	(general) - Unknown/Not determined

Factual Information

History of Flight

Enroute-cruise	Loss of engine power (total) (Defining event)
Enroute-cruise	Emergency descent initiated
Emergency descent	Controlled flight into terr/obj (CFIT)

On August 3, 2017, at 1503 Pacific daylight time, an experimental, amateur-built Lancair IV-TP, N420M, was substantially damaged when it was involved in an accident near Rio Linda, California. The commercial pilot was fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

An onboard GPS and avionics unit captured data from the accident flight; the airplane departed Auburn Municipal Airport (AUN), Auburn, California, about 1455. The pilot established the airplane on a heading of about 195° toward the destination of San Carlos, California and began to climb. The pilot contacted air traffic control and requested visual flight rules flight following to the destination, and when the controller advised the pilot that the airplane had been identified on radar, the pilot did not respond. The controller then saw the airplane turn and descend toward McClellan Airfield (MCC), Sacramento, California; no further communications were received from the accident pilot. (See Figure 1).

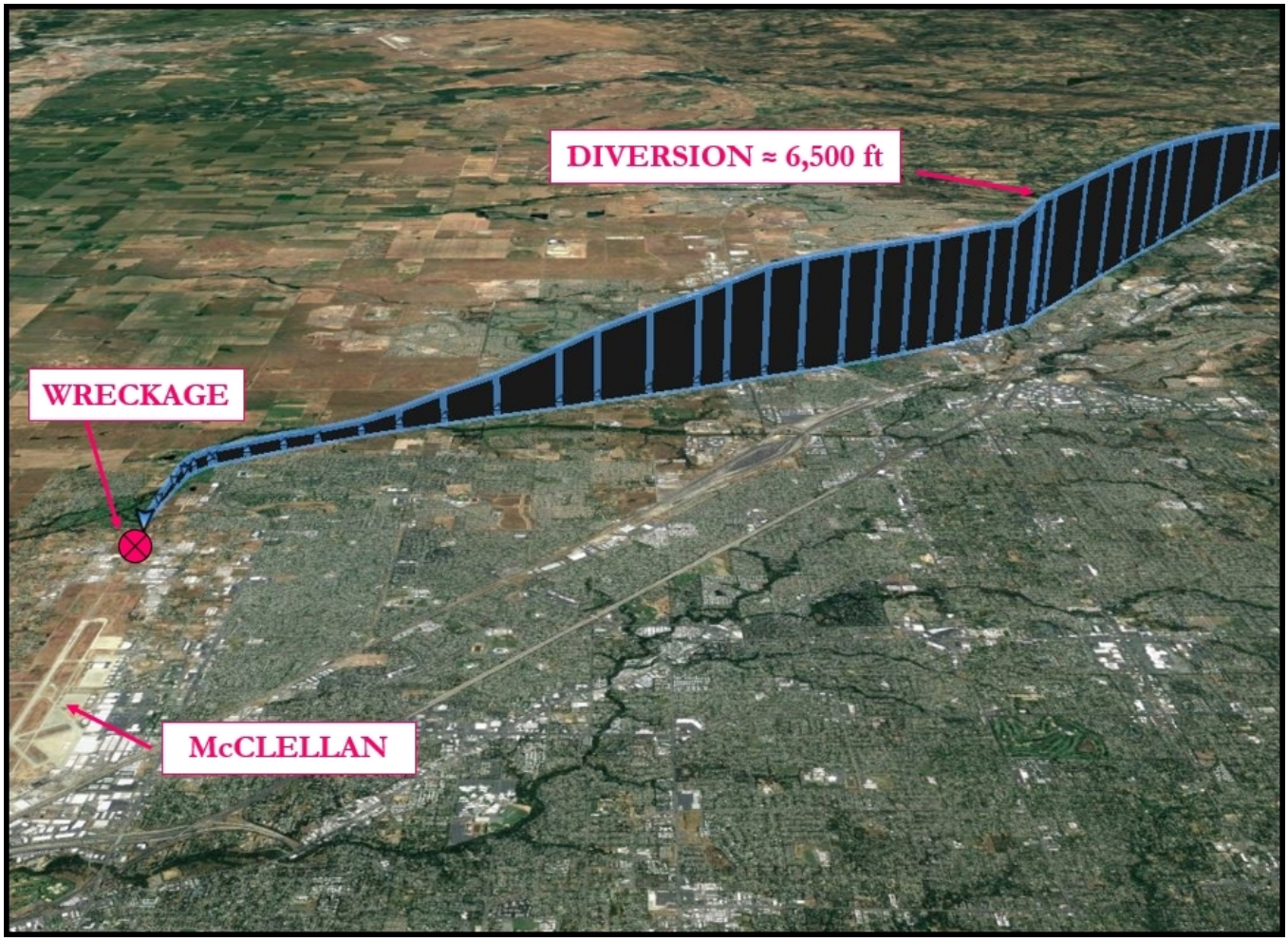

Figure 1: Flight Track Showing Diversion

Data showed that, at 1459:17, the fuel pressure began to rise from about 40 pounds per square inch (psi) to 43 psi. A few seconds later, after reaching 6,492 ft mean sea level (msl), the airplane pitched down and banked to the left, reaching 25° nose down and 36° left wing down. At 1459:24, torque and N1 (gas generator speed) were at 64% and 95%, respectively, and 15 seconds later, began to decrease consistent with the engine producing idle power. During that time, the oil pressure dropped from about 31 to 15 psi and fuel flow was reduced from 46 to 16 gallons per hour; the interstage turbine temperature decreased from 1,118°F to 786°F.

At 1459:53, the oil pressure increased to 28 psi and the voltage began to slowly decrease from 28 volts, consistent with the generator turning off and the airplane being powered by the standby alternator. The N1 stabilized about 65%, and the engine torque dropped to about 8%. At 1501:41, N1 began to decrease again and reached 0 about 15 seconds later, with a simultaneous decrease in oil pressure and ITT. At 1502:00, the aircraft banked about 40° to the left, aligning with runway 16 at MCC.

During the last 38 seconds of the flight, the airplane lost about 425 ft of altitude while slowing from 125

