WRECKAGE AND IMPACT

The Safety Board investigator-in-charge performed an on-scene wreckage documentation the day following the accident followed by the initial examination.

The destination airport in San Carlos, California (elevation 54 ft msl) was about 105 nm from Auburn Municipal Airport (elevation 1,550 ft msl) on a bearing of about 205-degrees. About 5 minutes after becoming airborne, the pilot diverted to McClellan Airfield.

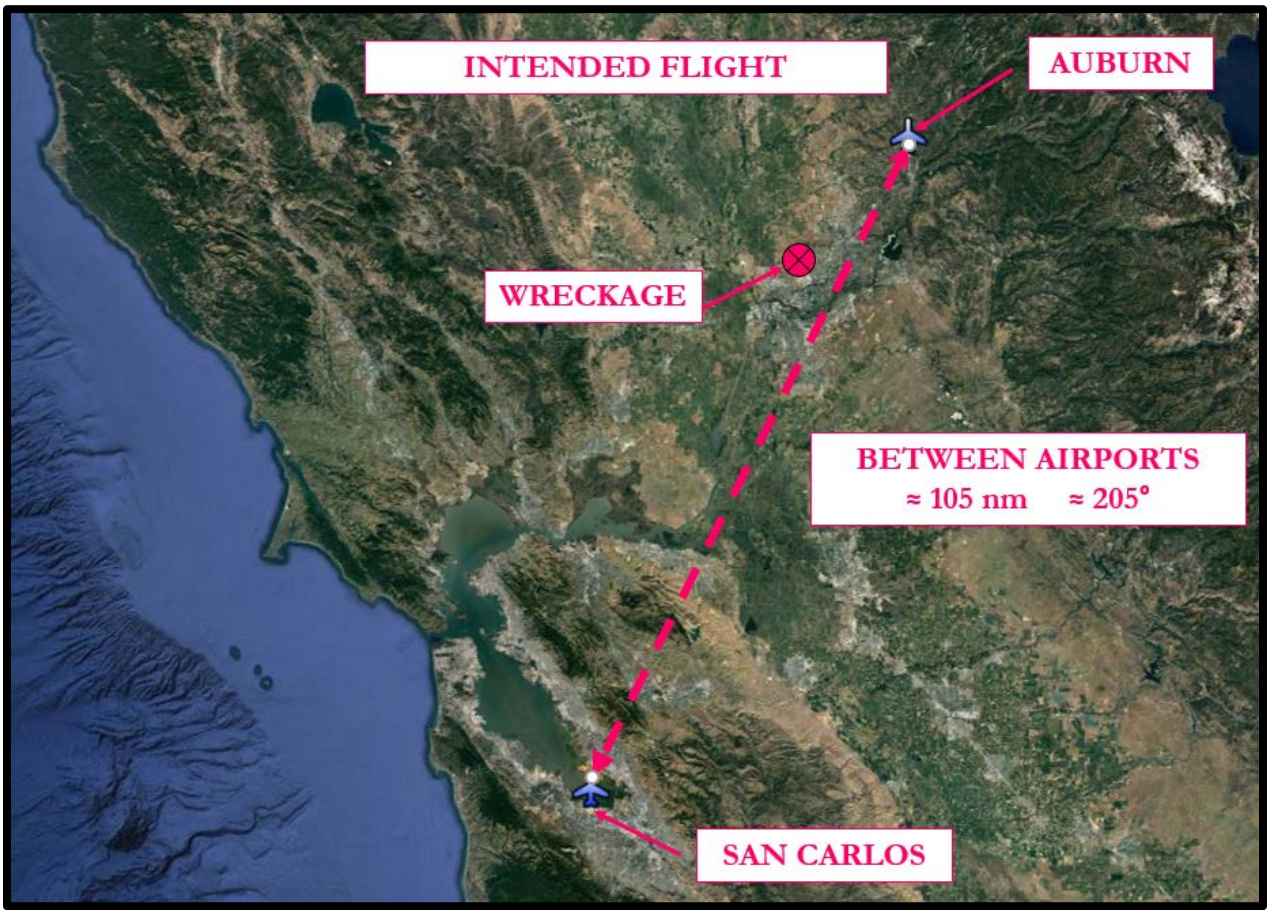


Figure 1: Intended Flight

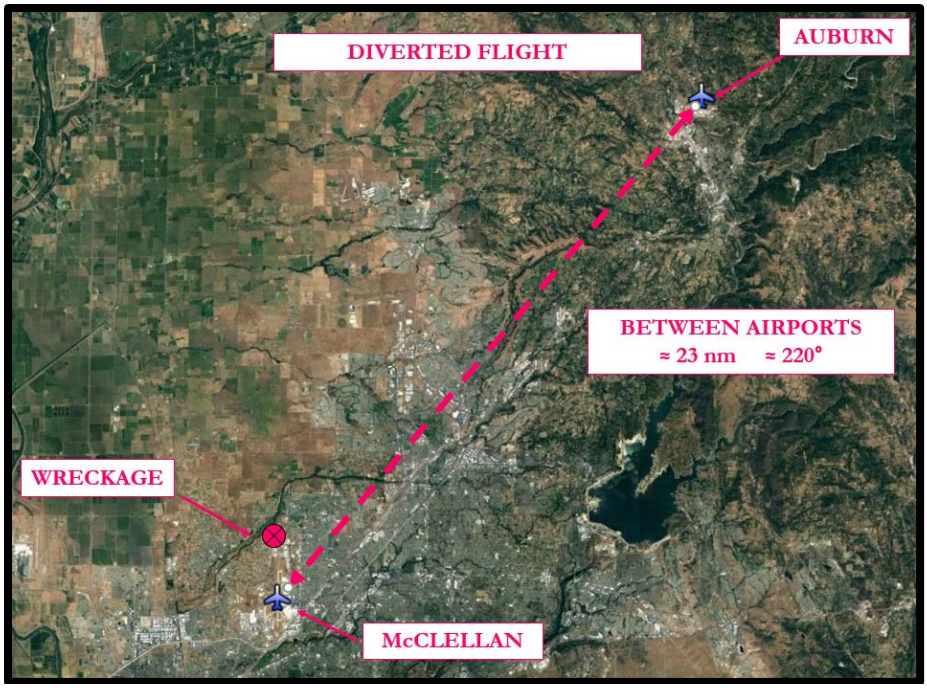


Figure 2: Flight Plan with Diversion to McClellan

Located in the wreckage was a Garmin GPSMAP 396, battery-powered portable GPS receiver. The unit stores date, route-of-flight, and flight-time information; all recorded data is stored in non-volatile memory. Recorded data plots were recovered for the time frame that matched the anticipated flight track of the airplane departing from Auburn. The track indicated that the airplane departed from runway 25 about 1455. After becoming airborne, the airplane climbed and headed toward San Carlos on a heading of about 220 degrees. At 1459:28, with the airplane about 6,800 ft msl, the airplane began a gradual descent and shifted to a 240-degree heading. The airplane continued in the direction while cruising between about 215-200 kts until 1502:02 when the airplane made a left turn to adjoin the final approach leg to runway 16 at McClellan Airfield.

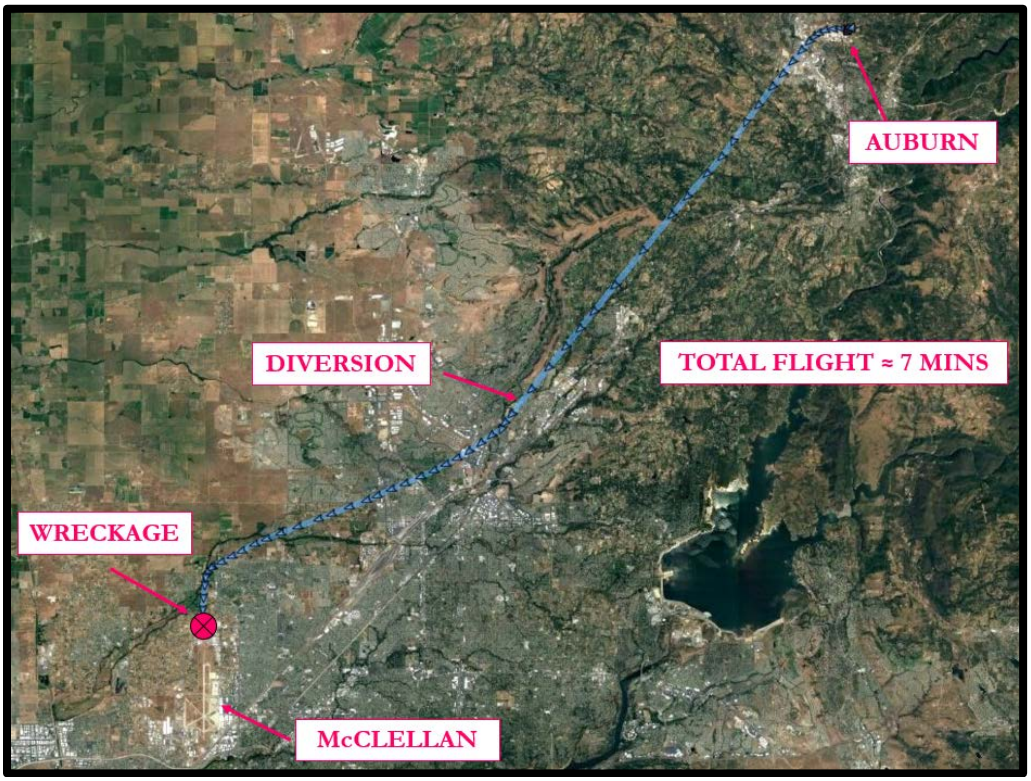


Figure 3: Accident Flight Recorded in the Handheld GPS with Diversion to McClellan

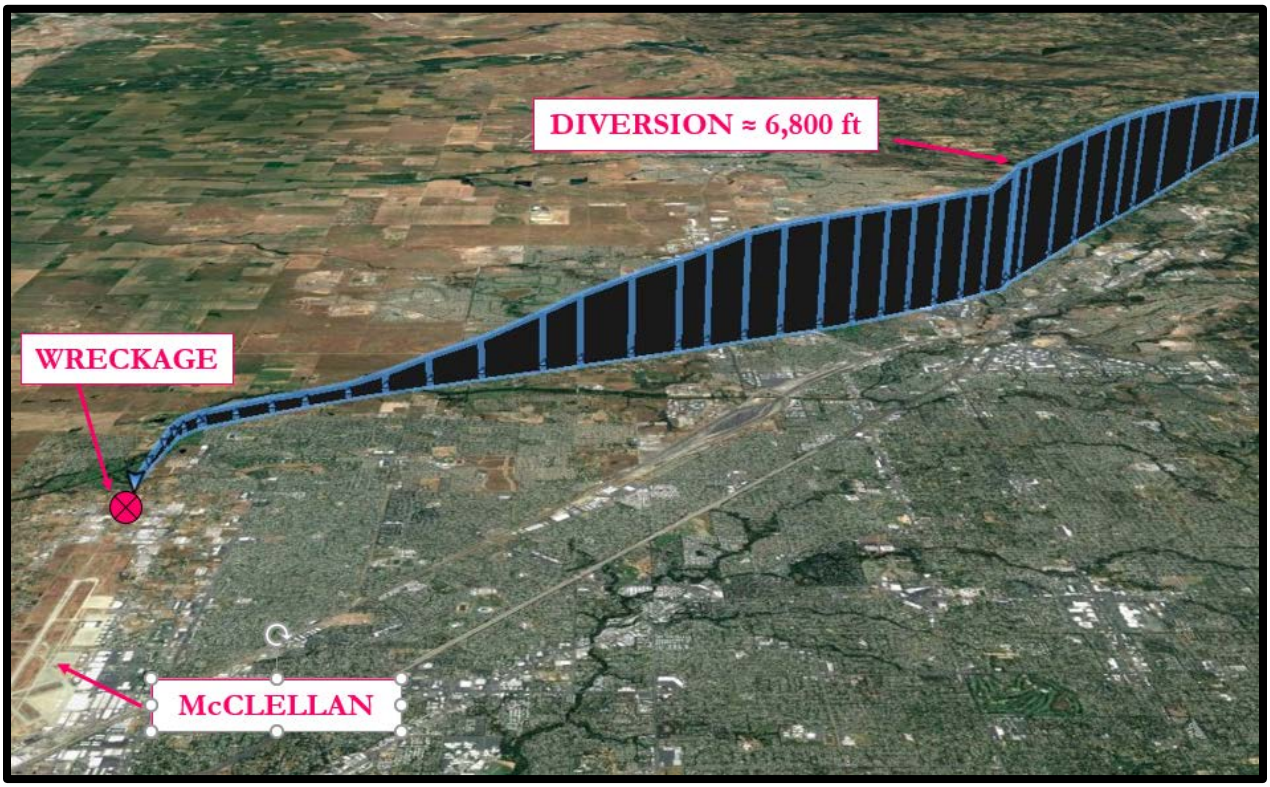


Figure 4: Accident Flight Recorded in the Handheld GPS with Altitude Profile

A comparison was made between the accident flight and a prior flight from Auburn to San Carlos. Lateral and perpendicular distances were measured between the prior flight path, and compared to the accident. Comparing the flight paths revealed that the accident flight was similar in speed and altitude gain until reaching the diversion point.

