Aviation Investigation Final Report

Location:	Paso Robles, California	**Accident Number:**	WPR12LA015
Date & Time:	October 21, 2011, 04:15 Local	**Registration:**	N422HP
Aircraft:	Piper PA46R	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (partial)	**Injuries:**	1 Minor
Flight Conducted Under:	Part 91: General aviation		

Analysis

The pilot reported that when he was established inbound on the second instrument approach, after missing the first one, the engine began to make a sound similar to fuel starvation. The pilot checked to ensure that the mixture was at full rich and turned on the fuel pump, but there was no change in the sound of the engine. He then switched fuel tanks, but there was still no change, and the airplane was losing altitude. The pilot stated that he had the throttle at full forward but that the engine was not making full power. He subsequently made a forced landing to an open field.

During the postaccident examination, downloaded data from the airplane's multi-function display (MFD) revealed that when he began the missed approach at 04:01:00, the pilot did not return the engine mixture to a full rich condition; the climb back to 6,000 feet was performed at a setting less than full rich. The data indicated that at 04:06:00, the engine was making full power; however, the fuel flow was at a very lean setting. The data further indicated that the cylinder head temperature (CHT) and the Turbine Inlet Temperature (TIT) were elevated. One of these two elevated temperatures likely tripped a red annunciator on the panel, prompting the pilot to go to the full rich condition at 04:06:30. When the pilot was leveling off, the CHTs started a steady drop along with the oil temperature. The TIT immediately dropped to a more normal value when the pilot advanced the mixture to full rich. At 04:09:30, the manifold pressure dropped, which indicated that the pilot closed the throttle. At 04:10:15, the data revealed that the airplane began a relatively normal descent, and that the MAP continued to decrease in steps. About 2 minutes later, or about 1 minute 45 seconds prior to the end of the data, the descent rate increased to about 1,800 feet per minute and remained there until the end of the data. At this time the MAP indicated that the throttle was closed or nearly closed. Data for MAP and TIT are consistent with the engine running with the throttle closed, or nearly closed, throughout the final descent until the data ended at 04:14:06. Accordingly, the MFD

data did not reveal any evidence of a powerplant-related failure.

Postaccident testing and examination of fuel samples revealed that two out-of-range results were noted, consistent with aged fuel. The postaccident examination also revealed that spark plug coloration was indicative of an even distribution of fuel to each cylinder and that there was no indication during the examination of a clogged fuel nozzle. Additionally, MFD data did not support the presence of a plugged fuel nozzle during the accident flight. Therefore, the investigation could not definitively determine if the condition of the fuel was contributory to the partial loss of power.

During the postaccident examination, the engine was run successfully and no mechanical anomalies or failures were noted that would have precluded normal operation; the loss of engine power could not be duplicated.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: A loss of engine power while maneuvering for reasons that could not be determined because postaccident examination did not reveal any anomalies that would have precluded normal operation.

Findings

Not determined	(general) - Unknown/Not determined

Factual Information

History of Flight

Approach-IFR final approach	Loss of engine power (partial) (Defining event)
Emergency descent	Off-field or emergency landing
Landing-flare/touchdown	Collision with terr/obj (non-CFIT)

HISTORY OF FLIGHT

On October 21, 2011, about 0415 Pacific daylight time (PDT), N422HP, a Piper PA-46R-350T airplane, sustained substantial damage as a result of a forced landing following a loss of engine power near Paso Robles Municipal Airport (PRB), Paso Robles, California. The pilot, the sole occupant of the airplane, suffered minor injuries. The airplane is registered to Central Valley Mortgage Services of Porterville, California. The cross-country business flight was being operated in accordance with Title 14 Code of Federal Regulations (CFR) Part 91, and an instrument flight rules (IFR) flight plan was filed and activated. The flight departed the Porterville Municipal Airport (PTV), Porterville, California about 0300, with PRB as its destination.