knots (kts) to 89 kts. During this time, the engine torque and N1 were 0, while the propeller rpm consistently slowed from 1,746 to 948. The next data point, 1 second later, depicted the airspeed as 0, and several parameters showed discontinuities consistent with impact.

Witnesses saw the airplane flying south along 28th Street toward MCC at low altitude. The airplane then made a sharp turn to the right and disappeared into the trees.

After the accident, the pilot's family listened to the radio transmissions for the final portion of the flight and they stated that they heard the pilot make three radio transmissions, the second of which was not discernable aside from the airplane's registration number. The third transmission was (presumably) the pilot acknowledging a controller's directions to squawk a discrete code by pressing the microphone; the pilot did not report an emergency or convey that he was in distress.

Pilot Information

Certificate:	Commercial	**Age:**	71,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Unknown
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	October 1, 2014
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	February 1, 2016
Flight Time:	(Estimated) 7300 hours (Total, all aircraft)		

The pilot's personal flight records were not recovered. On his last application for a medical certificate, the pilot reported 7,000 total hours of flight experience.

Aircraft and Owner/Operator Information

Aircraft Make:	Michaelian	**Registration:**	N420M
Model/Series:	Lancair IV-TP	**Aircraft Category:**	Airplane
Year of Manufacture:	2004	**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	LIV 071
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	August 4, 2016 Condition	**Certified Max Gross Wt.:**	
Time Since Last Inspection:	61 Hrs	**Engines:**	1 Turbo prop
Airframe Total Time:	934.7 Hrs at time of accident	**Engine Manufacturer:**	Diemech Turbines
ELT:	Installed	**Engine Model/Series:**	M601D
Registered Owner:	On file	**Rated Power:**	750 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

The Lancair IV-TP was an experimental, amateur-built airplane constructed mainly of composite materials The pilot purchased the kit directly from Lancair International Inc., in November 1995. The airplane received a special airworthiness certificate in the experimental category in September 2004. The logbook entry on August 4, 2016, stated that "a list of discrepancies and unairworthy items" were provided to the airplane's owner. This list, and the mechanic who performed the inspection, could not be located after the accident. The pilot recorded that he replaced the starter/generator in July 2016 at a total time of 868.0 hours.