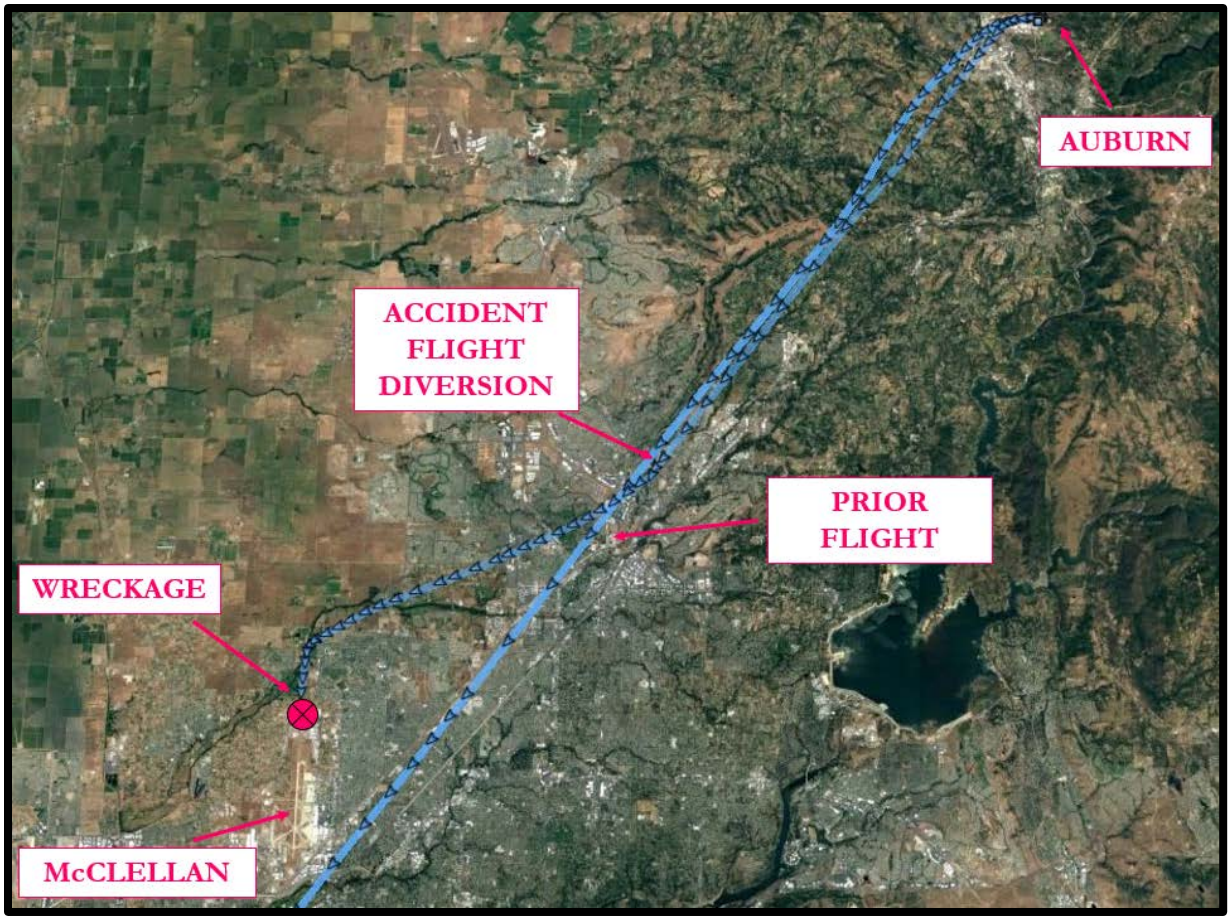


Figure 5: Accident Flight Compared to Prior Flight with Same Flight Plan

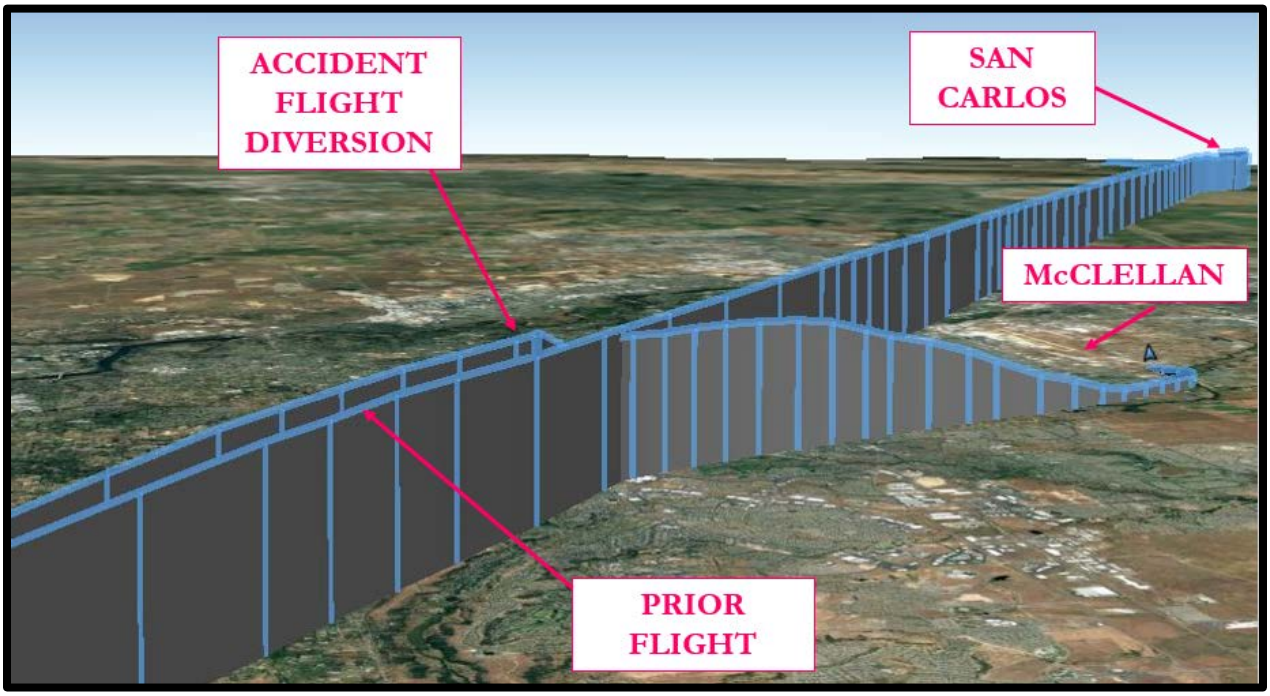


Figure 6: Accident Flight Compared to Prior Flight Showing Altitude Profile

The accident site was in a back yard of a residence located on the corner of U street (east-west oriented) and 28th street (north-south oriented). Powerlines were located 190 ft north of the wreckage with two support structures (wood poles) on both sides of 28th street (the south side of U street), at a distance of 73 ft apart. The lines had been separated from the west structure attach fittings (35-ft high) but remained attached to the east structure (about 55 ft high). The upper powerline had several bends in the center area consistent with the airplane having made contact with the wire. Situated on the level terrain, the airplane came to rest in upright with the nose oriented on an about 100-degree magnetic bearing. The main wreckage, which consisted of a majority of the airframe and engine, was located about 1.3 nm from the edge of the runway 16 at McClellan. The global positioning satellite (GPS) coordinates for the main wreckage were approximately 38 degrees 42 minutes and 14.35 seconds north latitude and 121 degrees 24 minutes and 6.28 seconds west longitude, at an elevation of about 70 ft mean sea level (msl).

