

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



WPR22FA335

INVESTIGATIVE MATERIAL SUPPLEMENT

ACCIDENT

Location: Columbia, California
Date: September 05, 2022
Time: 0948 Pacific daylight time
Airplane: Rutan Varieze

INVESTIGATIVE MATERIAL SUPPLEMENT

IIC Zoë Keliher
National Transportation Safety Board
Portland, Oregon

HISTORY OF FLIGHT

On September 05, 2022, about 0948 Pacific daylight time, a Rutan Varieze, N10EZ, was substantially damaged when it was involved in an accident near Columbia, California. The pilot was fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

The pilot had been performing maintenance on the accident airplane and upgrading various systems. The weeks prior to the accident, he installed an Electroair electronic ignition system. The accident flight was the first flight out of maintenance.

The radar and automatic dependent surveillance-broadcast (ADS-B) information disclosed that the airplane departed runway 17 about 0845. The airplane continued southeast about 8 nautical miles (nm) and then returned back to the airport, landing on the same runway about 0858.

The recorded data then shows that around 0903, the airplane departed and continued southeast in a climb for about 35 nautical miles (nm). After about 18 minutes, the airplane made a 180° left turn while passing through 13,500 ft mean seal level (msl). The airplane climbed to a peak altitude of 16,475 msl and then began a descent, maneuvering into a left traffic pattern for runway 35.

The airplane made a high-speed pass over runway 35 and then continued north-northeast for about 5 nm. Thereafter, the airplane returned back to the airport and around 0945, it passed over the center of the airport at an altitude of 2,850 ft (see Figure 1 below). The airplane turned right and joined the right traffic pattern for runway 17. At 0946:56, the airplane turned onto the base leg and the airspeed decreased.

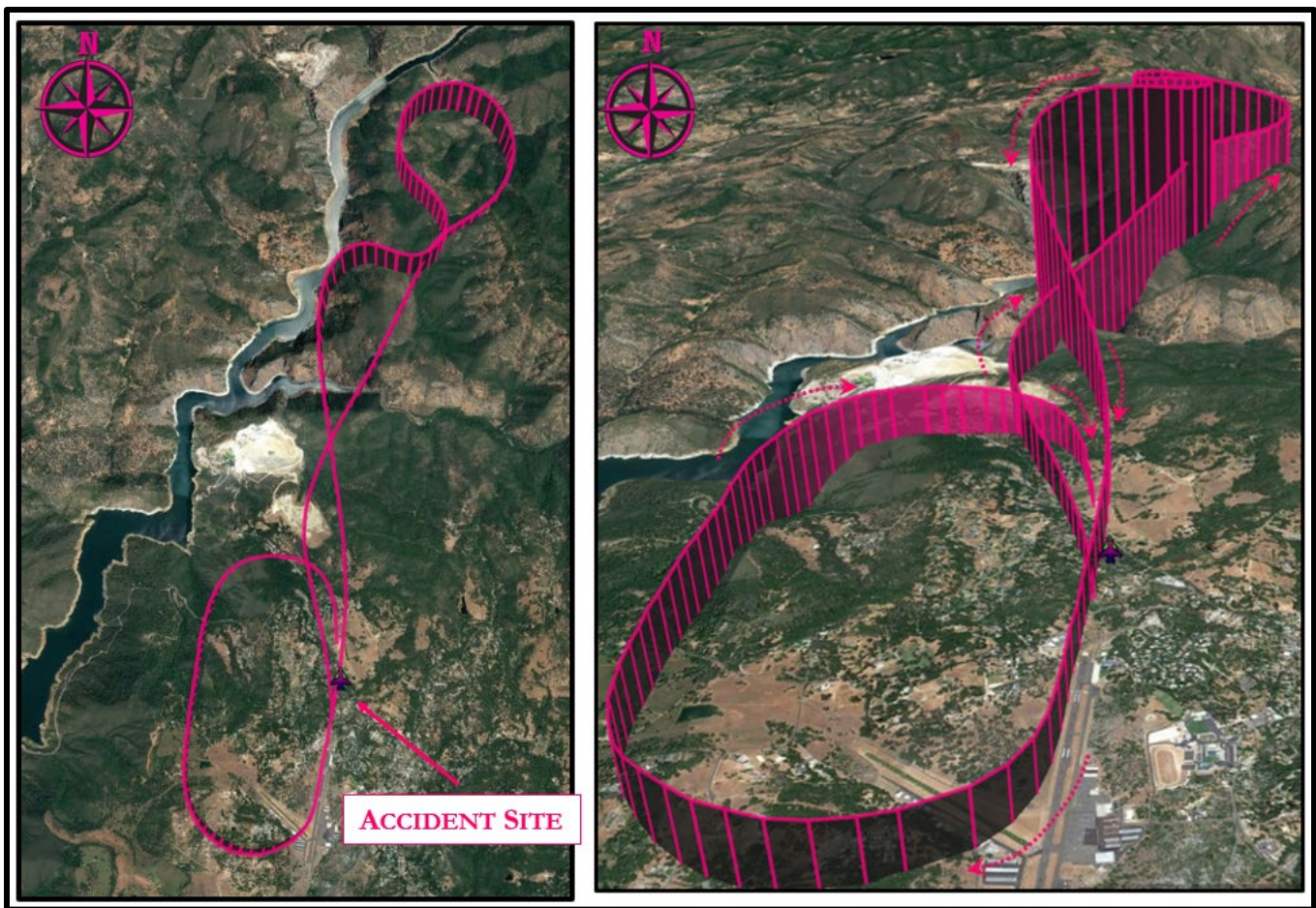


Figure 1: Recorded ADS-B Data from the End of the Accident Flight

The recorded data further disclosed that at 0947:25, when the airplane was about 1.25 nm north of the runway, at an altitude of about 680 ft above ground level (agl), it turned onto final approach at an airspeed of about 70 kts. The remaining data stretched over a distance of 3,200 ft in 24 seconds, equating to a derived ground speed of about 66 knots and a descent of about 400 ft. The last ADS-B point was at an altitude of 195 ft agl and about 1,800 ft north of the accident location.

A comparison of the first flight and the accident flight revealed that the speeds were similar during the landing approach. The first flight passed near the location of the last recorded ADS-B return about 75 ft higher (see Figure 2 below).

