

Factual Narrative

HISTORY OF FLIGHT

On June 19, 2016, about 1152 Pacific daylight time, a Piper PA-23-150, N1270P, was destroyed ~~when it after~~ collided ~~ed~~ with a ~~commuter railcar wash~~ building ~~following a loss of engine power~~ during an approach to land at Hayward Executive Airport (HWD), Hayward, California. The airline transport pilot was fatally injured. The airplane was registered to and operated by the pilot under the provisions of ~~Title 14~~ Code of Federal Regulations (CFR) Part 91. Visual meteorological conditions prevailed, and no flight plan was filed for the local ~~personal~~ flight ~~that-~~. ~~The personal flight~~ departed HWD about 1035.

According to a witness ~~at the airport, on the day of the accident,~~ the pilot ~~spent about 25 minutes conducting-completed~~ a series of high speed taxi tests ~~in the airplane on runway 28L for about 25 minutes before he departed on the accident flight. A witness stated that he observed the accident airplane complete the taxi tests on runway 28L on the morning of the accident flight. The pilot then taxied the airplane to the airport's was subsequently refueled at a self-serve fuel kiosk, and, a few minutes later, he then~~ taxied ~~it~~ to the airport-run-up area. ~~The witness remarked that the engines did not sound "synchronized" during the run-up.~~

Federal Aviation Administration (FAA) radar data ~~was plotted using a third party mapping program that featured a satellite view of the terrain. The data showed that~~ the airplane departed HWD to the south, ~~turned east, crossed over a mountain range, and turned north before it transitioned east over a mountain and then north. The airplane flew north, maneuvered over the north end of San Francisco Bay, and then flew~~ ~~The airplane completed~~ a reverse course ~~back during its return flight toward~~ HWD. According to an Air Traffic Control report furnished by the FAA, ~~a~~ At 1145:06, ~~when the airplane was about 10.5 nautical miles (nm) southeast of the airport, the pilot contacted the HWD air traffic control tower for a landing clearance about 10.5 nautical miles (nm) southeast of the airport. The local controller instructed the pilot was instructed to proceed to a straight in approach for runway 28L and to advise the controller when he was 3 three miles from the airport, on final approach.~~

At 1147:30, ~~when the airplane was~~ ~~and~~ about 6.5 nm from the airport, and ~~while~~ approaching several grass fields to ~~the his~~ right ~~of its flight path,~~ the pilot notified the ~~tower~~ controller that he was experiencing "difficulty" with his left engine and could not maintain altitude. At the request of the controller, the pilot reported that he was the only person onboard and had ~~about approximately 60 sixty~~ gallons of fuel remaining. Seconds later, ~~the pilot the~~ informed the controller that he would "not be able to make it to the airport." The controller then asked the pilot if he ~~observed saw~~ any landing sites ~~around him in his field of vision.~~ At 1148:51, the pilot informed the controller that he could see a field near a set of Bay Area Rapid Transit (BART) commuter train tracks ~~and would attempt to land there. , which is where he planned to attempt a forced landing. Seconds before the pilot reported the landing site to the controller, a witness, who was about one half mile east of the accident site, observed the airplane enter a steep left bank turn, to a westerly heading. According to the radar and map data, the airplane passed beyond the grass fields to the right of its flight path at about 1148:33, and, seconds later, it turned about entered an approximate 45° left turn. The airplane subsequently disappeared from the~~

witnesses view and approximately 30 seconds later he heard the accident, which was immediately followed by a plume of dark smoke.

Nearby surveillance video showed the airplane enter a slight left wing low attitude, which gradually increased as the airplane traversed a set of railroad tracks. The forward fuselage and right wing impacted the east wall of a small building. A mist covered the right wing, empennage, and tail, as they fell to the ground and a postcrash fire ensued.

Eyewitness Interviews

A total of three eyewitnesses were interviewed; two ~~who of which~~ observed-saw the airplane flying inbound to land (witnesses 1 and 2) and ~~one who another that~~ observed-saw the airplane moments before it impacted the building in the rail yard (witness 3).