In a written report submitted to the National Transportation Safety Board investigator-in-charge (IIC), the pilot reported that after missing the first instrument approach he was cleared by air traffic approach control for a second approach. The pilot stated that when he was on course [inbound] the engine began to make a sound similar to that of fuel starvation. The pilot further stated that he made sure that the fuel mixture was “full rich” and turned on the fuel pump, but there was no change in the sound coming from the engine. The pilot reported that he then changed fuel tanks but there was still no change in the engine sound, and as he was losing altitude fast he needed to set up for a glassy water [type] landing due to the fog, the dark night condition, and the hilly terrain. The pilot stated that he now had the throttle full forward, and while the engine was running it was not making full power. The airplane subsequently impacted an open field in the landing configuration, coming to rest in an upright position.

An onsite postaccident examination performed by a Federal Aviation Administration (FAA) aviation safety inspector revealed that the airplane sustained substantial damage to both wings. It was also revealed that both main landing gear and the flaps were extended and that the nose landing gear was bent aft from the extended position. There was no observable damage to the empennage. The airplane was recovered to a secured location for further examination.

PERSONNEL INFORMATION

The pilot, age 65, held an airline transport pilot certificate. He possessed ratings for airplane

single-engine land and sea, airplane multiengine land and sea, and instrument airplane. The pilot also held a flight instructor certificate for airplane single-engine, multiengine, and instrument airplane. The pilot reported a total time of 32,476.7 total hours of flight time, 23,061.7 hours in single-engine airplanes, and 9,415 hour in multiengine airplanes. The pilot reported 243.9 hours flown in the past 90 days, 109 hours in the last 30 days, and 4.1 hours in the last 24 hours. The pilot reported 420 hours in the make and model as the accident airplane, with 75.3 hours as an instructor in make and model. His most recent flight review was conducted on September 21, 2010. The pilot held a second-class medical certificate issued on July 29, 2011, with the restriction that he "must have glasses available for near vision."

AIRCRAFT INFORMATION

The 2009 fixed wing single-engine airplane, serial number 4692122, received a FAA airworthiness certificate on May 29, 2009. The airplane was equipped with a Lycoming TIO-540-AE2A , turbocharged, fuel injected, reciprocating engine, serial number L-13354-61A, and was rated at 350 horsepower. The engine was equipped with a composite three-blade Hartzell constant speed propeller.

A review of aircraft maintenance records indicated that the most recent annual inspection was performed on May 4, 2011, at a total aircraft time of 281.1 hours. A review of the engine logbooks revealed that a left magneto, part number 6363, serial number 09020514, was removed and reinstalled after repairs had been completed by Ly-Con Rebuilding Co. of Visalia, California, on October 18, 2011, at a total aircraft time of 336.6 hours.

The airplane was equipped with an Avidyne Flightmax Entegra EX5000 R8.1 Multi-function Display unit (MFD). The engine page provides the pilot with engine parameters depicted on simulated gauges and electrical system parameters located in dedicated regions within the MFD display.

The most recent fueling of the airplane was recorded to have taken place at the Visalia Municipal Airport, Visalia, California, on October 7, 2011, two weeks prior to the accident. At that time the airplane was topped off with 69.4 gallons of 100LL aviation fuel. The only flight reported to have taken place during the two week period preceding the accident flight was the reposition flight from Visalia to Porterville, a distance of about 23 nautical miles.

METEOROLOGICAL INFORMATION

At 0403, the PRB weather reporting facility located about 3 nautical miles (nm) south of the accident site reported wind 310 degrees at 6 knots, visibility 1 ¾ miles, mist, overcast clouds at 200 feet mean sea level (msl), temperature 12 degrees Celsius (C), dew point 11 degrees C, and an altimeter setting of 30.08 inches of mercury.

At 0414, the PRB weather reporting facility indicated wind 300 degrees at 4 knots, visibility 2 ½ miles, mist, overcast clouds at 200 feet msl, temperature 12 degrees C, dew point 11 degrees

C, and an altimeter setting of 30.09 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

The airplane came to rest upright in an open field surrounded by gentle rolling terrain about 3.07 nm north and slightly west of the extended centerline of runway 19 at PRB. The measured geographical coordinates at the accident site were 35 degrees 43.862 minutes north latitude and 120 degrees 36.905 minutes west longitude, and the elevation was measured at 927 feet msl.