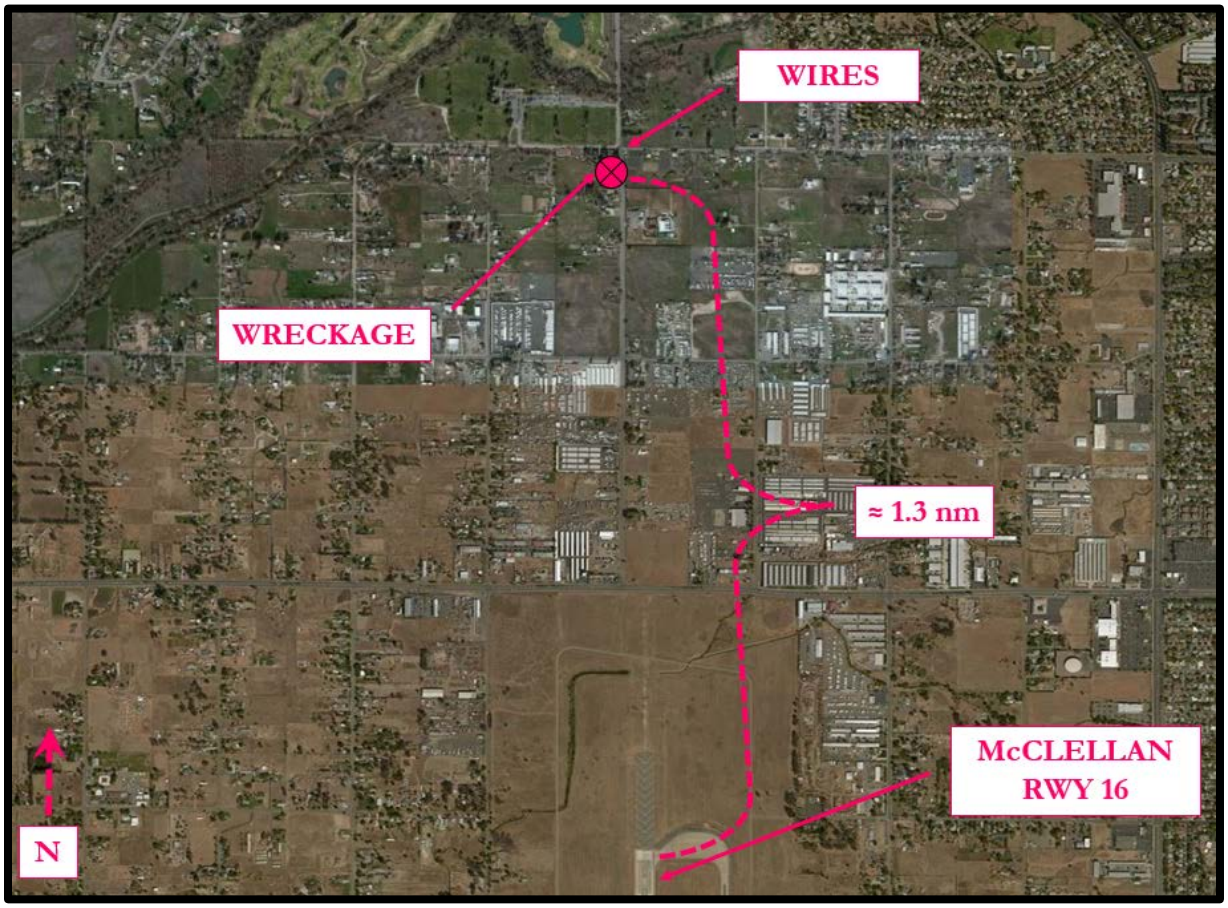


Figure 7: Wreckage Relative to Diversion Airport

Figure 8: Wreckage Relative to Diversion Airport

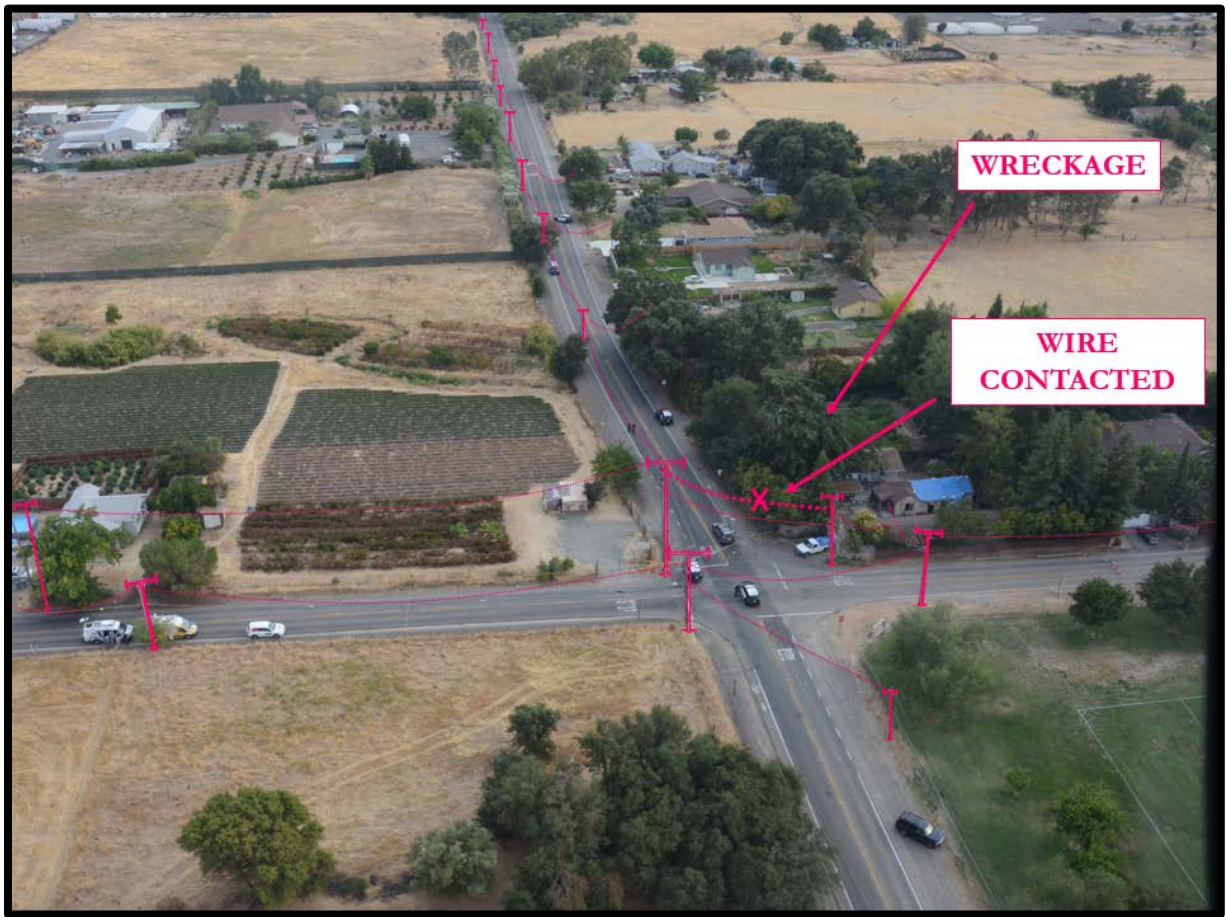


Figure 9: Surrounding Wires Relative to Wreckage

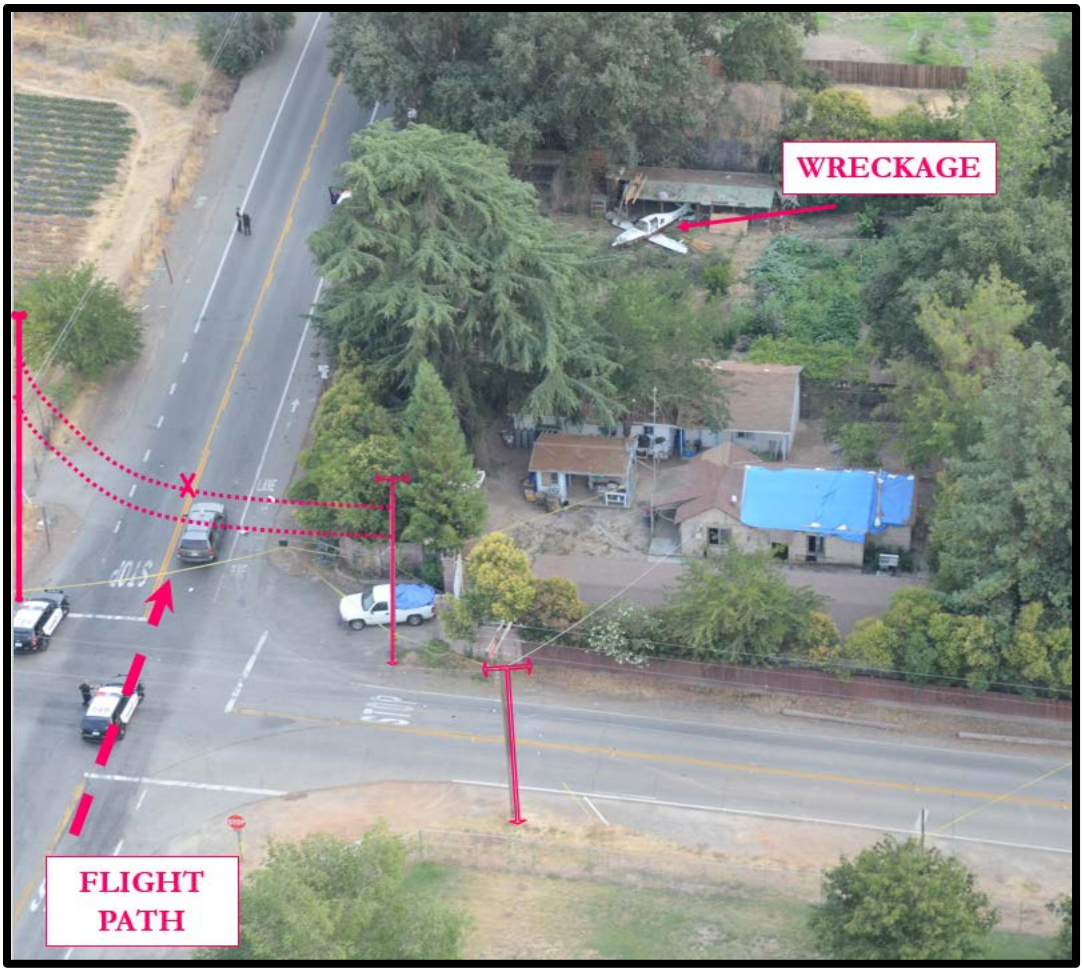


Figure 10: Wreckage Relative to Impacted Powerlines

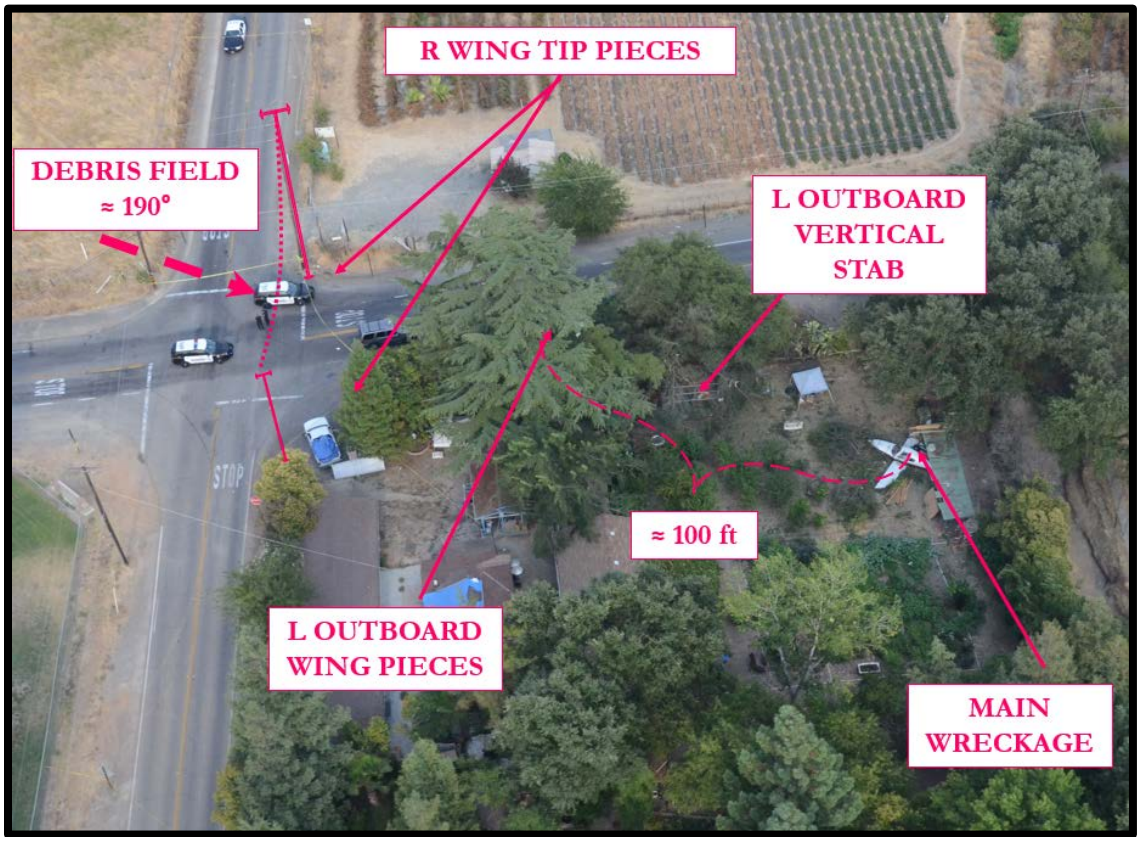


Figure 11: Debris Field Relative to Wires

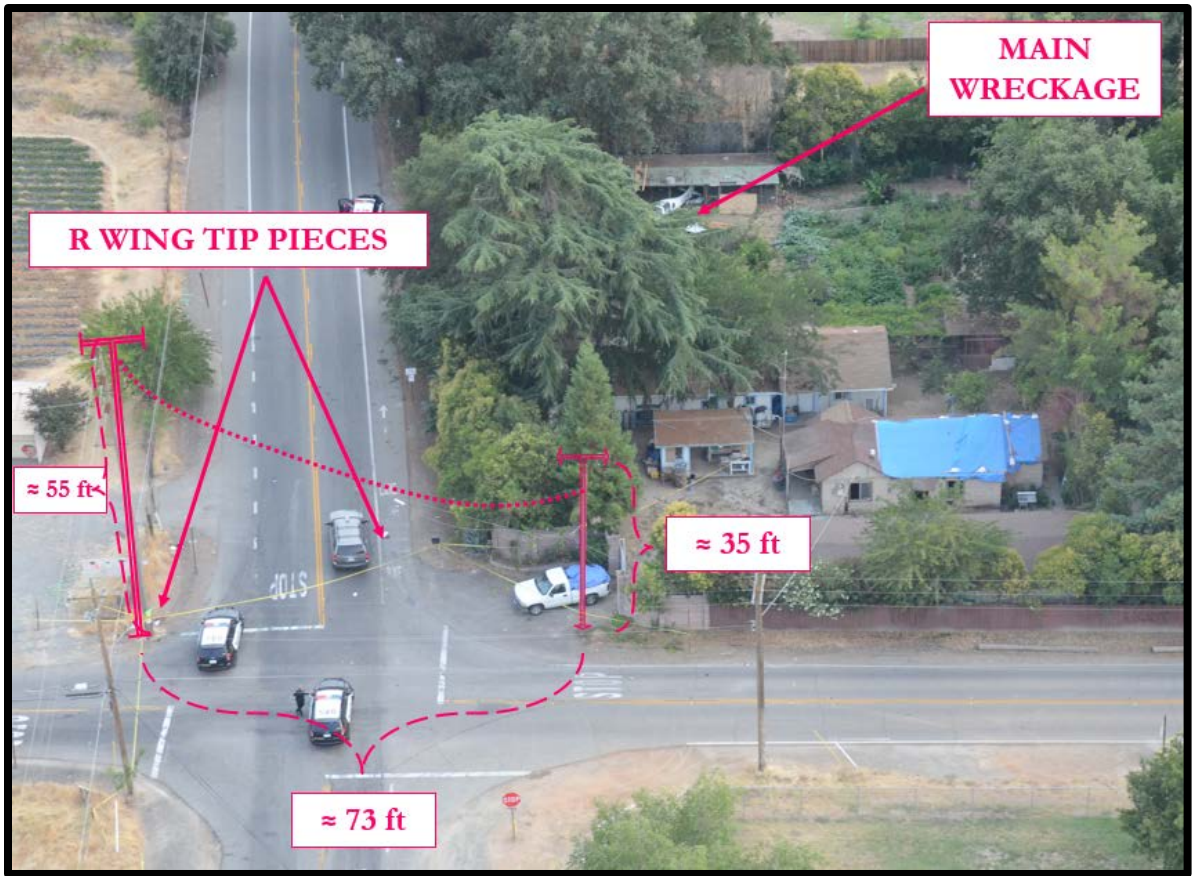


Figure 12: Main Wreckage Relative to Wire Contacted

The inboard portion of the right wing (measuring about 7 feet and 4 inches) remained attached to the wing root; fuel was seeping out at the attached points. The outboard portion of the wing was located on top of the shed, below the first impacted tree; the fuel cap remained secured. The right flap remained attached to the wing and the inboard 4 inches of aileron was attached. The remainder of the aileron was separated into 2 pieces, the inboard piece was found in the shed area in the outboard piece was located at the beginning of the debris field adjacent to the right-wing tip on the west side of the road. The right wing tip was fragmented into three major pieces: the end tip was found on the east side of the road; the midsection was found on the west side of the road where fragmented pieces of green/blue lens were scattered in the dirt; in the remained with the outboard portion of the right wing near the shed area.

The left inboard 11 feet and 7 inches of the wing remained attached to the airframe at the wing root. The flap was still attached at its respective hinges. The aileron was separated into two sections, one of which remained attached to the wing and the outboard portion was found in the shed area. The outboard portion of the left-wing was severely fragmented and found along the debris field. A larger section of the upper wing (which included the fuel cap) was located in the canopy of the tree branches along with the pilot tube. The left wing tip was found in the shed area and the bracket that affixes the lens to the wingtip was located near the main wreckage.