~~As shown in Figure 1, The first witness (Witness 1 on the map) was located near the airplane's inbound leg, about approximately 9 nm southeast of nautical miles from HWD. Witness 2, was located approximately 10 miles from HWD in proximity of the airplane's outbound leg. Witness 3, was located one half mile from the accident site in a nearby graveyard. Please refer to the map below for a graphical depiction of the witness locations.~~

Witness 1 reported that she heard ~~the airplane and~~ an abnormal sound from inside her home. She went outside and observed-saw an airplane approaching her house from a group of hills located to the east. The airplane appeared to be losing altitude, and the engine made a "sputtering sound," which she also described as "cutting out." The sound repeated when the airplane ~~reached-flew~~ above her property and again seconds later after it passed her home.

Witness 2 was located about 10 miles southeast of HWD near the airplane's outbound leg and about 1 mile south of the airplane's inbound leg. Witness 2 stated that he was working in his yard all morning and initially observed-saw a red and white ~~colored~~ airplane on a southeast~~ern~~ heading ~~about at~~ approximately 1,750 feet. He never observed-saw any smoke, but heard a sound that resembled an engine "backfiring." The airplane subsequently made a left turn, ~~and~~ proceeded eastbound, and disappeared behind a group of hills. About 30 minutes later, he observed-saw the same airplane northeast of his house flying towards the airport. The witness reported hearing ~~more~~ sounds ~~that resembled like~~ an engine "popping" and "backfiring." He added that he did not observe-see any smoke, foreign object debris, or fluids coming from the airplane, ~~and he but~~ further remarked-said that the engine "backfiring" sounds were much louder than those he heard during the airplane's ~~outin~~ inbound leg.

Witness 3 was located about 1/2 mile from the accident site. According to Witness 3, he Witness 3 observed ~~He saw the~~ airplane flying abnormally low over a group of houses ~~before noon on the day of the accident. The witness stated that he observed~~ He reported that the airplane was in a wings level descent for a few seconds before it suddenly entered a steep left turn, with the right wing about approximately 70 degrees to the horizon. The airplane then disappeared behind a residential area. About Approximately 10 seconds later he heard a loud impact sound, ~~and,~~ shortly thereafter, plumes of smoke emerged-came from the airplane's direction. ~~He added that he may have been downwind of the accident because he smelled fuel burning.~~

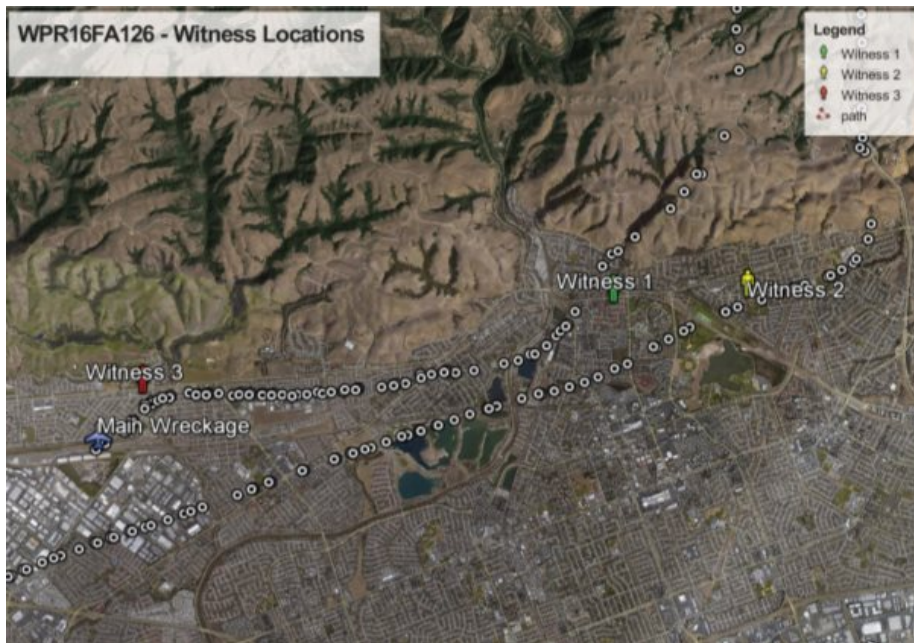


Figure 1 – Witness Locations

BART surveillance video showed the airplane in a slight left-wing-low attitude, which gradually increased as the airplane flew across a set of railroad tracks. The forward fuselage and right wing impacted the east wall of a small building. A mist covered the right wing, empennage, and tail as they fell to the ground, and a postcrash fire ensued.