An examination of the airplane at the accident site revealed that both wings had sustained substantial damage, all three propeller blades were damaged, and that the flaps and landing gear were configured in the extended position. The airplane's cabin section and aft fuselage, inclusive of the empennage, were intact and appeared undamaged.

TESTS AND RESEARCH

On November 9th and 10th, 2011, under the supervision of the National Transportation Safety Board IIC, representatives from the FAA, Lycoming Engines and Piper Aircraft, Inc. examined the airplane at the facilities of Plain Parts, located in Pleasant Grove, California.

Multi-Function Display (MFD) examination

During the examination the airplane's Avidyne Multi-Function Display (MFD) yielded a CF memory card, which provides GPS position, time and track data, as well as information from the airplane concerning altitude, engine and electrical system parameters, and outside air temperature. Under the supervision of the IIC, the MFD memory card was downloaded on site using a portable laptop computer. This data was then sent to the NTSB Vehicle Recorders Laboratory in Washington, D.C., who processed the recorded flight data. (Refer to the NTSB Vehicle Recorder's Specialist's Factual Report, which is located in the docket.)

The downloaded MFD data resulted in 3 plots and corresponding tabular data being generated, which were then provided in graphical format to the IIC. The plots covered a time period from 03:15:00 to 04:15:00 (PDT), which is the entire flight. The last recorded data point occurred at 04:14:06. Plot one contains basic engine parameters, including engine speed, oil pressure, oil temperature, and cylinder temperatures. Plot two contains fuel system and gear weight on wheels information. Plot three contains electrical system parameters.

A review and analysis of the Avidyne MFD data was conducted by a Lycoming Electronic Engine Controls Lead Engineer and a Piper Aircraft Powerplant and Mechanical Systems Engineer. This information was subsequently reviewed by an NTSB powerplant engineer, who concurred with both assessments. Their reviews revealed the following:

Lycoming Engines engineer's review: (all times referred to are Pacific daylight time)

When the pilot did his missed approach procedure at 04:01, he did not return the engine to a full rich condition. The pilot's climb back to about 6,000 feet pressure altitude was performed at something less than full rich.

At 04:06, the [engine] was making full power with about 42 in-Hg manifold pressure and 2,500 RPM. However, he was running a fuel flow which put him in the 0.43 Brake Specific Fuel Consumption (BSFC) range (so he was not at 350 horsepower). This is very lean, and his cylinder head temperature (CHT) peaked around 450 degrees Fahrenheit (F), while the Turbine Inlet Temperature (TIT) was running [between] 1,700 to 1,800 degrees F for about 5 minutes. One of these two elevated temperatures likely tripped a red annunciator on the panel, prompting the pilot to go to the full rich condition at 04:06:30.

Once at full rich, the pilot was leveling off, so we see the CHTs started a steady drop, along with oil temperature. The TIT did an immediate drop to a more normal 1,400 degrees F when the pilot went to full rich.

At 04:09:30, the manifold pressure makes a nice drop to about 18 in-Hg, which is below the International Civil Aviation Organization (ICAO) standard atmospheric pressure for 6,000 feet, which makes us think that he closed the throttle. As he descends, the manifold pressure should decrease, but it does not, suggesting the throttle was not opened.

If there was an un-commanded loss of power, say from both turbo[chargers] dying, I would expect the engine to perform as a normally aspirated engine, which should have been sufficient to land the aircraft. Seems he closed the throttle.

Piper Aircraft engineer's review: (all times referred to are Pacific daylight time)

In summary, it appears the data ends during a second approach attempt. At 04:09:30, there was a large drop in MAP consistent with closing of the throttle to a low power setting. At 04:10:15, the aircraft begins a relatively normal descent at a rate consistent with the previous attempt. The MAP continues to decrease in discreet steps. About 2 minutes later (1:45 prior to the end of the data), the descent rate increases to roughly 1,800 [feet per minute] and remains there until the end of the data. MAP is very low (about 5-6 in Hg) at the end of the data, indicating the throttle is closed or nearly closed.