Engine and Propeller

The Diemech M601D engine is a two-spool engine comprising a gas generator that drives a power turbine, which drives a reduction gearbox. The gas generator compressor consists of two axial flow stages and one centrifugal stage. Inlet air enters the compressor section radially just forward of the accessory section and travels forward through the compressor. The exiting compressor air enters an annular combustor to mix with fuel for the combustion process. The gas generator turbine nozzles then direct the expanded flowpath gases to the gas generator turbine, which directs the exiting gases to the power turbine for the final power extraction before exiting the engine forward of the compressor inlet.

The power turbine drives the propeller system by means of the reduction gearbox. The accessory gearbox, which is located on the aft end of the engine drives all engine accessories by a direct shaft coming from the compressor spool. Typical engine accessories are the main fuel pump, fuel control unit, starter/generator, hydraulic pump, and the propeller governor, which is driven by the reduction gearbox located at the front of the engine.

The oil system is a circulatory pressure system with an integral oil tank incorporated into the accessory gearbox. This system provides lubrication for all areas of the engine and oil pressure for the torque meter and propeller pitch control.

The powerplant was controlled by three sets of levers. The power lever controlled the power output of the engine and the propeller blade angles in Beta and reverse. The propeller lever controlled the propeller speed via the primary propeller governor and emergency propeller feathering. The condition lever actuated the fuel shutoff valve and, if an emergency circuit was on, controlled engine power.

The propeller was equipped with an overspeed governor on the cylinder front face, which featured an internal spring-loaded weighted valve. Centrifugal forces of the propeller rpm act on the weighted valve, and once the spring pressure is overcome, the valve opens, allowing oil from the low pitch area in the hub to the drain until the rpm decreases to correspond with speed setting.

The airplane was not equipped with an emergency electric propeller feather pump; thus, emergency feathering could be activated by moving the propeller lever onto the feather stop. However, this required the gas generator portion of the engine to still be operating, since the gas generator drove the main oil pump and provided oil pressure to the propeller for pitch control and emergency feathering. However, when an engine loses power for any reason, the gas generator section quickly stops rotating and there is no engine oil pressure available to feather the propeller. With no engine power to turn the propeller, it will quickly stop rotating, making the counterweights and aerodynamic pressure on the rotating blades the only driving force available to feather the propeller. Unless the pilot immediately moves the propeller conditioning lever into the feather stop when the engine loses power, the propeller will effectively be locked at the blade pitch that was selected at the time of the engine failure.

Fuel System

The airplane was last fueled on July 29. According to the refueling technician, the pilot requested that the airplane be refueled to capacity, and the records indicated he purchased 103 gallons of Jet A. The technician recalled filling both of the wing tanks; he noted that the pilot rarely filled the belly tank. Onboard data indicated that the right and left fuel tanks each contained about 20 gallons of fuel before the flight, but the total amount of fuel onboard was unknown.

The fuel system comprised two 56-gallon wing tanks and a 36-gallon belly tank; all tanks fed into a 24-gallon header tank. From the header tank via an electric boost pump, the fuel passed through a filter and continued by the fuel pressure sensor and then the fuel flow sensor to the fuel control unit (FCU). The fuel pressure and flow rate displayed on the instrument panel were based on what the pressure header tank supplied to the FCU. The header tank was equipped with a vent line.

The airplane was equipped with a VR Avionics Fuel System Management (FSM), which was designed to automatically select the fuel tank with the lowest quantity as the feeder tank. In an effort to equalize the fuel level, the tank would be switched to the lowest when an imbalance of 3 gallons was reached. The system additionally monitored the fuel pumps and fuel pressure, providing the pilot with an annunciation if the levels were low.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KMCC,77 ft msl	**Distance from Accident Site:**	2 Nautical Miles
Observation Time:	21:55 Local	**Direction from Accident Site:**	178°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	240°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.87 inches Hg	**Temperature/Dew Point:**	37°C / 7°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	AUBURN, CA (AUN)	**Type of Flight Plan Filed:**	VFR
Destination:	SAN CARLOS, CA (SQL)	**Type of Clearance:**	VFR flight following
Departure Time:	14:54 Local	**Type of Airspace:**	

Airport Information

Airport:	MC CLELLAN AIRFIELD MCC	**Runway Surface Type:**	Concrete
Airport Elevation:	76 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	16	**IFR Approach:**	None
Runway Length/Width:	10599 ft / 150 ft	**VFR Approach/Landing:**	Forced landing;Straight-in

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	38.703887,-121.401664

The accident site was in the back yard of a residence located at the corner of two streets. Powerlines were located 190 ft north of the wreckage with two support structures (wood poles) on both sides of the street about 73 ft apart. A powerline about 190 ft from the main wreckage exhibited several bends in the center area consistent with airplane impact. (See Figure 2)

Figure 2: Accident Site

The airplane came to rest upright on level terrain oriented on an approximate 100° magnetic heading. The main wreckage, which comprised a majority of the airframe and engine, was located about 1.3 nautical miles (nm) from the approach end of runway 16 at MCC.