PERSONNEL INFORMATION

According to the flight instructor who administered the pilot's most recent flight review, the flight review was conducted in March 2015 in the pilot's BE60 airplane and included two simulated left engine failures. The first simulated engine failure took place during an instrument landing system approach. The instructor failed the left engine during the approach, and the pilot completed the engine out procedure and continued the approach successfully. During the simulated engine failure, the instructor noted that, during the simulated engine failure, the pilot's yaw control was "good" and that his the airplane's descent was "smooth and right on." A subsequent simulated engine failure took place at 5,000 feet when the flight instructor reduced the left engine manifold pressure to 13 inches in Hg. He then asked the pilot to complete a 45° turn and hold his altitude, but the airplane was unable to maintain accommodate the altitude demand due to the combination of a low power setting and a higher-than-standard rate turn. During both simulated engine failures, the pilot successfully kept the airspeed above the airplane's minimum controllable airspeed (Vmc)(VMC).

AIRCRAFT INFORMATION

According to FAA records, the airplane was manufactured in 1955 and registered to the pilot on September 2, 2015. The airplane was powered by two Lycoming O-320-A, normally-aspirated, ~~direct-direct~~ drive, ~~air-air~~ cooled, 150-horsepower engines. The pilot's family provided the original aircraft logbooks, which ~~included~~ were comprised of service information that spanned from May 1986 to July 2015. ~~The~~ An initial entry record in the earliest engine and airframe logbooks stated that the first three entries had been re-constructed as the original logbooks were lost. A review of the logbooks revealed that the airplane's most recent 100-hour inspection was completed on July 15, 2015, at which time the left engine tachometer read had accumulated a total of 4,051 flight hours, and the right engine tachometer read had accumulated 4,059 flight hours.

~~According to the logbooks, a~~ At the time of the most recent 100-hour inspection its most recent service, the left and right engines had accumulated about approximately 1,955 hours and 1,957 hours, respectively, since their its engine's most recent major overhauls as indicated by a recent entry in the engine logbook. ~~Although r~~ Records of the left and right engine overhauls could not be located in the available aircraft records, and the dates of the overhauls could not be determined a logbook entry stated that the right engine had accrued 1,957 hours since major overhaul at the time of the last 100-hour inspection. The logbooks did not contain any record of a camshaft lobe inspection or camshaft replacement.

The airplane's recording hour-hobbs meter was not recovered, and the airplane total time at the time of the accident was estimated computed using the right engine tachometer time. Based on the pilot's 17 hours of accumulated time in the airplane after he purchased it, the airplane's total time at the time of the accident was estimated to be about 4,076 hours, at the time of the accident.

Commented [JB1]: Also need to indicate that it wasn't flown between its 100-hour inspection and the time the airplane was purchased.

According to records furnished by a fixed base operator refueling station at HWD, the pilot had purchased fuel from their self-service facility 11 times in the previous 10 months. The records showed that the pilot did not purchase fuel at HWD on the day of the accident; they showed that he last purchased fuel for the accident airplane at HWD in September 2015, in the amount of 23.4 gallons. A witness reported seeing the pilot taxi to the airport's self-serve fuel kiosk; however, the fuel history did not show a record of the pilot purchasing fuel on the day of the accident. According to the fuel service facility, they did not receive any reports of water contamination from customers who obtained 100 low lead aviation grade gasoline from their self-service fuel kiosk on the day of the accident.

Commented [SG2]: Since the records show he did not purchase any fuel here on the day of the accident, I don't think this needs to be included.

According to the pilot's logbook, showed that he flew the accident airplane on May 1, 2016, he flew the airplane to Nut Tree Airport (VCB), Vacaville, California. VCB refueling records indicated that the pilot purchased which correlates to a fuel purchase in the amount of about 15 gallons of 100LL low lead gasoline that day took place the same day at Nut Tree Airport (VCB), Vacaville, California. Before Prior to that, the pilot had purchased about 28 gallons of 100LL low lead gasoline at VCB on September 27, 2015.