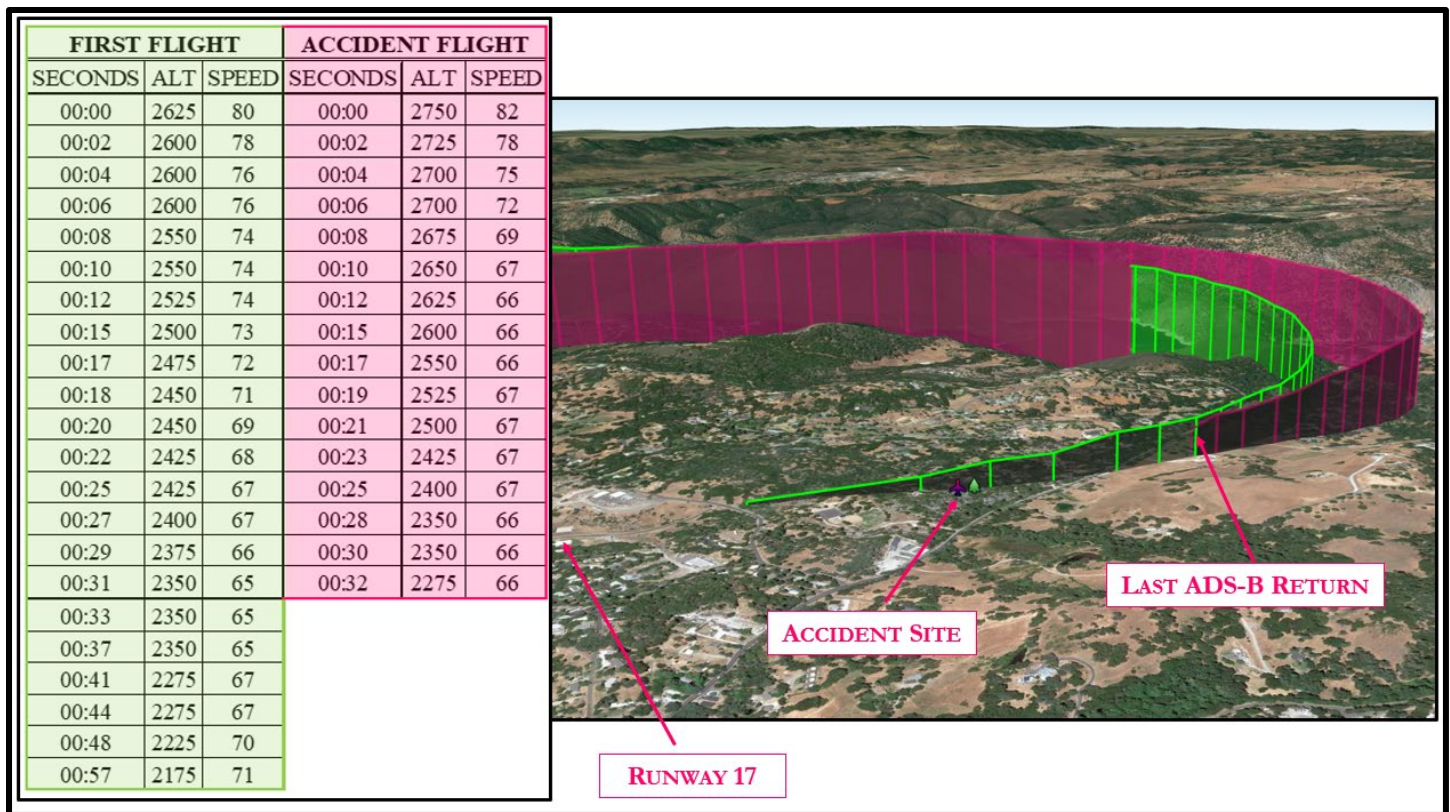


Figure 2: Comparison of Flights with Speeds

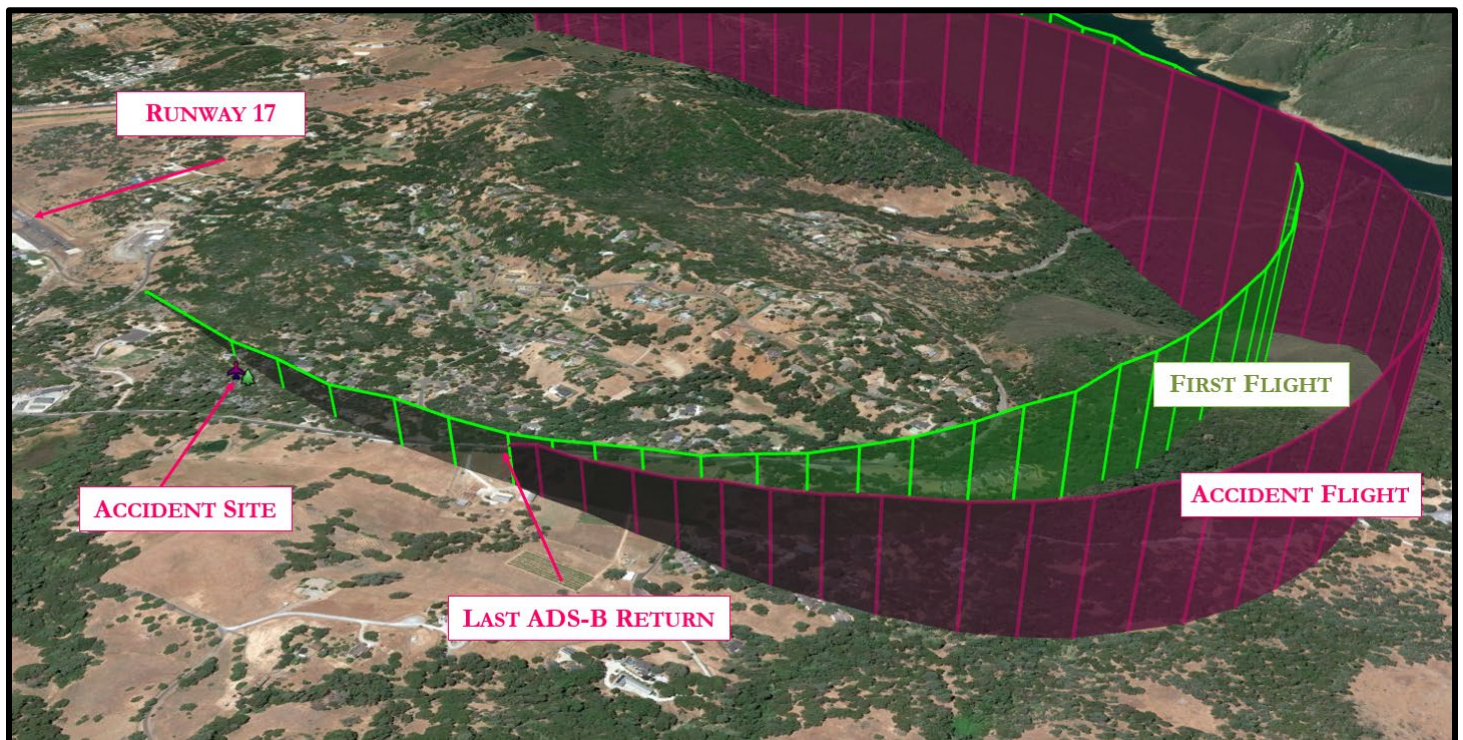


Figure 3: First Flight Path in Comparison to Accident Flight

AIRPLANE INFORMATION

The amateur-built Rutan Varieze airplane, serial number BB001, was manufactured in 1993. The airplane was powered by a rear-mounted Continental O-200 reciprocating engine rated at 100 horsepower, and drove a fix-pitched, composite propeller. A review of Federal Aviation Administration (FAA) records revealed that several individuals had owned the airplane and the accident pilot had purchased the airplane in May 2021

WRECKAGE AND IMPACT

The accident site was located in a sparsely populated residential neighborhood in uneven terrain made up of large boulders, loose rocks, and numerous trees and brush. The main wreckage, consisting of a majority of the airframe and engine, was about 0.5 nautical miles north of the runway threshold at 38.043051,-120.409957. There was a northwest-southeast oriented main-road located 375 ft east of the accident site and numerous other streets in the immediate area.