The engine's upper cowling was intact and no evidence of soot or oil; the bottom cowling had suffered crush deformation. The landing gear were physically in the retracted position and the selector handle was "down."

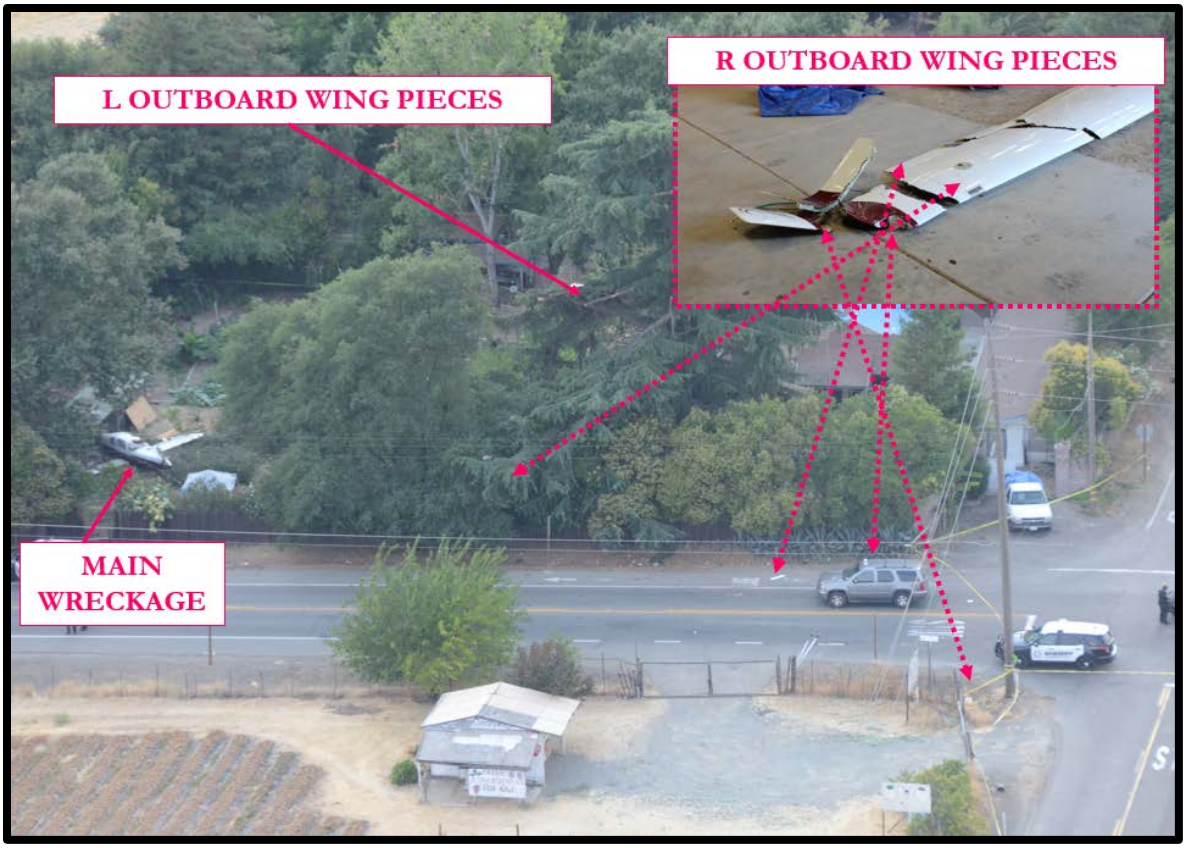


Figure 13: Debris Field Highlighting Right Wing Pieces

Figure 14: Debris Field Highlighting Left Wing Pieces

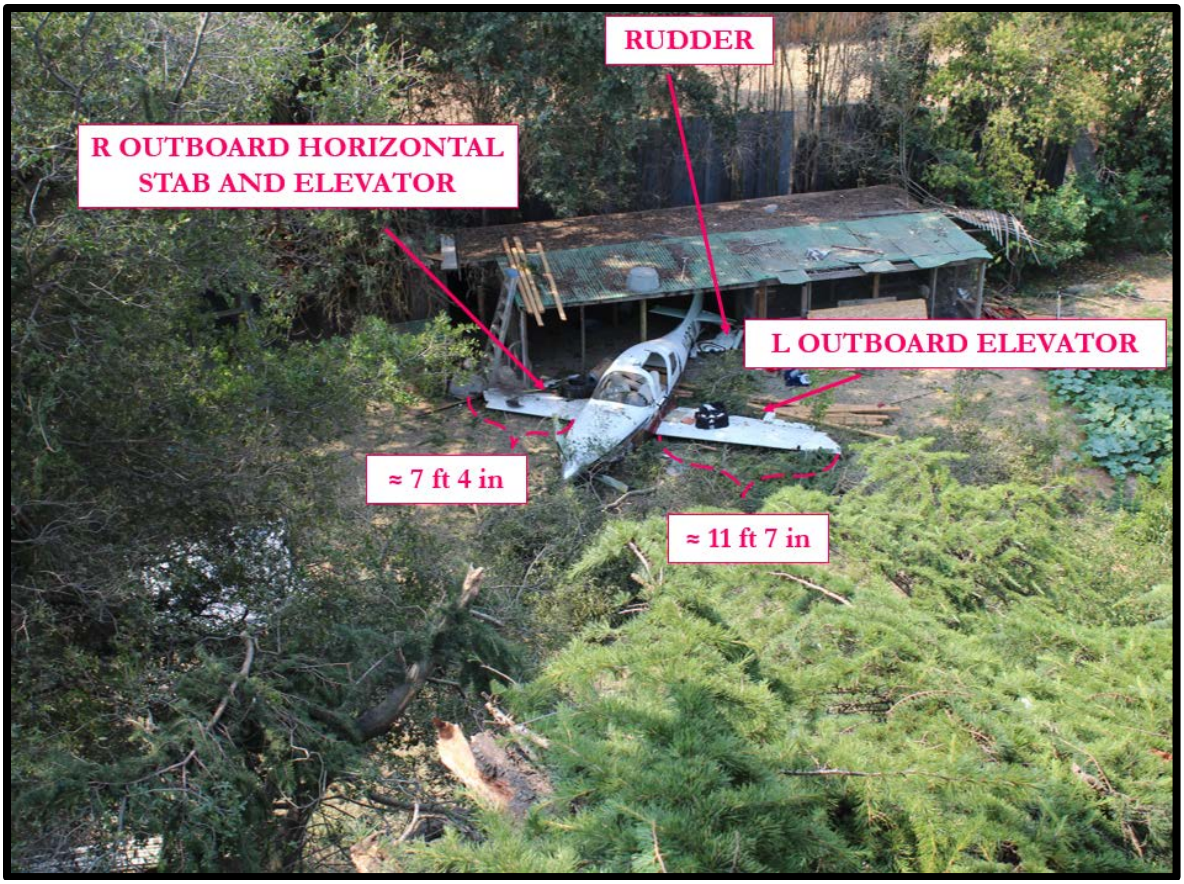


Figure 15: Main Wreckage

The inboard portions of the horizontal stabilizers and elevators remained attached to the empennage. The right outboard portion of the horizontal stabilizer and elevator were found under the right wing of the main wreckage. The left outboard horizontal stabilizer was found in the debris field between the first-impacted tree and the main wreckage. The left outboard elevator was found under the left-wing. The rudder had separated from its attached points and located in the main wreckage under the inboard portion of the left horizontal stabilizer.

On the top of the tailfin, where the empennage transitions into the vertical stabilizer, there were numerous black/grey marks and smudges. The markings measured about 1 to 2 inches in length and increased in intensity moving toward the outboard section of the left horizontal stabilizer; there were additionally blue and red paint transfer marks at the spine. The leading edge of the stabilizer was darker grey/black in color and blistered/cracked at the leading-edge tape. The dark coloration continued at to the leading edge of the elevator in the trim tab at a concentration of black at the bottom leading-edge. The attached fittings of the elevator trim tab were black and had an appearance of sustaining thermal damage. According to the NTSB materials lab experts, the signatures could be indicative of electrical arcing of the e-glass composite airframe as it contacted a high-tension power line.

The door was not located. The door actuator hinge was located in the cockpit.