Commented [SG3]: Was this his most recent flight in the airplane? Need to add to personnel info section.

Textron-Lycoming Service Bulletin SB301B—Valve Maintenance Procedures

~~A service bulletin was issued by Textron Lycoming On February 18, 1977. Textron Lycoming issued entitled "Service Bulletin No. 301B" (SB301B), which. The service bulletin contained maintenance procedures and service limitations for intake and exhaust valves.~~

Commented [SG4]: Why is this SB referenced? It's not referred to in the analysis. Either delete or add a sentence or two about these procedures that shows how they relate to accident.

~~Textron Lycoming Service Instruction SI1009AZ— Recommended Time Between Overhaul Periods~~

According to ~~Textron Lycoming "Table 1" of service instruction SI1009AZ,~~ the recommended time between overhaul (TBO) period for the Lycoming O-320 engine is 2,000 hours ~~or 12 years, whichever comes first. The service instruction further states that "all engines that do not accumulate the hourly period of TBO specified in this publication are recommended to be overhauled in the twelfth year."~~

Commented [JB5]: The engines were under 2000 hours and we don't know if they were over or under 12 years since we don't know when overhaul occurred, so I'm not sure this should be included.

~~The manufacturer's published Vmc for the airplane is 85 mph. PA-23 Emergency Procedure for Feathering a Propeller~~

A procedure to feather the propeller of an inoperative engine was included in the airplane's aeronautical flight manual (AFM). According to the AFM, ~~the procedures was to do the following:~~

1. Throttle "CLOSED".
2. Prop Control "FEATHERED". PROP CANNOT BE FEATHERED UNDER 700 RPM.
3. Mixture control "IDLE CUT-OFF".
4. Ignition switches "OFF".
5. Electric fuel pump (if in use) "OFF").
6. Main valve "OFF".

METEOROLOGICAL INFORMATION

The 1152 recorded weather observation at HWD included wind 280° true at 11 knots, visibility 10 statute miles, clear skies, temperature 27°-C, dew point 8°-C, and an altimeter setting of 30.06 inches of mercury.

According to ~~an employee of a fixed base operator at HWD a representative of APP Jet Center, he reported that~~ the airport received significant levels of rain during the winter of 2016. In February, the rain levels resulted in an overflow of the airport's drainage ditch.

The investigation was unable to ~~determine whether confirm if~~ the airplane was parked outside ~~during the winter of 2016 between the time it was purchased and the accident flight.~~

WRECKAGE AND IMPACT INFORMATION

Initial examination of the accident site by the National Transportation Safety Board investigator-in-charge revealed that the airplane came to rest at the base of a fiberglass railroad car wash building, about 5 ~~nautical miles~~ southeast of HWD. All major structural components of the airplane were accounted for at the accident site, which was contained within an area about 35 feet long and 25 feet wide. The ~~main~~ fuselage came to rest inverted on a heading of 095° magnetic and was destroyed by fire. With the exception of some thermal damage, the empennage

was ~~intact in one piece~~ and remained connected to the fuselage ~~by through~~ the airplane's rudder control cables. The right wing was destroyed by fire, and its corresponding engine was inverted and covered in soot. The left wing was co-located with the main wreckage in a near vertical position, at rest against the southeastern end of the building, and exhibited an odor of fuel near the left wingtip. Both sets of propeller blades remained attached to their respective hubs; the left engine propeller blades were in the feathered position and did not display any damage. The right engine propeller blades were in a low pitch position and displayed nicks, gouges, and tip curling.

Airframe Examination

Left Wing

Left aileron control continuity was confirmed from the left aileron bell crank to the wing root where the cables had been cut by recovery personnel. The rubber seal to the inboard left tank fuel cap was rusted, and the cap did not form a seal inside the fuel tank ring when installed. The fuel cap rubber seal to the left outboard tank displayed some corrosion and did not form a seal when installed in the fuel tank ring. The left fuel selector valve displayed ~~3/4~~ inches of space between the lever and the valve. According to the manufacturer, this position ~~was~~ consistent with an auxiliary tank setting. A trace amount of fuel was drained from the left engine gascolator into a plastic container that had been cleaned and dried. The fuel odor and appearance resembled 100LL aviation grade gasoline; however, a SAR-GEL fuel purity test indicated that the fuel was contaminated with water. The left ~~electric wing~~ fuel boost pump was not recovered.