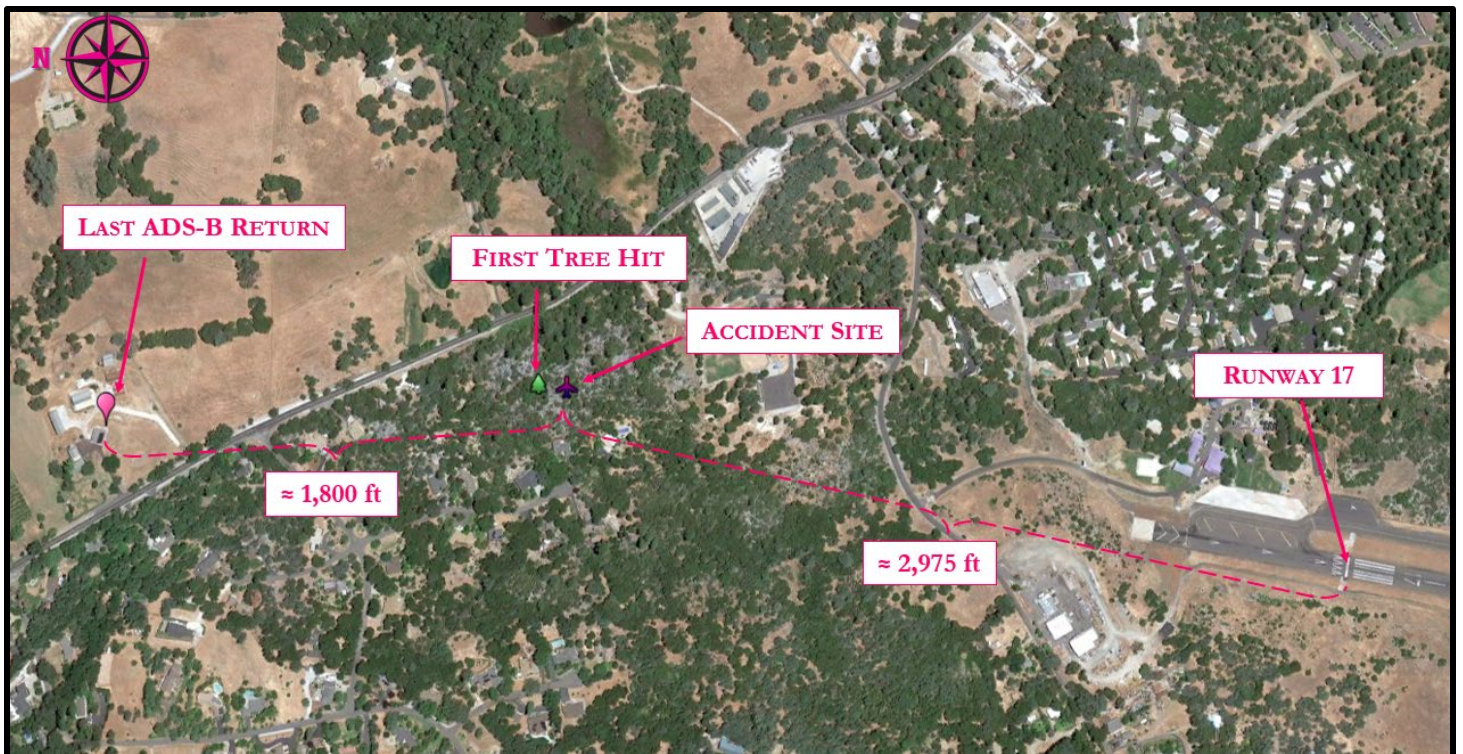


Figure 4: Wreckage Site in Reference to the Last ADS-B

The first identified point of impact was a 50-ft maple tree about 110-ft from the main wreckage on a bearing of 185°; the top of the tree had several severed limbs. Adjacent to the tree was a small portion of the outboard right wing cuff. The second point of impact was a large 80-ft tall fir tree located 90-ft from the wreckage on a bearing of 201°; there were severed branches about 35 ft up the tree. Pieces of the nose and forward undercarriage were about 30 ft from the wreckage near a boulder that contained several ground scars. The right and left canards were found fragmented in the debris field around the ground scar and the main wreckage. The airplane fuselage came to rest inverted, and the wings remained attached. The wreckage was consistent with the nose gear being in the down position. The keys were not in the ignition, which was in the “off” position.

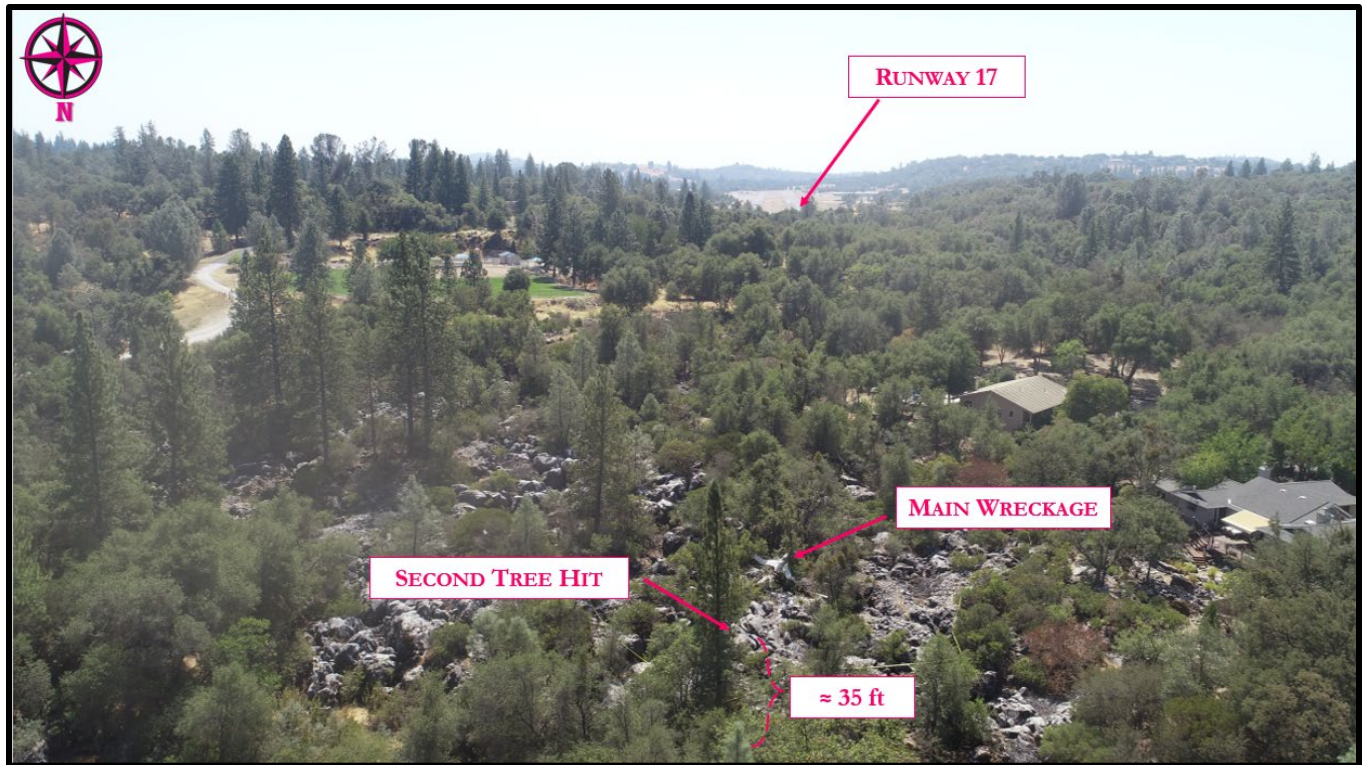


Figure 5: Wreckage Site in Reference to the Runway

The engine remained attached to the airframe by the engine mounts. Visual examination of the engine revealed no evidence of preimpact catastrophic mechanical malfunction or failure. The propeller was not damaged except for a bent tip on one blade as a result of the impact.

AIRFRAME

Complete control continuity could not be verified due to the extensive impact-related damage. The airplane sustained major crush damage to the front cockpit. The wiring in the front was hanging over a boulder.



Figure 6: Front of Airplane

The nose landing gear was fully extended. A towel was near the mechanism, but it did not appear to have affected the extension.

The wings' center-section spar cap was inspected for corrosion. Investigators cut out the aluminum fittings on the top and bottom of the right-wing and no corrosion was observed.