Figure 16: Tail Section

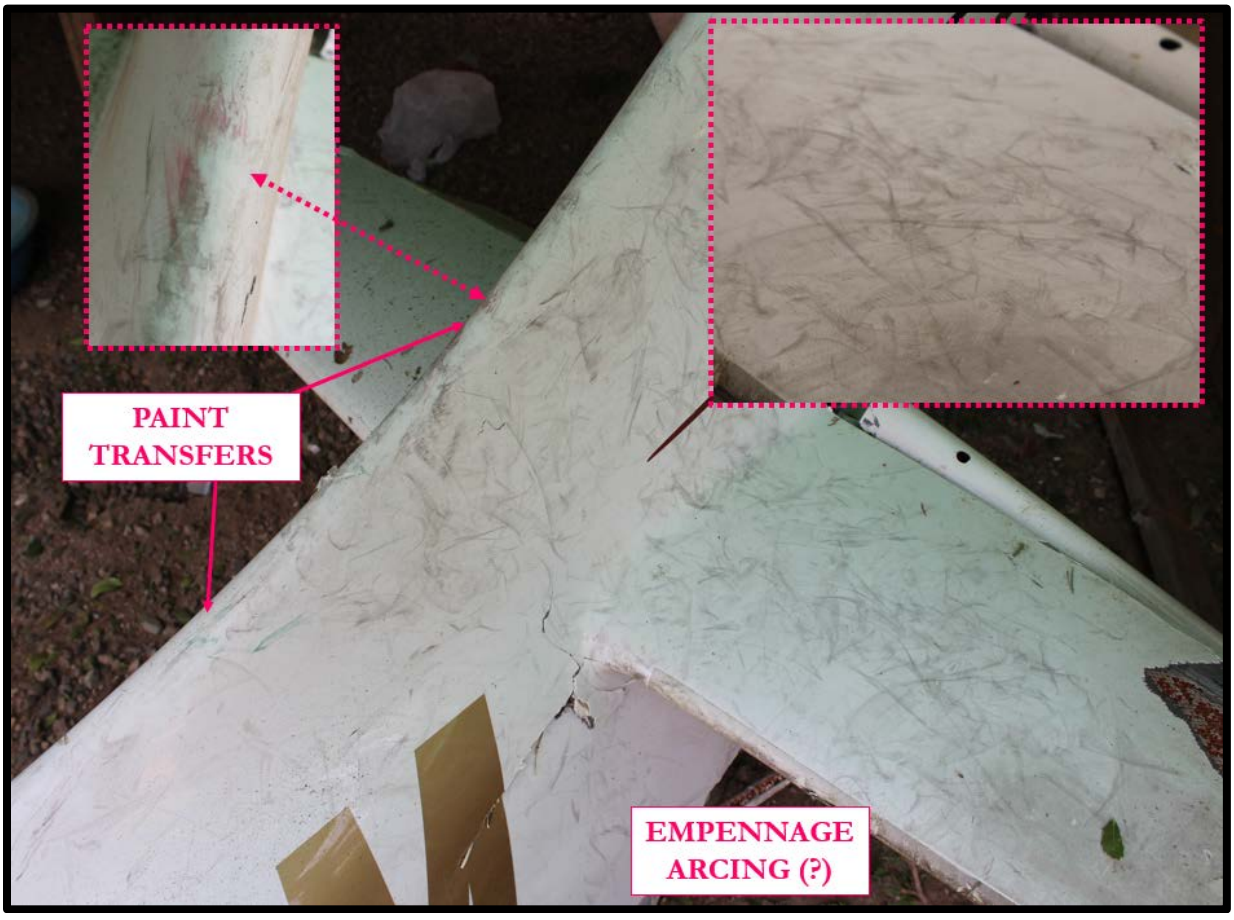


Figure 17: Markings on Empennage

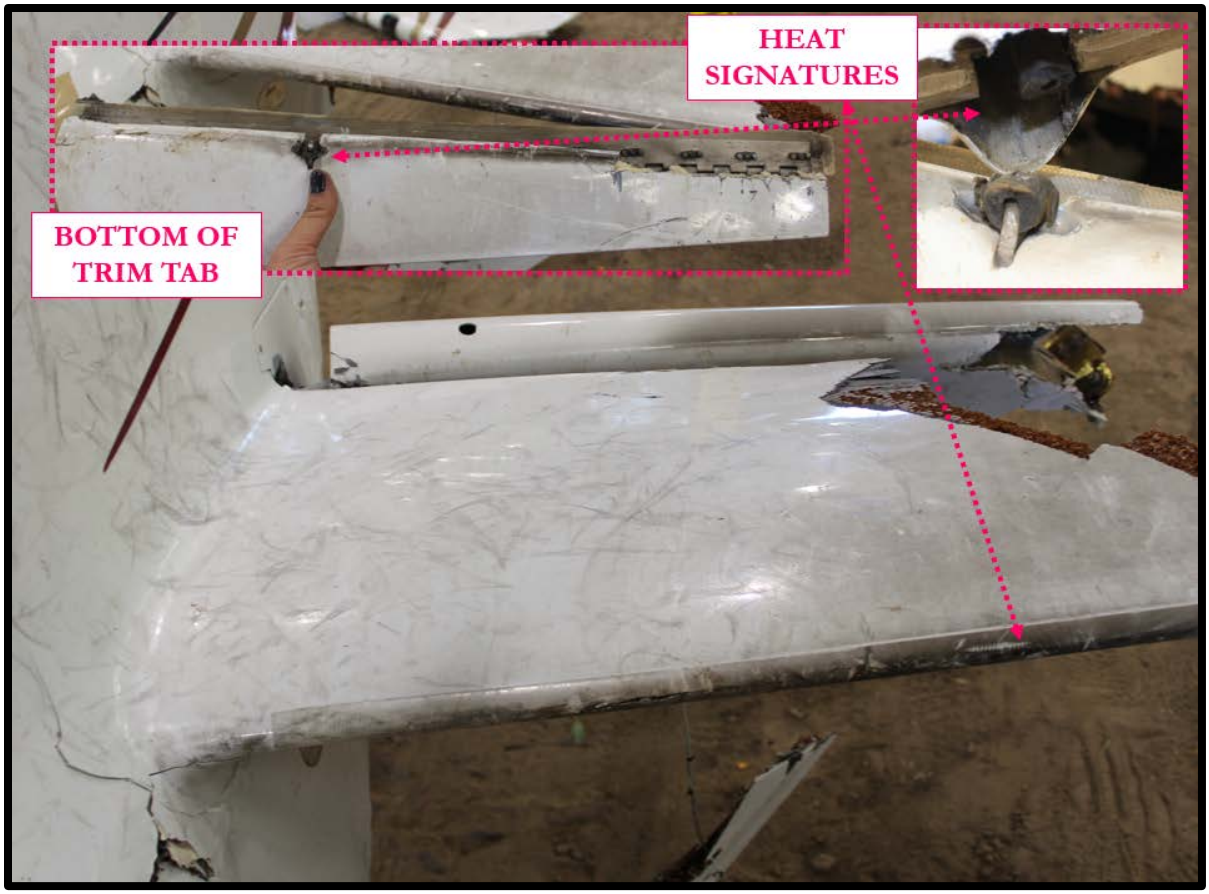


Figure 18: Markings on Empennage Showing Heat Signatures

Figure 19: Accident Airplane Door Hinges

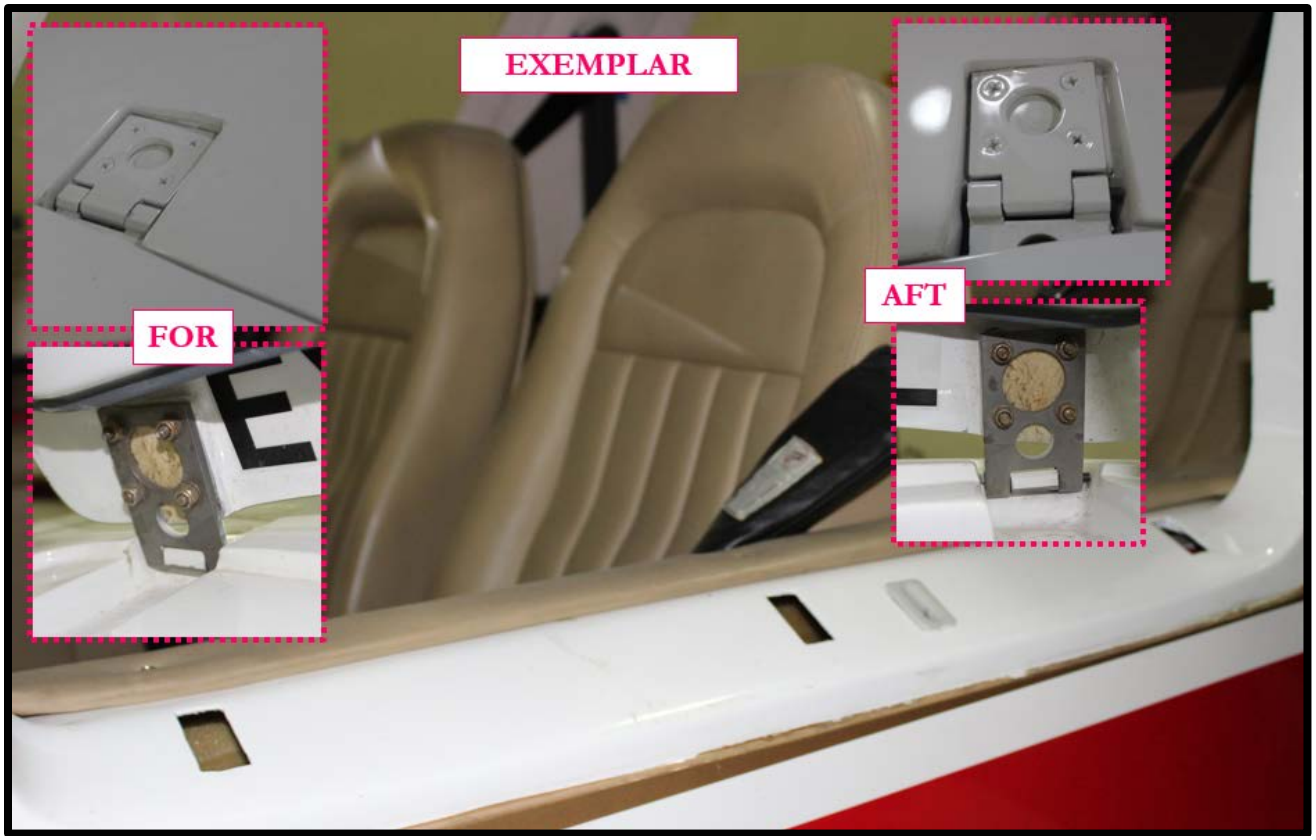


Figure 20: Exemplar Airplane Door Hinges

TESTS AND RESEARCH

AIRPLANE INFORMATION

The Lancair IV-TP, serial number (s/n) LIV 071, was an amateur-built experimental airplane constructed mainly of composite materials. The high-performance, pressurized airplane was equipped with four seats, retractable tricycle landing gear, and traditional flight control surfaces. The airplane received a special airworthiness certificate in the experimental category for the purpose of being operated as an amateur-built aircraft in September 2004. The pilot purchased the kit directly from Lancair International Inc., in November 1995. The most recent condition inspection was recorded as completed on August 04, 2016, at a total time of 873.8 hours. The logbook entry for that maintenance stated that "a list of discrepancies and unairworthy items" were provided to the airplane's owner; this list was not located and the mechanic could not be located. The pilot logged that he replaced the starter/generator in July 2016 at a total time of 868.0 hours.

Engine and Propeller

The airplane was equipped with a Diemech Turbines, Inc. M601D engine, s/n 871020, rated at 750 shaft horse power (SHP). The Diemech M601D is a two-spool engine consisting of a gas generator which drives a power turbine which drives a reduction gearbox. The gas generator compressor is a mixed configuration consisting 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 two axial stages and one centrifugal stage. The exiting compressor air enters an annular combustor arrangement for mixing with fuel for the combustion process. The expanded flowpath gases are then directed to the gas generator turbine by the gas generator turbine nozzles. The remaining expanded flowpath gases exiting the gas generator are then directed to the power turbine for the final power extraction before exiting the engine forward of the compressor inlet.

The power turbine then 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 is controlled by three sets of levers. The power lever control the power output of the engine and the propeller blade angles in Beta and reverse. The second lever controls the propeller speed via the primary prop governor and emergency propeller feathering. The third actuates the fuel shutoff valve and, if an emergency circuit is on, it controls engine power.

The airplane was equipped with a constant-speed three-bladed Avia Propeller V508/E/84/B2, s/n 140651237, that was manufactured in 1981; the blades were 84 inches in length. The propeller is equipped with an overspeed governor on the cylinder front face, which features 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 till the RPM decreases to correspond with speed setting.

The airframe remained relatively intact and the was only minor crush damage to the cockpit. The throttle was between mid and full throttle (not in the emergency detent); the propeller lever was at feather and the condition lever mid-range. The throttle quadrant retention clip was displaced and the throttle lever was slightly bent. It is unknown if the clip displacement was a result of the cockpit deformation at impact.