Data traces for MAP and TIT are consistent with the engine running with the throttle closed, or nearly closed, throughout the final descent until the data ends at 04:14:06, and 1909 feet pressure altitude.

Discrete steps in the MAP are consistent with deliberate reductions in throttle position during the final descent, but that is speculative without throttle position data.

There's no obvious evidence in the data that points to a powerplant related failure.

The data supports Lycoming Engines comments that the pilot failed to enrich the mixture prior to the climbout at 04:02 to 04:06, as maximum recorded TIT was 1768 F (18 F over the limit). TIT hovered between 1750 F and 1755 F for about 2 minutes and only exceeded 1755 F for about 30 seconds when it peaked at 1768 F. At 04:06:36, he quickly enriched the mixture which immediately reduced TIT; possibly in response to a redline alarm. Maximum recorded cylinder head temperature was 464 F on number 5; well below the redline limit of 500 F. Fuel quantity shows sufficient fuel in each tank and engine fuel flow is indicated throughout the flight.

Engine examination

An examination of the engine revealed that the fuel injection servo remained undamaged and securely attached at the mounting flange. The throttle/mixture controls were found securely attached and continuity to the cockpit was established. The plug on the side of the injector body was secure with the safety wire in place. The fuel injection servo and induction system were examined and observed to be free of obstruction.

All engine compartment fuel lines were found to be in place and tight at their respective components.

The fuel flow divider remained secure at the mounting bracket situated at the top of the engine. The fuel lines remained secure at each flow divider fitting. The fuel injection nozzles remained secure at each cylinder with the respective fuel line attached.

The fuel pump was attached to the engine at the mounting pad. The fuel lines remained secure at their respective fittings. The fuel pump was not removed for examination.

The airframe fuel selector/gascolator fuel filter screen was found properly installed and free of contamination.

The engine fuel system components performed within manufactures specifications during the engine operational check. During the operational check there was no indication of a plugged fuel nozzle. Further, the downloaded Avidyne data did not support the presence of a plugged fuel nozzle during the accident flight.

The spark plugs were secure at each position with their respective spark plug lead attached. The top spark plugs were removed, examined and photographed. The spark plug electrodes remained mechanically undamaged. The spark plugs coloration and symmetry were indicative of an even distribution of fuel to each cylinder.

The turbocharger system components remained secure at their respective mountings. The turbocharger compressor and turbine impellers remained intact and undamaged. The turbine was free to hand rotate. Each exhaust system clamp was secure at each location. The exhaust bypass valve/wastegate remained secure at the transition. The butterfly valve remained intact

and undamaged.

Engine run

Prior to conducting an operational check of the engine, the top spark plugs were removed examined and photographed. The crankshaft was rotated by hand utilizing the propeller. The crankshaft was free and easy to rotate in both directions. Thumb compression was observed in proper order on all six cylinders. Mechanical continuity was established throughout the rotating/reciprocating group and accessory section during hand rotation of the crankshaft. The bottom spark plugs were not removed. The combustion chamber of each cylinder was examined through the spark plug holes utilizing a lighted borescope. The combustion chambers remained mechanically undamaged, and there was no evidence of foreign object ingestion or detonation. The valves were intact and undamaged. There was no evidence of valve to piston face contact observed. The gas path and combustion signatures observed at the spark plugs, combustion chambers, and exhaust system components displayed coloration consistent with normal operation. There was no oil residue observed in the exhaust system gas path.

A test propeller was installed to facilitate the engine run, since the installed propeller had been damaged during the landing sequence.

The top spark plugs were re-installed and their respective leads attached to facilitate an engine operational check. A remote fuel source was attached at the inlet fitting of the electric fuel boost pump and electrically energized. A fuel pressure indication within the normal operating range was observed.