The airplane was swabbed and samples were sent to the Smithsonian National Museum of History for analysis. While numerous traces of bird were found in several samples, it was not consistent in quantity and origin with a bird strike.

FUEL SYSTEM

The fuel tanks were all intact and there was no evidence of a breach. There was no fuel found in the left tank; about 2 gallons found in the right tank; and about 6 ounces in the header tank. The fuel found was free of water and debris. There was evidence of seepage out of the vented cap in the header tank (blue staining). The same liquid was found when activating the accelerator pump in the carburetor, but the bowl was dry. The impact damage made it not possible to determine the total fuel quantity at the time of impact.

According to the VariEze Owner's Manual:

If engine failure occurs when there is less than one gallon of fuel in one or both fuel tanks, or during a long, sustained, steep descent with low fuel (less than two gallons in each tank), the most probable cause is fuel starvation. Select fuselage tank. If wing fuel starvation occurred during descent, the wings may have one to two gallons of fuel that is still usable during level flight or climb.

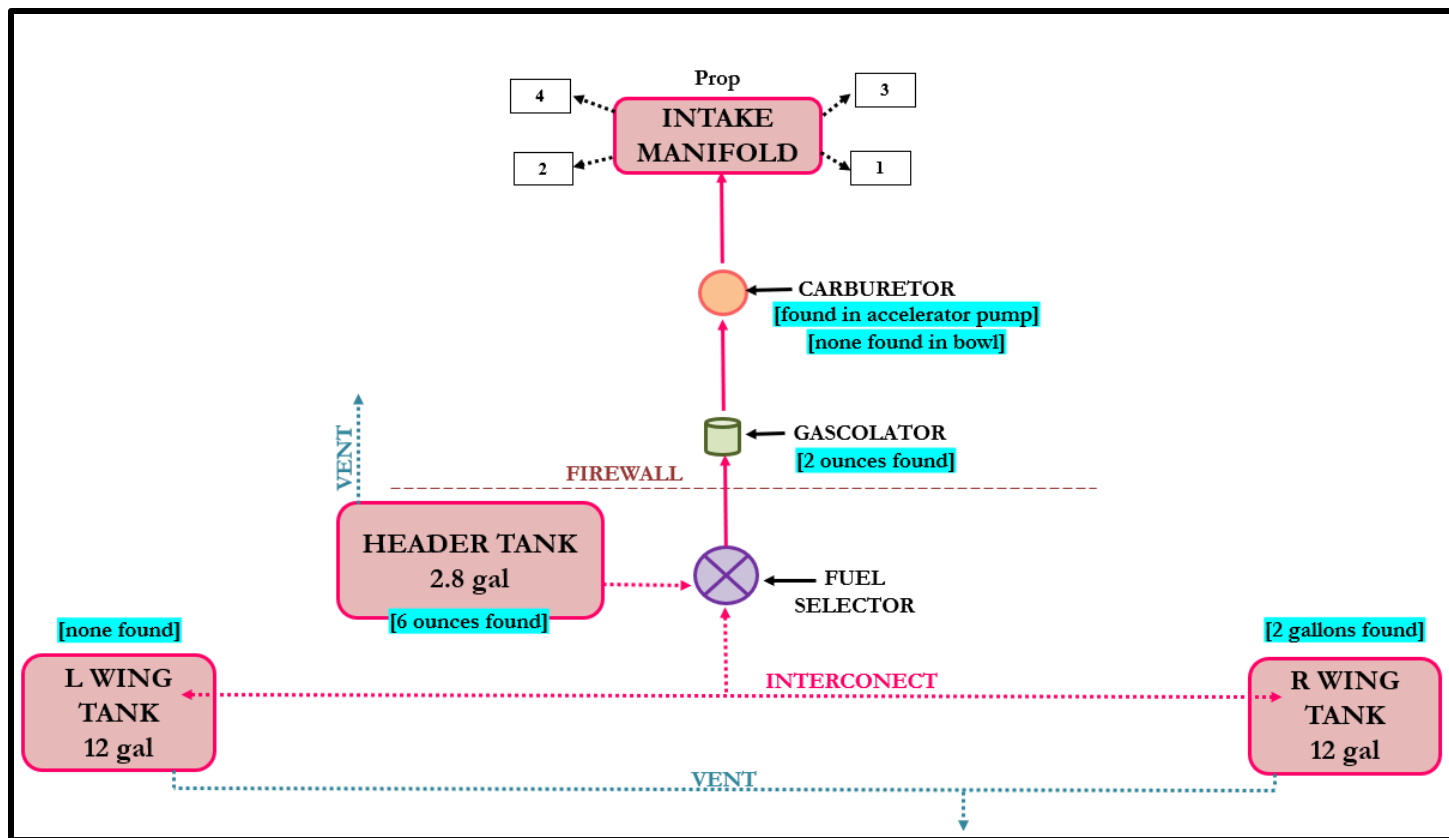


Figure 7: Fuel System Diagram

The carburetor was a Precision model MA-3SPA. The carburetor remained intact and was attached at the mounting pad. The throttle/mixture controls were found securely attached at their respective control arms on the carburetor and continuity to the cockpit was established. The engine compartment fuel lines were found to be in place and secure at their respective fittings. The fuel bowl of the carburetor contained no fluid; upon activation of the accelerator pump, fluid jet out. The metal float pontoons were not damaged. The butterfly valve was in the near-closed position there was a black outline on the intake.