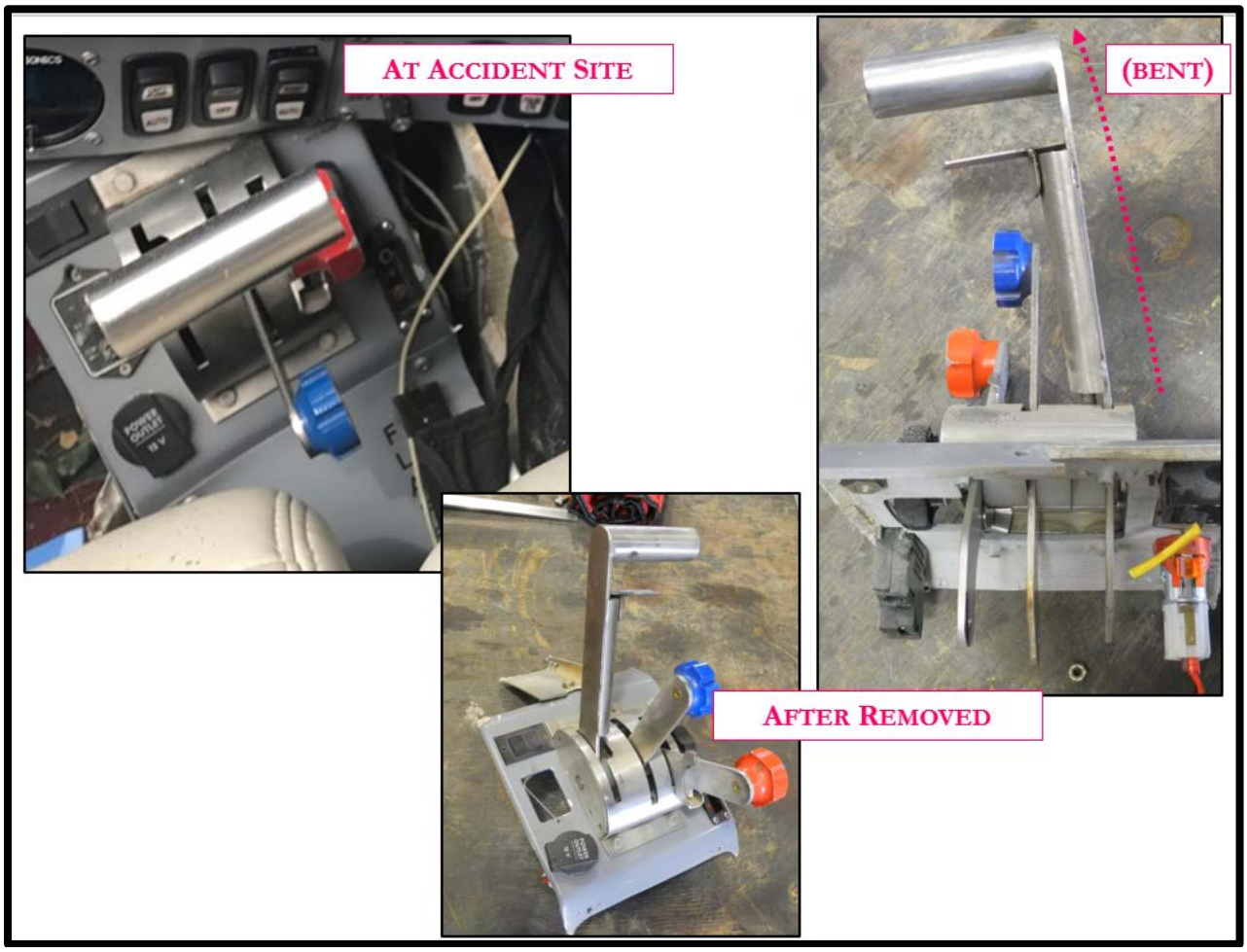


Figure 21: Throttle Quadrant

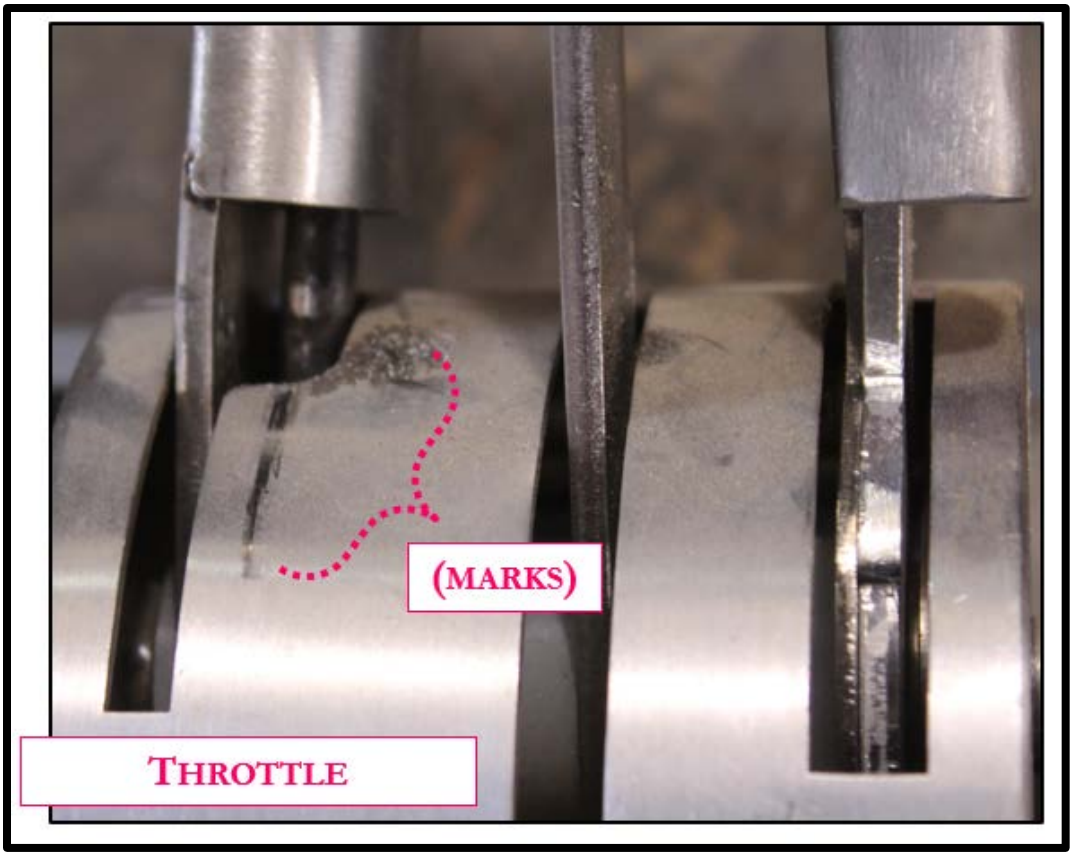


Figure 22: Rub Marks

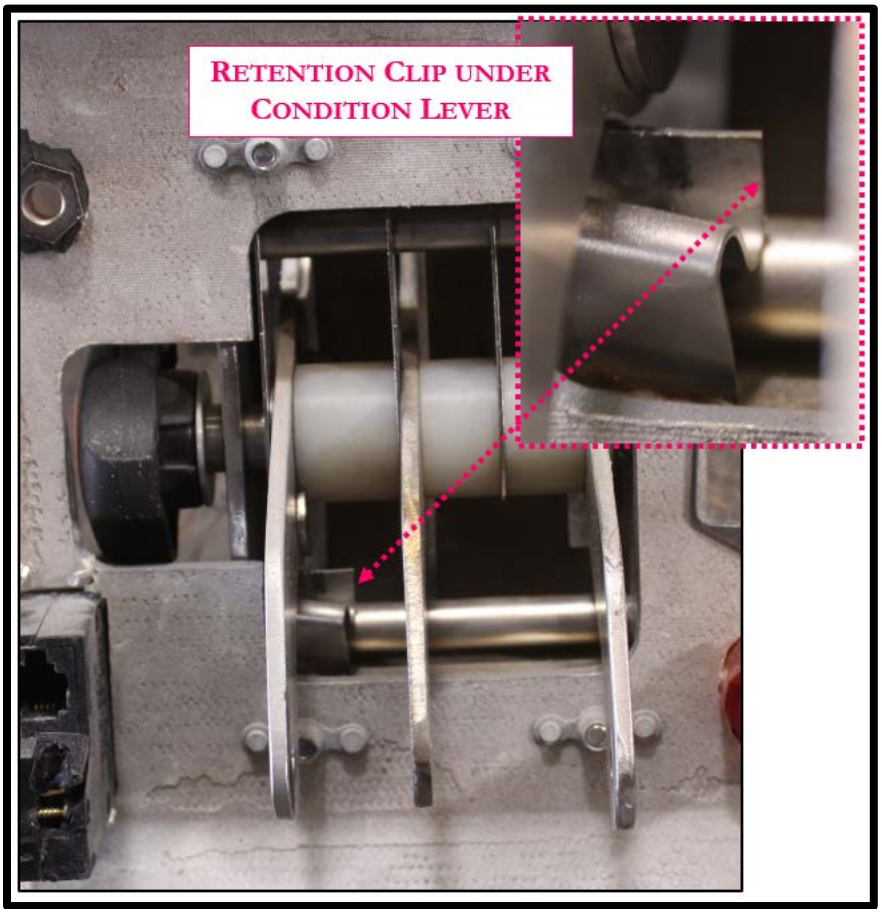


Figure 23: Retention Clip

The generator switch was selected to “on” and the generator circuit breaker was out. The air conditioner switch was “on.”

The engine was removed, and placed in a test cell for operational testing. Prior to the testing the oil level was approximately 6 liters, which is between the acceptable limits (5.5 liter low and 7 liters high). The oil was clean and a bright straw color. The engine started normally. The propeller was cycled twice from fine to feather, 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 or 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 the 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 approximately 18° to 20° or fine pitch. The emergency condition of the blades during an engine problem should be feather, or 90° degrees; the dual acting propeller does not have an internal feathering spring.

Propeller Governor

An external visual examination revealed that the propeller governor was undamaged. Oil was seen to exit the mounting flange passages. The propeller governor featured an oil pressure port which was intended to allow oil pressure from an emergency electric feathering pump to feather the propeller in the event of an engine failure; however, this port was intentionally blocked as part of the engine installation design. The double-acting governor intended to be used only with double-acting propellers, used oil pressure to decrease and increase propeller blade pitch.

A review of the accident Lancair airplane systems revealed that there was no emergency electric propeller feathering pump installed in the airplane. According to Lancair, there was no requirements or engine installation guidance to have such a system installed.

Emergency feathering, without an emergency electric propeller feather pump, can also be activated by moving the propeller conditioning lever onto the feather stop; however, this requires the gas generator portion of the engine to still be operating since it drives the engine main oil pump and provides oil pressure to the propeller that is used for pitch control and emergency feathering. If the main oil pump no longer operates, then the only way the blades can be driven into the feather position is by the moment of the counterweights, however this requires the propeller to be rotating quickly for the counterweights to be effective. Additionally, the aerodynamic loads on the propeller blades, which drive the propeller into the feather position, are also very low when the propeller is rotating slowly.

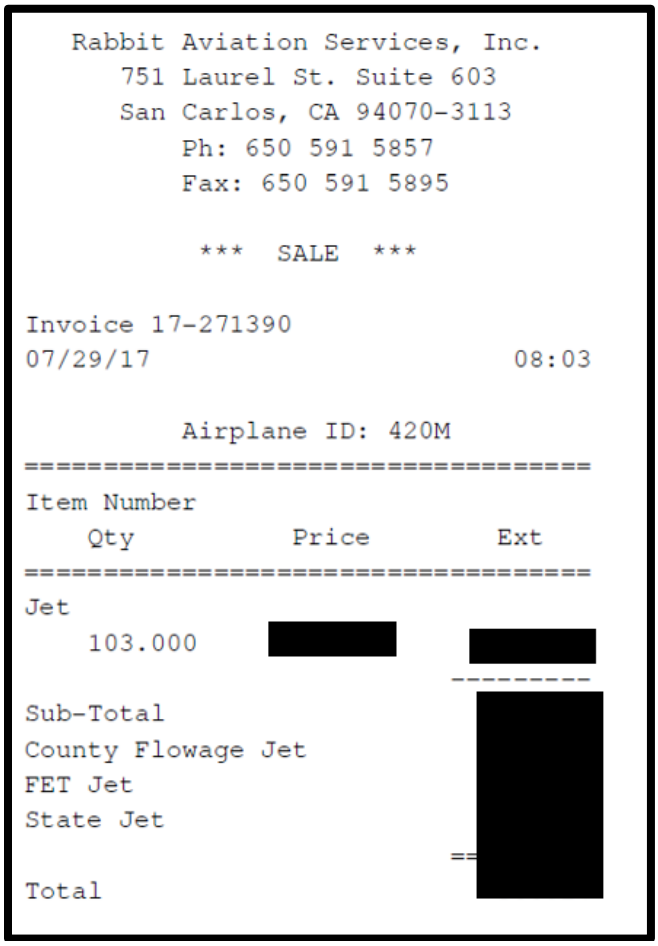
In an installation without an emergency electric propeller feather pump: when an engine loses power for any reason, the gas generator section quickly stops rotating and there is no engine oil pressure available to feather the propeller. With no engine power to turn the propeller, it will quickly stop rotating, making the counterweights and aerodynamic pressure on the rotating blades the only driving force to feather the propeller; however, unless the pilot immediately moves the propeller conditioning lever into feather stop, the propeller RPM will be too slow for the counterweights and aerodynamic loads on the blades to feather the blades in a

timely manner, thus effectively locking the propeller pitch into the last selected position at the time of engine failure.