Right Wing

The right wing ~~aileron~~ bell crank was damaged by fire, but remained intact and attached to the primary aileron and balance cables. The right aileron cable was continuous from the bell crank to the chain, which had fracture signatures consistent with overload separation.

The right ~~electric wing~~ fuel boost pump was disassembled, and the gasket and internal components displayed carbon coloring consistent with exposure to fire. The pump was void of fuel, and the fuel screen was found free of debris.

Fuselage

One arm from the control T-bar assembly separated at the T-section, and the assembly was damaged by fire; however, the remaining three sprockets were intact. A portion of elevator control tube remained attached to the tube stem.

Continuity of the rudder assembly was traced from the rudder torque tube through a control cable located on the right side of the airplane to the rudder flight control surface. A rudder control cable on the opposing side was traced from the rudder to the cockpit; however, the cable had separated from the torque tube arm, which had separated from the torque tube.

The flap actuator measured ~~about~~ approximately 20 inches, which ~~was~~ consistent with partial deployment of the flaps. According to the airplane manufacturer, an actuator measurement of 18.35 inches corresponds ~~to~~ with a full flap extended position and 25.50 inches corresponds ~~to~~ with a full flap retracted position. While the flap actuator rod displayed significant fire damage

on the fore and aft ends, the intermediate section was shiny in appearance with only some blue discoloration.

Elevator continuity was traced from the elevators to a fractured control tube near the aft fuselage.

~~Empennage~~

The rudder trim jackscrew displayed ~~about~~approximately 1 inch of exposed threads. According to the manufacturer, this measurement ~~was~~is consistent with a neutral trim position.

The elevator trim displayed ~~approximately~~about 17 threads, which correlated~~s~~ to a near full nose-up trim position. However, the elevator trim cables were loosely fixed to the trim drum, which indicated~~s~~ that the trim jackscrew may have moved during the accident sequence.

~~Engine Examination~~

Left Engine

Mechanical continuity of the left engine was confirmed from the propeller throughout the valve train to the accessory section when the propeller was rotated by hand. Thumb compression and suction were established on each of the engine's four cylinders, and the valve train moved in the proper firing order. An examination of each cylinder's internal combustion chamber revealed no evidence of foreign object ingestion or detonation.

A magneto synchronizer confirmed the magneto breaker points opened at 25°~~degrees~~ below top dead center. Both the left and right magnetos were timed within 1°~~degree~~ of each other. The magnetos were then removed from their respective mounting pads to facilitate a magneto examination. Hand rotation of each drive produced spark at each of the four plug leads.

The top and bottom spark plugs were secured in their respective positions and undamaged. ~~As each plug was cross-checked against the Champion Spark Plug "Check-A-Plug" chart AV-27,~~ The plugs were oil-soaked, but displayed coloration consistent with normal operation as shown on the Champion Spark Plug "Check-A-Plug" chart AV-27.

The carburetor was attached to the engine accessory case at the mounting flange, and the throttle/mixture controls were secured to their respective controls arms at the carburetor. The carburetor fuel screen was free of debris, and the carburetor floats were intact. Trace amounts of residual fuel were discovered in the carburetor fuel bowl and in the accelerator pump. A subsequent SAR-GEL water indicating paste test confirmed the presence of water contamination in both cavities. A white powdery residue was observed on the accelerator pump plunger, consistent with corrosion.

Disassembly of the left engine-driven fuel pump revealed trace amounts of residual fuel, which exhibited an odor and appearance of 100LL aviation gasoline. A subsequent SAR-GEL test ~~indicated~~confirmed that the pump had been contaminated by water. The internal chambers to the fuel pump exhibited significant corrosion signatures consistent with long term exposure to water. Additionally, the pump valves and backing plate displayed a white powdery substance consistent with corrosion.