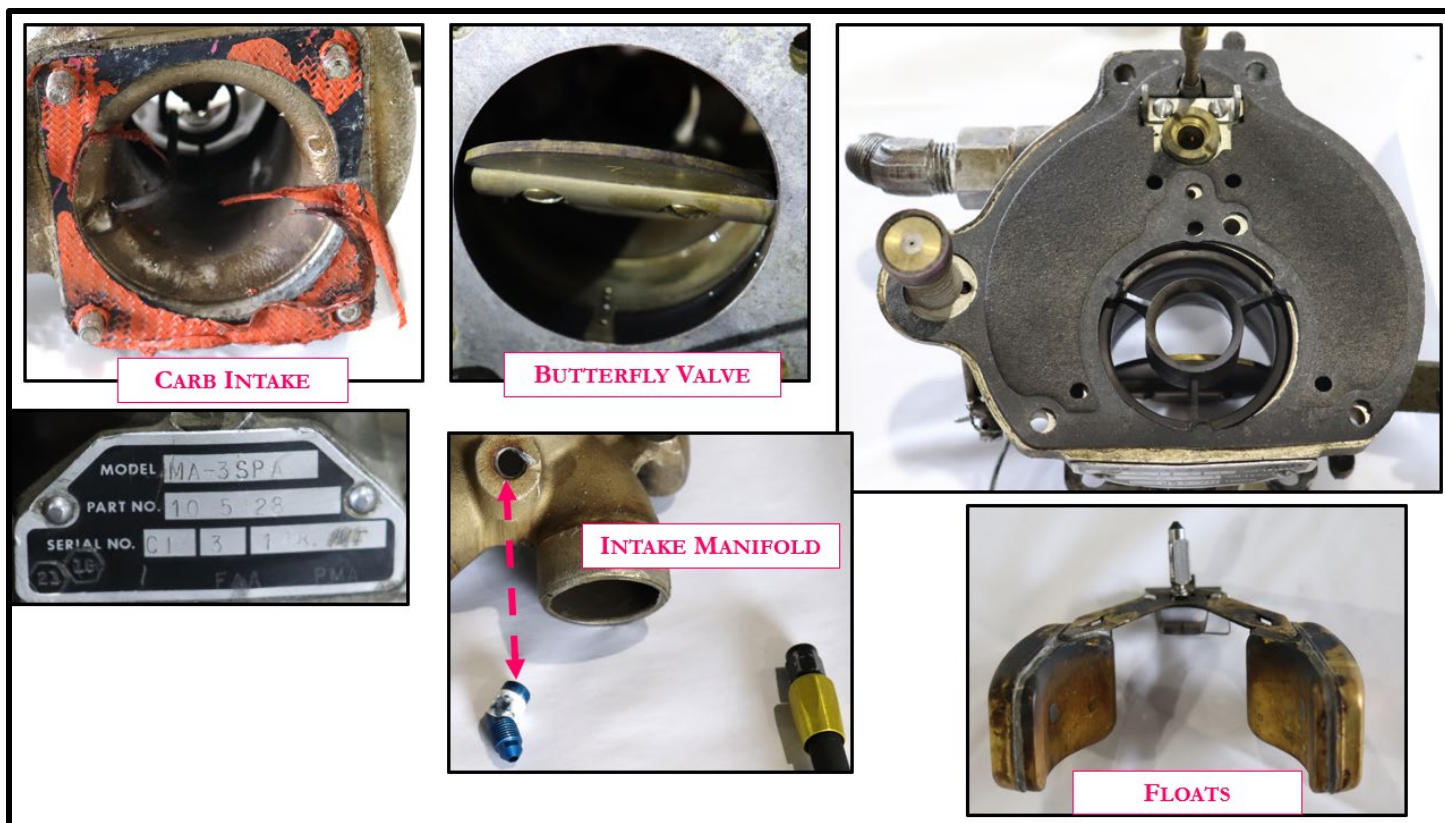


Figure 8: Carburetor (Showing Shooting)

The fuel selector position could not be confirmed due to the damage from the cockpit handle to the selector located aft of the cockpit. There was wiring ty-wrapped to fuel lines at the fuel selector and chaffing was seen on the insulation.

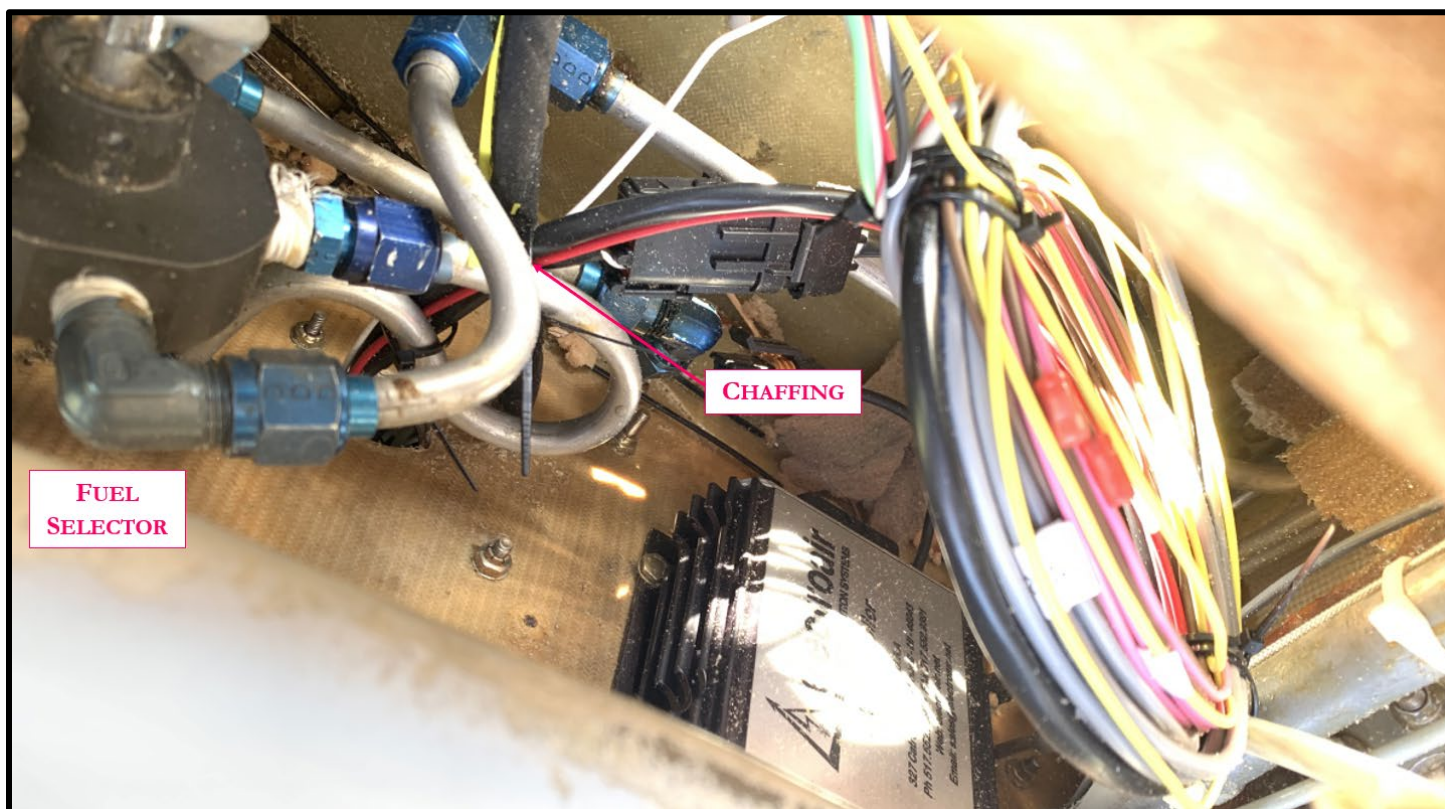


Figure 9: Fuel Selector Connected to Wiring

COCKPIT

There were not circuit breakers tripped on the panel; the master switch was the sole toggle switch that was in the “on” position. The turn-bank coordinator was tumbled (flagged red). The altimeter, with no apparent external damage, was reading incorrect

ENGINE

A Safety Board investigator performed a complete disassembly of the Continental O-200 (s/n 255033) engine. Investigators established continuity of the valve and gear train by rotating the crankshaft via the crankshaft flange (exerting force on the propeller); compression was detected in all cylinders. Normal lift action was observed at each rocker assembly. Clean, uncontaminated oil was observed at all four rockerbox areas. There was no evidence of valve to piston face contact observed. The pistons and their respective rings were intact. The valves were intact and undamaged. The back of the intake valves and the intake pipes were sooty down through the intake manifold to the area above the butterfly valve of the carburetor.

IGNITION SYSTEM

The airplane was equipped with a dual ignition system that the pilot had configured in the month prior; there was one electronic ignition and one magneto installed at the time of the accident.

The ignition system was configured with the Electroair routed to the top spark plugs and the left magneto to the bottom spark plugs. The timing of the magneto was 24° before top-dead center (BTDC); the electronic ignition was internally timed to 22°(BTDC). The magneto was turned on by a keyed ignition and the electric ignition was operated by a single-pole single-throw (SPST) switch.