FUEL SYSTEM

The fuel system consisted of two 56-gallon wing tanks and a 36-gallon belly tank that all fed into a 24-gallon header tank. From the header tank there was an electric boost pump where the fuel was fed through a fuel filter and continued by the fuel pressure sensor and then the fuel flow sensor to the fuel control unit (FCU), meaning the pressure and flow displayed on the instrument panel were based on what the pressure header tank was supplying to the FCU. The header tank had a vent line.

The fuel pressure remained relatively stable through the flight. Immediately after the accident, the left and right fuel pumps were selected to “auto” and the center pump was selected to “off.” During a post accident examination of the fuel system, the fuel line was detached from the fuel control unit (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 recorded fuel flow of about 70 gallons per hour.



Rabbit Aviation Services, Inc.
751 Laurel St. Suite 603
San Carlos, CA 94070-3113
Ph: 650 591 5857
Fax: 650 591 5895

*** SALE ***

Invoice 17-271390
07/29/17 08:03

Airplane ID: 420M

Item Number	Qty	Price	Ext
Jet			
	103.000	[redacted]	[redacted]
Sub-Total			[redacted]
County Flowage Jet			
FET Jet			
State Jet			
Total			

Figure 24: Fuel Receipt

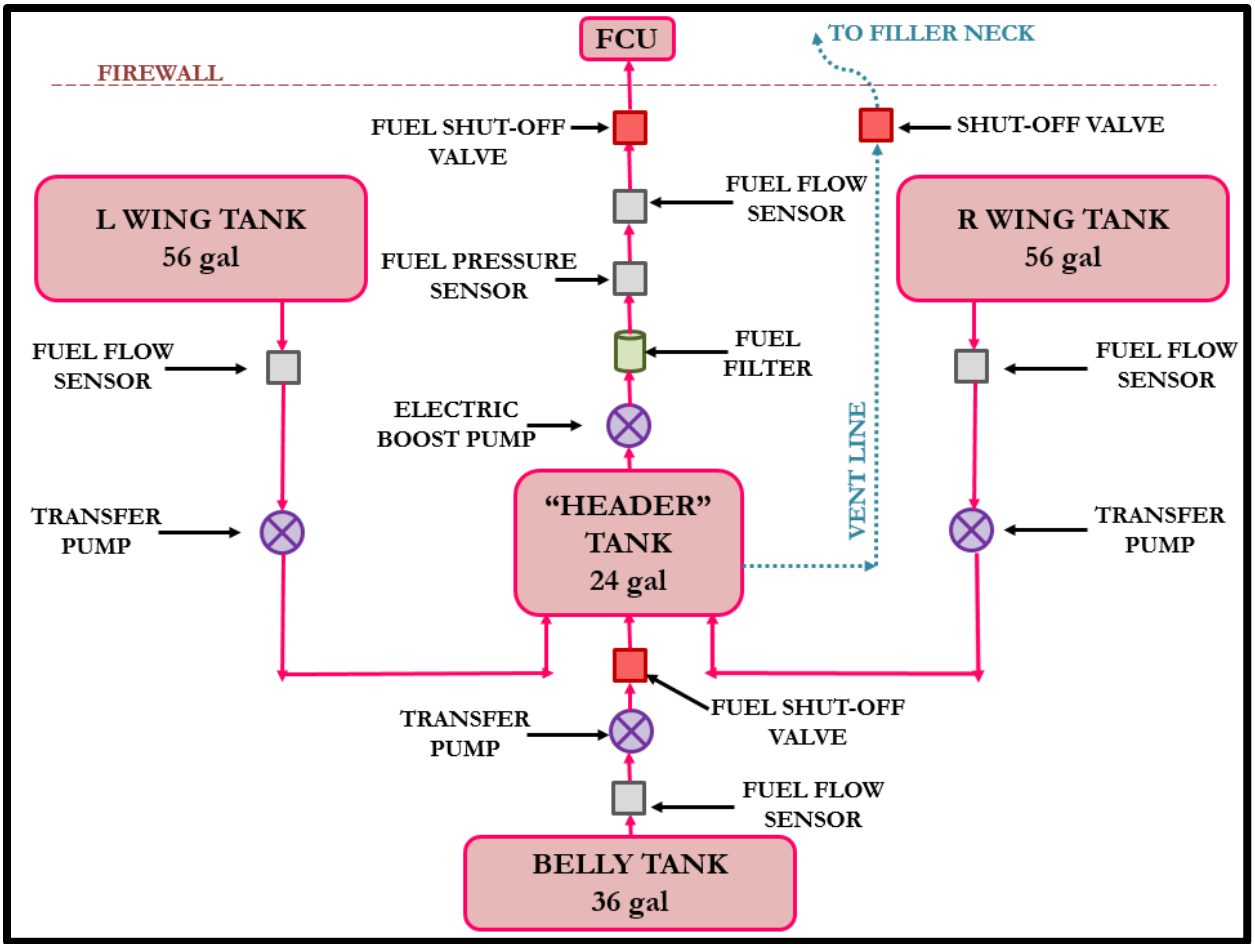


Figure 25: Fuel System

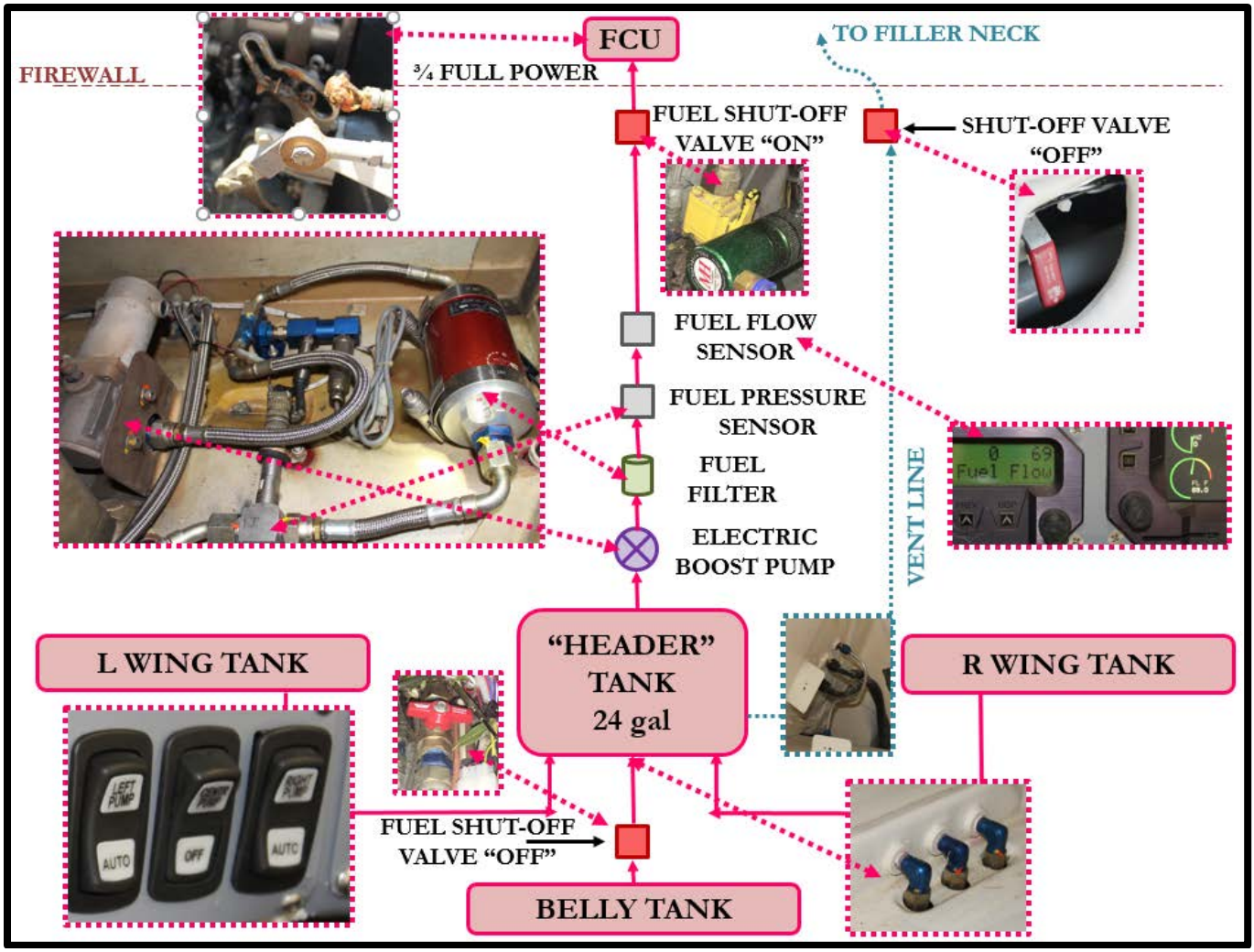


Figure 26: Fuel System as Installed

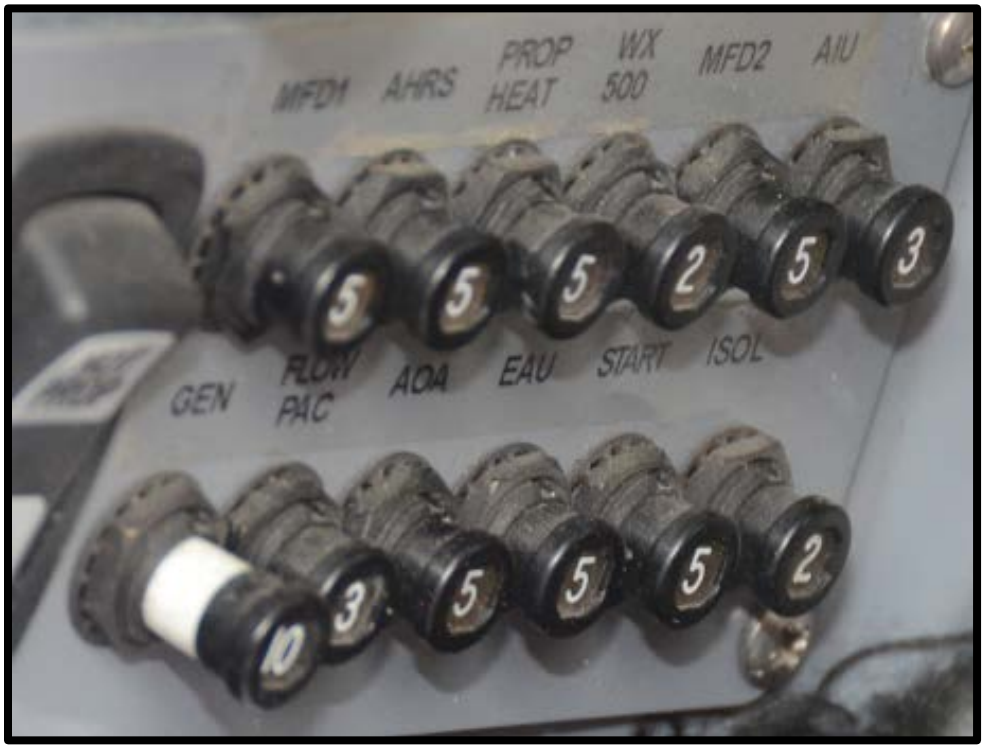
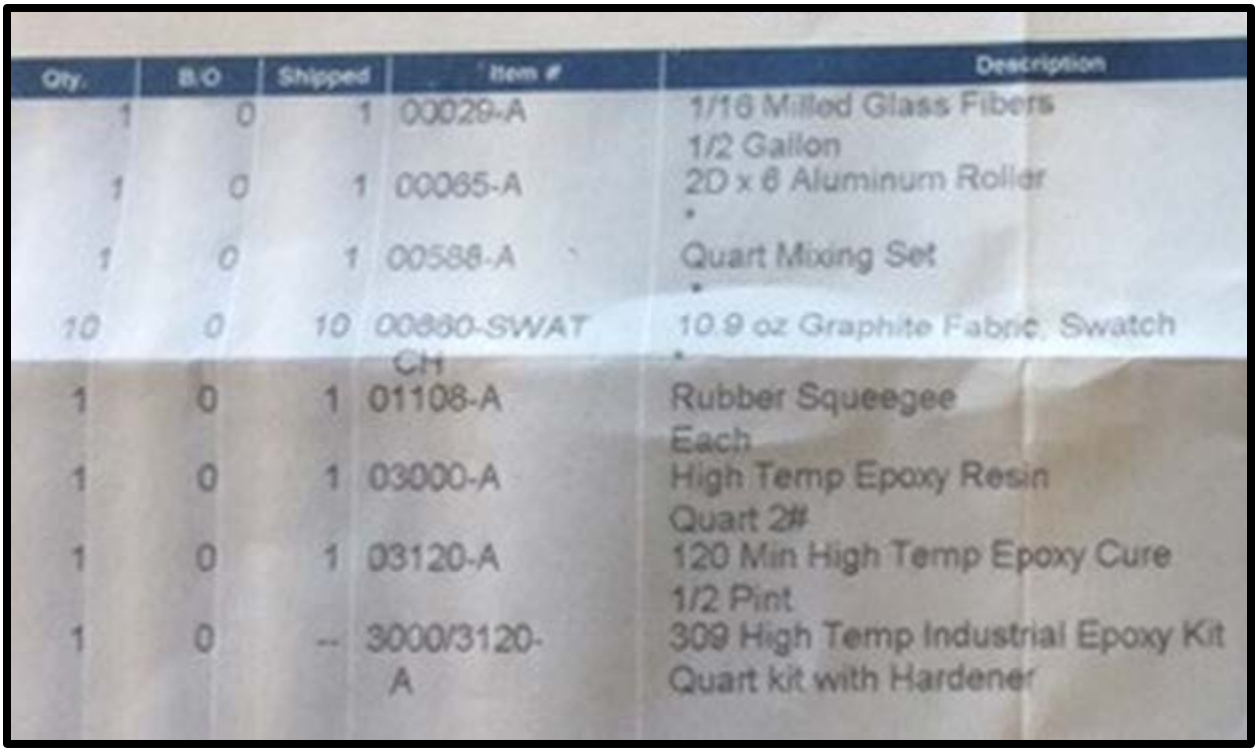