The engine was started with the starter using standard procedures. An oil pressure indication within the normal operating range was observed at the cockpit mounted oil pressure gauge.

Once the engine stabilized at above idle, the electric fuel boost pump was de-energized, at which time the engine continued to run smoothly. The engine driven fuel pump delivered a fuel pressure indication within the normal operating range.

Once the engine was at operating temperature, the throttle was advanced to about 1600 revolutions per minute (rpm), at which time the magnetos were checked utilizing the cockpit mounted ignition switch. Both magnetos operated at each of their respective switch detents and within manufactures specifications.

The throttle was advanced to the maximum stop at which time the engine would produce manifold pressures within specification that also indicated the turbo charger system was functioning. The engine rpm was not within specification due to the mismatch of test propeller and governor.

The engine operational check exhibited no unusual indications, fuel or oil leaks.

Fuel samples

Two fuel sample test reports were sent to the NTSB Materials Laboratory in Washington, D.C., for examination by an NTSB chemist. The results of the examination revealed that all tests were found to be within specification with two exceptions: 1) Potential Gum (ASTM D873) which was found to be higher than the specification, and 2) ASTM Equation Vapor Pressure (ASTM D5191), which was found to be lower than the specification. These out-of-range results are consistent with aged fuel or fuel that had been exposed to air for a period of time (i.e. sitting in an aircraft fuel tank).

Fuel Servo and Flow Divider examination

On November 28, 2011, under the supervision of the NTSB IIC, the airplane's fuel servo and flow divider were examined at the facilities of Precision Airmotive, located in Marysville, Washington. The Precision technician who performed the tests revealed that no anomalies were noted that would have precluded normal operation.

Pilot Information

Certificate:	Airline transport	**Age:**	65,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land; Multi-engine sea	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	July 29, 2011
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	September 21, 2010
Flight Time:	32477 hours (Total, all aircraft), 420 hours (Total, this make and model), 32384 hours (Pilot In Command, all aircraft), 244 hours (Last 90 days, all aircraft), 109 hours (Last 30 days, all aircraft), 5 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N422HP
Model/Series:	PA46R 350T	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	4692122
Landing Gear Type:	Tricycle	**Seats:**	6
Date/Type of Last Inspection:	May 2, 2011 Annual	**Certified Max Gross Wt.:**	4358 lbs
Time Since Last Inspection:	1 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	338 Hrs at time of accident	**Engine Manufacturer:**	Lycoming
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	TIO-540-AE2A
Registered Owner:	On file	**Rated Power:**	350 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Night/dark
Observation Facility, Elevation:	PRB,840 ft msl	**Distance from Accident Site:**	4 Nautical Miles
Observation Time:	04:03 Local	**Direction from Accident Site:**	190°
Lowest Cloud Condition:	Thin Overcast / 200 ft AGL	**Visibility**	3 miles
Lowest Ceiling:	Overcast / 200 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	4 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	300°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.09 inches Hg	**Temperature/Dew Point:**	12°C / 11°C
Precipitation and Obscuration:	N/A - None - Drizzle		
Departure Point:	Porterville, CA (PTV)	**Type of Flight Plan Filed:**	IFR
Destination:	Paso Robles, CA (PRB)	**Type of Clearance:**	IFR
Departure Time:	03:30 Local	**Type of Airspace:**	

Airport Information

Airport:	Paso Robles Municipal Airport PRB	**Runway Surface Type:**	Asphalt
Airport Elevation:	840 ft msl	**Runway Surface Condition:**	Unknown
Runway Used:	19	**IFR Approach:**	VOR/DME
Runway Length/Width:	6008 ft / 150 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Minor	**Latitude, Longitude:**	35.673332,-120.626663

Administrative Information

Investigator In Charge (IIC):	Little, Thomas
Additional Participating Persons:	Michael A Schaadt; Federal Aviation Administration; San Jose, CA Charles Little; Piper Aircraft, Inc.; Vero Beach, FL Mark Platt; Lycoming Engines; Williamsport, VA
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Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=82134