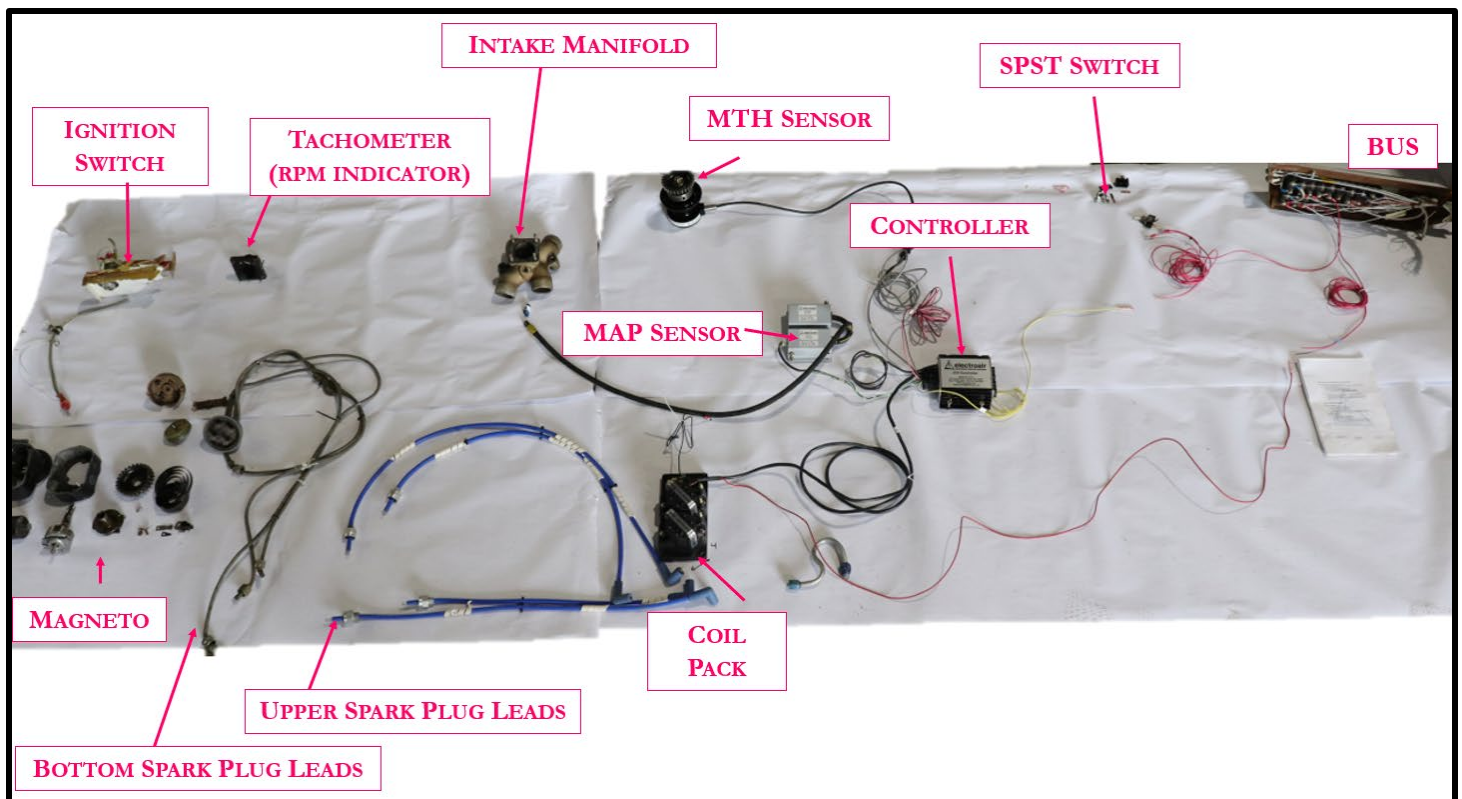


Figure 10: Ignition System

The magneto had two P-leads connected. Both wires were routed to the keyed-ignition switch: one attached to the “right” and one to the “left” position. This would have made the magneto not operable for all positions (OFF, RIGHT, LEFT) except the BOTH position.

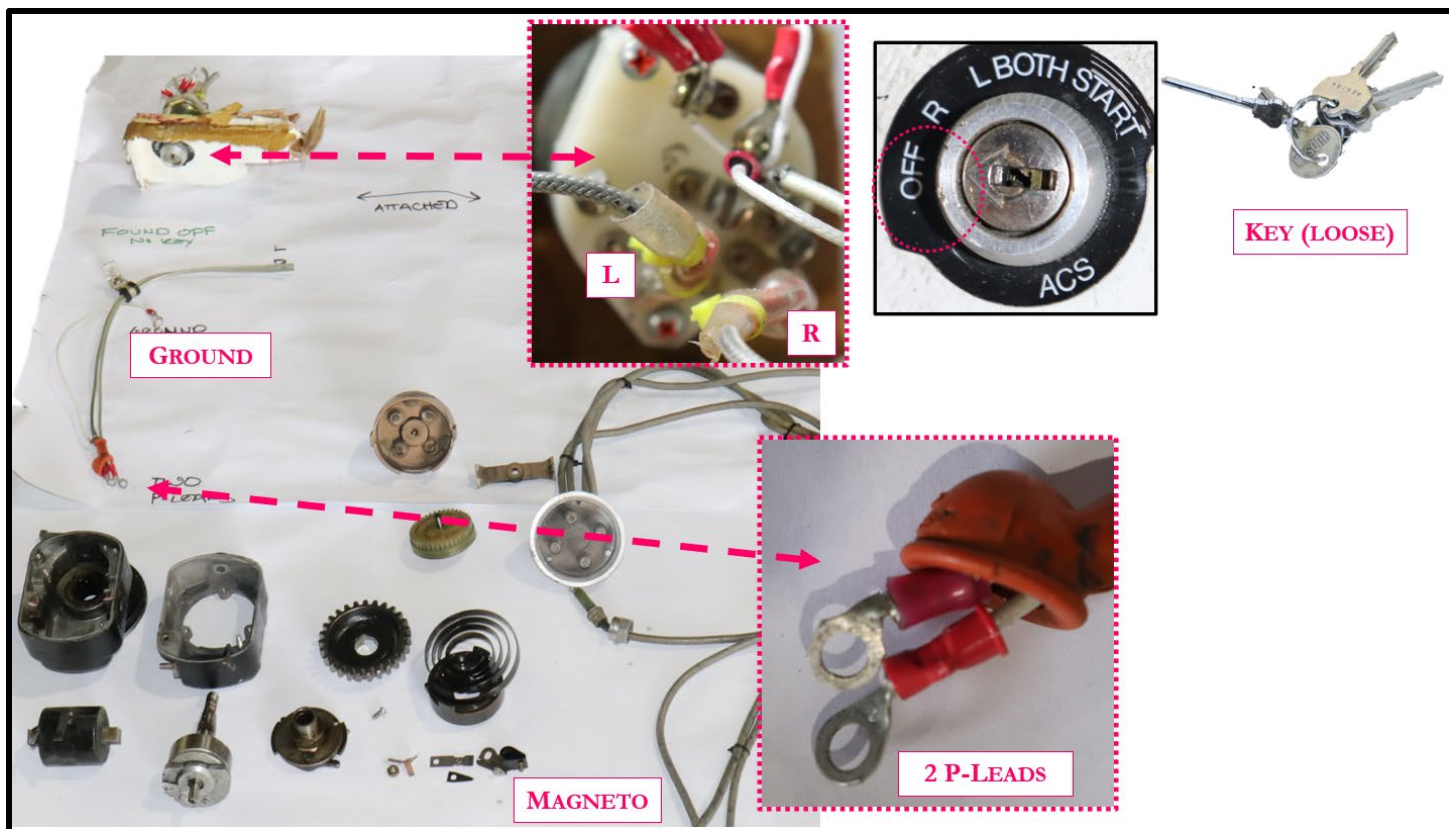


Figure 11: Wiring To/From the Magneto

Disassembly of the magneto revealed a fine carbon dust in the housing and the distributor brush was worn.