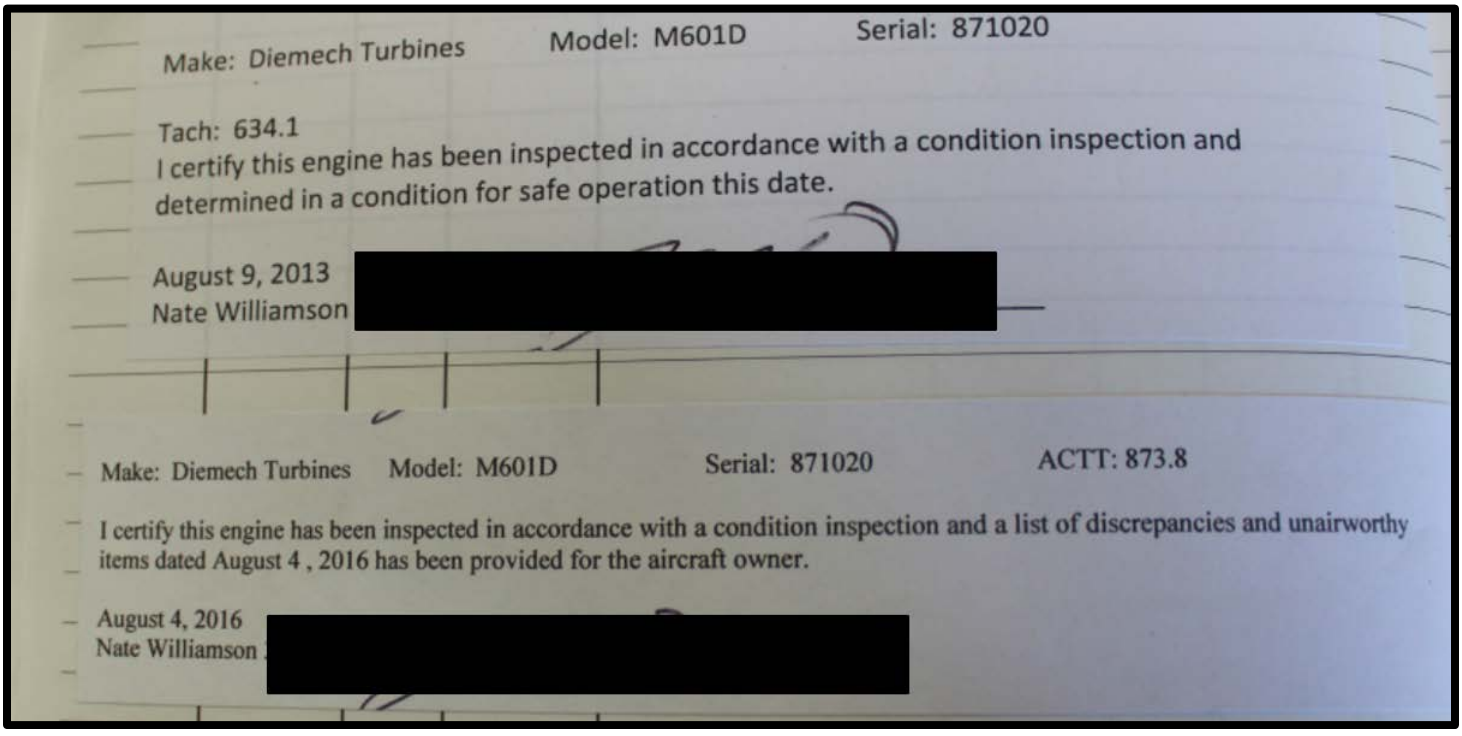
Figure 27: Generator Circuit Breaker

The pilot had ordered materials from Fibre Glast that arrived at his residence after the accident. It was likely to be used for the accident airplane but it is unknown what he was doing with the materials.



Qty.	B/O	Shipped	Item #	Description
1	0	1	00029-A	1/16 Milled Glass Fibers 1/2 Gallon
1	0	1	00065-A	2D x 6 Aluminum Roller
1	0	1	00588-A	Quart Mixing Set
10	0	10	00880-SWAT CH	10.9 oz Graphite Fabric, Swatch
1	0	1	01108-A	Rubber Squeegee Each
1	0	1	03000-A	High Temp Epoxy Resin Quart 2#
1	0	1	03120-A	120 Min High Temp Epoxy Cure 1/2 Pint
1	0	--	3000/3120-A	309 High Temp Industrial Epoxy Kit Quart kit with Hardener

Figure 28: Invoice Showing Materials Received After the Accident



Make: Diemech Turbines Model: M601D Serial: 871020

Tach: 634.1
I certify this engine has been inspected in accordance with a condition inspection and determined in a condition for safe operation this date.

August 9, 2013
Nate Williamson [redacted]

Make: Diemech Turbines Model: M601D Serial: 871020 ACTT: 873.8

I certify this engine has been inspected in accordance with a condition inspection and a list of discrepancies and unairworthy items dated August 4 , 2016 has been provided for the aircraft owner.

August 4, 2016
Nate Williamson [redacted]

Figure 29: Last Engine Maintenance

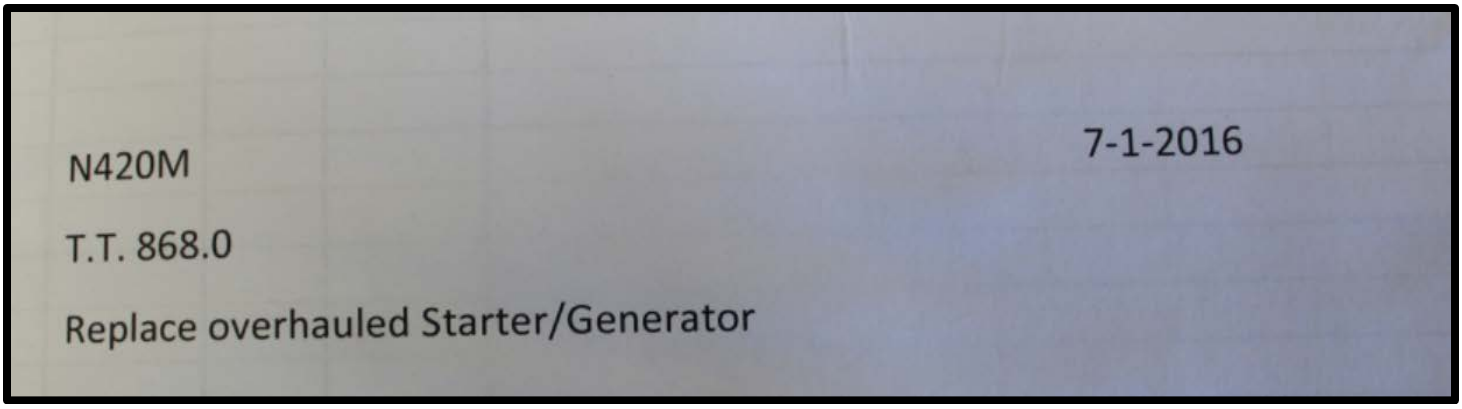


Figure 30: Maintenance Logbook Entry

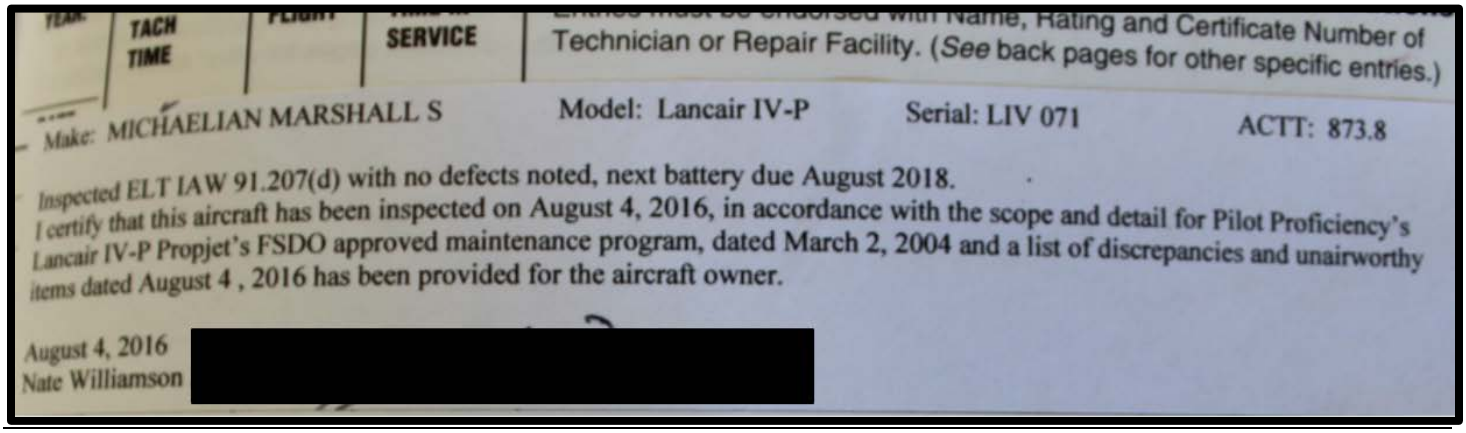


Figure 31: Last Airframe Maintenance Logbook Entry

WEATHER

South to southwest wind 5 to 10 knots high cirrus clouds; on the warm side with near record temperatures.

PILOT INFORMATION

A review of Federal Aviation Administration (FAA) airman and medical certification records revealed that the pilot, age 71, held a commercial pilot certificate with category ratings for multiengine and single-engine land airplanes; he held a rating for instrument flight. The pilot's most recent third-class medical certificate was issued October 2014, with the limitation that he must wear corrective lenses.

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