Right Engine

The right engine and accessories displayed significant fire damage. Mechanical continuity of the engine was established from the crankshaft through the valve train to the accessory section when the propeller was rotated by hand. Thumb compression and suction was achieved for each cylinder; however, a borescope inspection revealed that the intake valve rocker arm for each cylinder displayed little movement as the valve train was rotated. The exhaust rocker arms moved normally, and the pushrods did not exhibit any bending.

An internal examination was achieved by drilling holes through the top of the engine case material in-line with the rotational plane of each connecting rod. Subsequent inspection of the camshaft with a lighted borescope revealed that the intake camlobes for cylinder Nos. 3 and 4 were concentric in shape, consistent with long term wear. The intake camlobes for cylinder Nos. 1 and 2 were had been worn down about approximately 90% and had formed a nearly concentric shapes. The corresponding tappet faces displayed significant spalling on the subject camlobes.

Both magnetos remained attached to their respective mounting pads. Due to thermal damage, Magneto-to-engine timing could not be established, and the magnetos could not be functionally tested as they had been thermally damaged due to post-crash fire.

The top spark plugs were secured in their respective positions and had been thermally damaged. Although undamaged, the ground electrode wear could not be determined as each plug displayed a varying amount of coloration due to the thermal effects of the post-impact ground fire.

MEDICAL AND PATHOLOGICAL INFORMATION

The Alameda County Sheriff's Office, Oakland, California An autopsy was performed an autopsy on the pilot by the Alameda County Sheriff's Office, Oakland, California. The autopsy report indicated the cause of death was "extensive blunt trauma."

The FAA's Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, performed A toxicological tests on specimens recovered from the pilot was performed by the FAA Bioaeronautical Sciences Research Laboratory. A carboxyhemoglobin saturation test revealed no evidence of carbon monoxide in the pilot's cavity blood. The pilot's toxicology results were negative for ethanol, and but positive for ibuprofen in his urine.

TESTS AND RESEARCH

Radar Data

FAA radar data captured the airplane's position, altitude, and airspeed, at a sampling rate of about approximately 5 seconds. According to the data, the airplane departed on a local flight at approximately 1035. During their return to HWD, the pilot initiated a descent from about approximately 2,000 feet, at a rate of about 450 feet per minute (fpm). From the beginning of the descent this approach to the time of impact, the airplane's rate of descent fluctuated between 450 fpm and 700 fpm. As the airplane began its left turn near the end of their final movements of

flight, the airplane's groundspeed was recorded at 59 knots (about 68 mph) at an altitude of 375 feet mean sea level (msl). The airplane never exceeded this groundspeed during its subsequent descent to impact. Additionally, about 20 seconds before the last radar return, the airplane's groundspeed reached a minimum of 52 knots (60 mph), ~~at an approximate height~~ an altitude of about 225 feet msl (about 173 feet above ground level), ~~which was approximately 20 seconds before the last radar return and about the time of the accident.~~

Commented [JB6]: Move this to History of Flight...it doesn't need to be in Tests and Research.

~~The manufacturer's published minimum control speed (V_{mc} single engine) is 85 mph.~~

ADDITIONAL INFORMATION

According to the FAA's Airplane Flying Handbook, ~~published by the FAA,~~ V_{mc}

~~V_{MC}~~ is defined as the "~~m~~Minimum control speed with the critical engine inoperative," and is marked with a red radial line on most airspeed indicators. ~~It is t~~The minimum speed at which directional control can be maintained under a ~~very~~ specific set of circumstances outlined in 14 CFR Part 23, Airworthiness Standards.

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~~The handbook explains that e~~Engine inoperative flight with wings level and ball centered requires large rudder input towards the operative engine. The result is a moderate sideslip towards the inoperative engine, ~~which reduces,~~ climb performance ~~will be reduced by the moderate sideslip.~~ With wings level, V_{mc} ~~V_{MC}~~ will be significantly higher than published as there is no horizontal component of lift available to help the rudder combat asymmetrical thrust.

The ~~handbook publication~~ further remarks that a single engine failure in a twin-engine airplane will result in "high drag, large control surface deflections required, and rudder and fin opposition due to sideslip."