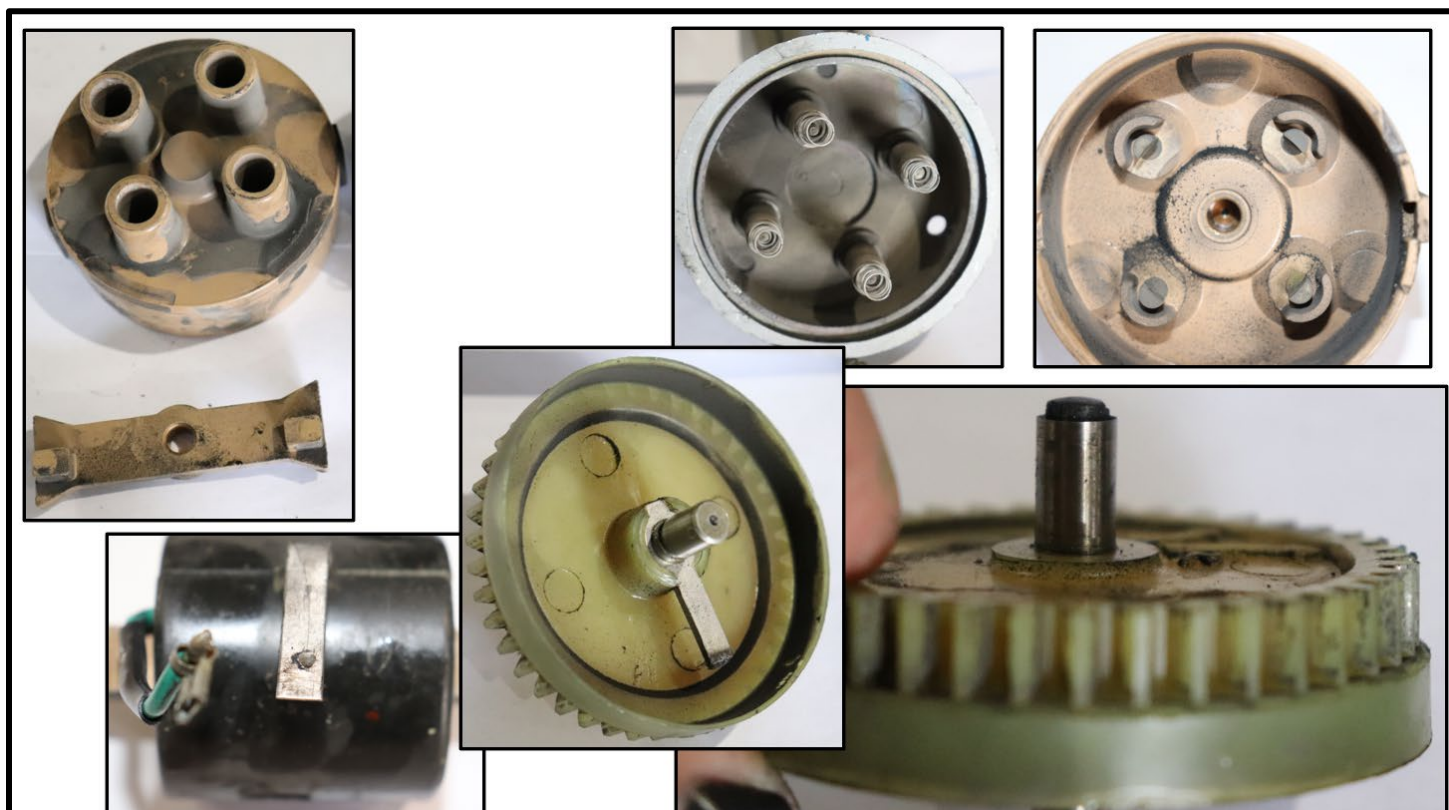


Figure 12: Magneto

The Electroair unit was removed from the airplane. The wire from the coil pack to the bus (10 amp) was separated at the butt splice and had not been properly crimped on one side (the barrel was not depressed on one side); the wire was also chaffed

where it had been routed along the fuel lines. The wire from the controller to the bus (3 amp) was also separated and not properly crimped. The SPST ignition switch on that wire had a tang bent and one wire was not connected; the switch was broken internally. It is unknown if the switch was damaged prior to impact.

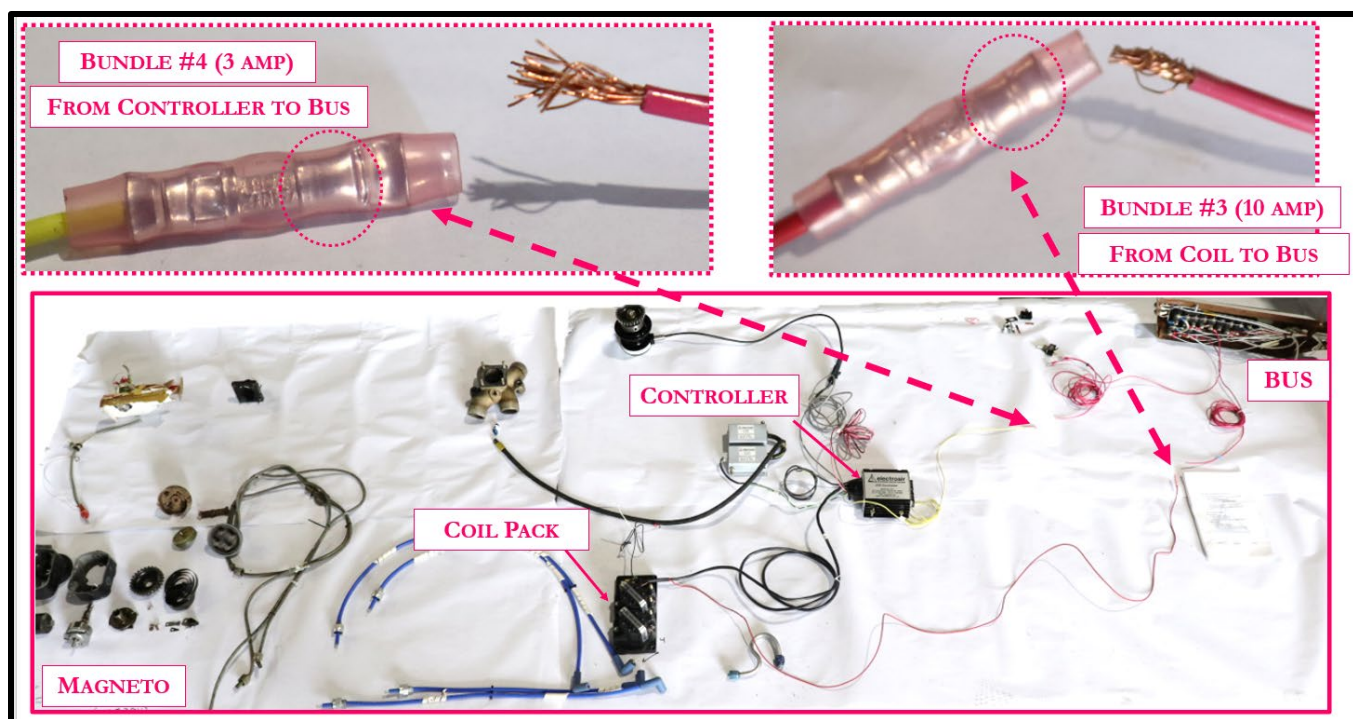


Figure 13: Electrical System Showing Wire Separation

The electronic units were sent to the manufacturer for testing. A terminal on Coil B had broken at the spark plug lead consistent with impact damage. The controller was tested by wiring an exemplar coil to the controller and utilizing a crank trigger simulator for activation. The controller activated the coils on all four towers and operated normally. Coil B was removed, and Coil A was tested and found to operate normally. The controller was disassembled revealing it was set at 21.9° before top-dead-center (TDC). The mag timing housing (MTH) was undamaged; the gears were intact. The MTH was tested with an oscilloscope and determined to be within the expected performance (at the trigger signal it registered 88% with over 70% being passing). The manifold absolute pressure (MAP) sensor was tested on a calibration bench and was operational reaching over 5 volts.