The airframe remained relatively intact and the cockpit sustained minor crush damage. The throttle was between the mid- and full-throttle positions; the propeller lever was at feather and the condition lever was mid-range. The throttle quadrant retention clip was displaced and the throttle lever was slightly bent. It could not be determined if the clip displacement was the result of cockpit deformation at impact.

The generator switch was selected to "on," and the generator circuit breaker was out. The air conditioner switch was "on."

Fuel System

According to the recorded airplane data, the fuel pressure remained relatively stable through the flight. After the accident, the left and right fuel pumps were selected to "auto" and the center pump was selected to "off." During post-accident examination, the fuel line was detached from the FCU and the system was activated. Upon activation of the boost pump, about 20 gallons of fluid was pumped from the header tank at a flow rate of about 70 gph, consistent with normal operation.

An external examination revealed that the FCU had sustained impact damage, and whether there was air in the system could not be determined. Functional testing of the FCU and hydromechanical system revealed no anomalies that would have prevented normal operation. The mechanical fuel pump was removed and disassembled, revealing that its shaft was intact. There was no evidence of excessive wear or pre-impact damage that would have prevented normal operation.

Engine Examination

The engine was removed and placed in a test cell for operational testing. The engine started normally. The propeller was cycled twice from fine to feather pitch to purge the propeller piston cavity of air. After an initial idle period, the engine power was increased to 85% N1. Acceleration and deceleration behavior were acceptable, with no indications of hesitation, stall, or flameout.

The examination revealed no evidence of pre-impact mechanical malfunction or failure that would have precluded normal operation.

Propeller Examination

The propeller was generally intact and clean. The spinner was not present. When one blade was rotated around its span axis, all other blades rotated in unison, consistent with internal mechanical integrity. There was no evidence of positive blade twisting along the span axis, which is normally observed when the propeller is being driven with engine power at impact. The leading edges of all the blades, although abraded from normal use, displayed no evidence of soft or hard body impact damage. A geometric analysis of shear damage to the bearing ring concluded that the blades were at the minimum flight angle (low pitch stop) of about 18° to 20°, or fine pitch. The emergency condition of the blades during an engine problem should be feather, or 90°; the dual-acting propeller was not equipped with an internal feathering spring.

Propeller Governor

An external visual examination revealed that the propeller governor was undamaged. Oil was seen exiting the mounting flange passages. The accident airplane was not equipped with an emergency electric propeller feathering pump. According to Lancair, there was no requirement or installation guidance for such a system.

The airplane was equipped with a VR Avionics Turbine Starter Limiting/Monitoring System (TSLM). It was designed to act as a start sequence controller, an engine protection limiter, and an engine monitor/recorder. Data from the unit indicated that the pilot did not attempt to restart the engine during the flight.

Medical and Pathological Information

The County of Sacramento Coroner, Sacramento, California, completed an autopsy on the pilot. The cause of the pilot's death was listed as blunt force injuries. Atherosclerotic disease was reported as a finding, with up to 70% and 60% stenosis in the left anterior descending branch and right coronary arteries, respectively. An area of fibrosis, confirmed by microscopic exam, was also reported, consistent with a remote myocardial infarction. No other significant natural disease was identified. These findings placed the pilot at some increased risk for a sudden cardiac event, including a heart attack or arrhythmia. First responders reported that the pilot stopped breathing shortly after being extricated from the wreckage.

Toxicology testing performed at the FAA's Forensic Sciences Laboratory was negative for carbon monoxide and ethanol. The results were positive for Atorvastatin and Pioglitazone.

Administrative Information

Investigator In Charge (IIC):	Keliher, Zoe
Additional Participating Persons:	Jeff Snider; Federal Aviation Administration; Sacramento, CA
Original Publish Date:	September 23, 2020
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=95747