PROPELLER BLADES

The two-bladed fixed pitch was Hertzler SN63x69, installed May 31, 2021.

The propeller remained intact and attached to the engine with no visible chordwise scratches or leading edge damage. One blade was cracked at the tip as a result of coming to rest on a rock.



Figure 14: Propeller at Accident Site

RECORDS

The Hobbs meter at the accident displayed 668.1 hours, equating to 11.4 hours after the last maintenance. The last annual inspection was recorded as being completed on October 06, 2021 at a total airframe time of 676.4 hours and 701.4 hours of engine time since the last major overhaul. On that inspection the mechanic notated the following squawks: both magnetos needed to be replaced and were over-due for the 500-hour inspection; the carburetor had reached the maximum time-between-overhauls (in excess of 10 years). The mechanic entered the following safety concerns:

1. Both Wing Attach Fittings (ALL VARIEZES) - Due to the inherent design from RAF, it is not possible to check for internal corrosion of wing attach fittings. I recommend removing wings at alternate CI's and checking externally for corrosion, with the understanding that without ~40 - 100 hours of disassembly/reassembly, a full inspection of the fittings and full confidence in the condition of the fittings is not possible. Plan on wing removal for more extensive examination at the 2022 CI. Obey RAF's +2.5G / -1.5G limits
2. Magnetos - remove, inspect, repair as required. These are well past the 500 hour mark for inspections and refurbishment, with unknown time on each. I recommend: <http://aeroacc-vny.com/> for magneto service, but there are many other shops as well
3. Right Fuel Sight Gauge - seems to have a clog in the bottom hole, preventing accurate level indication. either re-drill lower hole and repair, or install electric fuel level senders

According to the Owner's Manual for and Engine Out Approach:

If an engine-out landing is unavoidable, check wind direction, choose your landing area, and establish your glide at 80 to 85 knots. Gliding performance is shown on page __. Remember that with the engine out and prop windmilling, your glide will be considerably steeper than the normal engine-idle glide that you are accustomed to. If you are radio equipped, tune in 121.5, declare an emergency, and give your intended landing site. Shut off the fuel valve. Your landing gear should be down, even for an off-airport landing in rough terrain or water. Your glide will be steepened and rate of descent increased with the gear down. Turn your electrical power and mags off before touchdown to minimize any potential fire hazard. Touchdown as slowly as possible if landing in rough terrain.

The pilot added 7.28 gallons of Avgas several days before the accident. A review of the ADS-B data revealed that he did not fly between that time and the accident flight.

Created on (UTC): 9/6/2022 4:27:38 PM

Terminal: M4000-4000666

Start Date: 8/6/2022 9:26:00 AM

End Date: 9/6/2022 9:26:00 AM

Date	Invoice #	Status	Card Number	Card Holder Name	Card Type	Product / Pump	Amount	Units	Tail Number
9/2/2022 7:59:17 PM	105045	CLOSED		LANCASTER/KEN R		100 LL / 100 LL #2		7.2800	N10EZ

Running Totals

Number of Sales: 1

Sale Total:

Units Total: 7.2800

Figure 15: Last Fuel Receipt

PILOT INFORMATION

Pilot: Ken Randall Lancaster

The Commercial Pilot AMEL, Instrument; Private Privileges ASEL; Flight Instructor, was a 42-year-old male. This pilot reported civil flight experience that included 1200 total and 150 hours in last six months as of exam dated 1/25/2022. This pilot was 73 inches tall and weighed 168 lbs. at the time of the last exam. This pilot was issued a Second Class Medical Certificate without limitation. He had flown for Cal Fire.

WEATHER INFORMATION

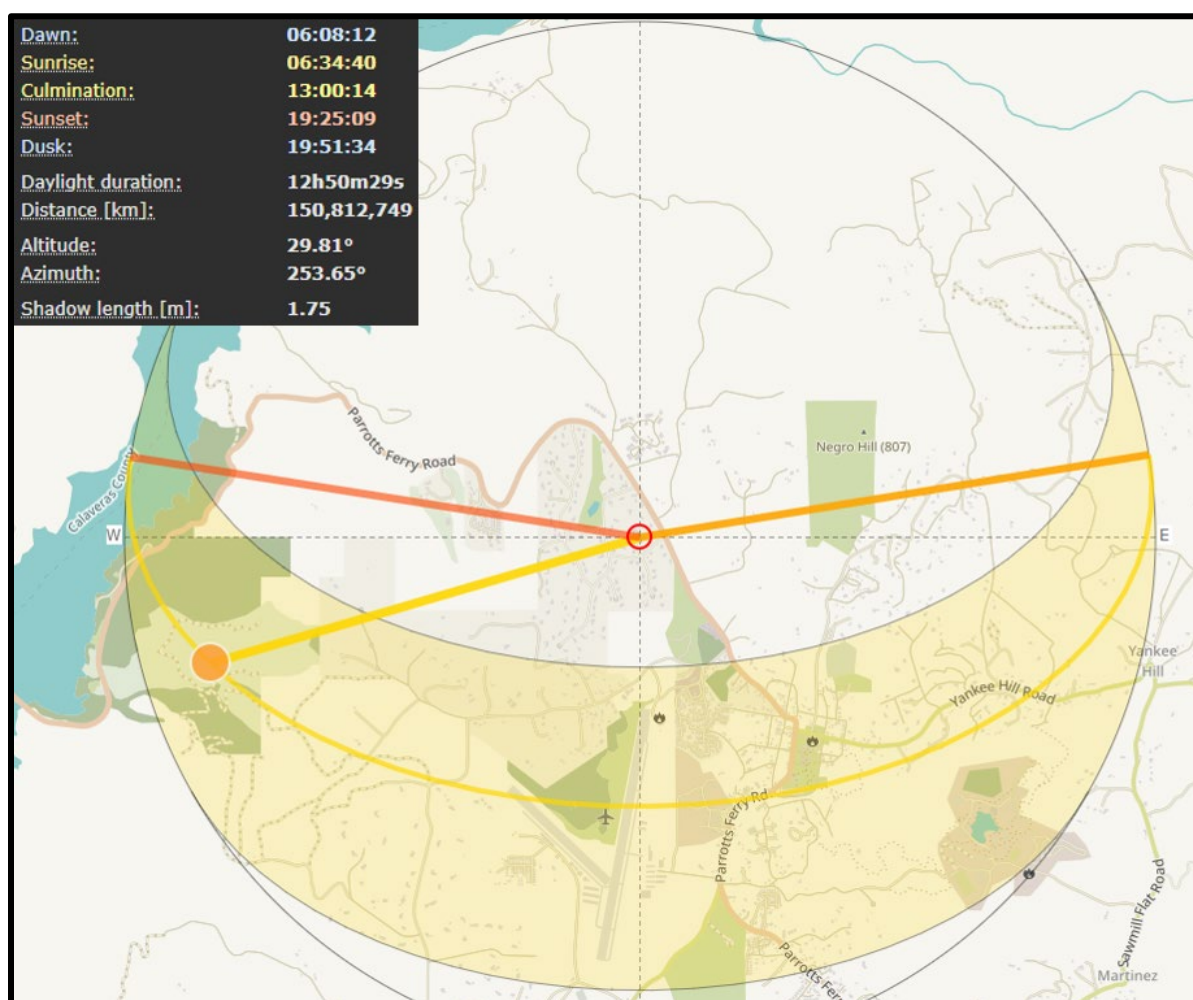


Figure 16: Sun Calculation (from suncalc.org)