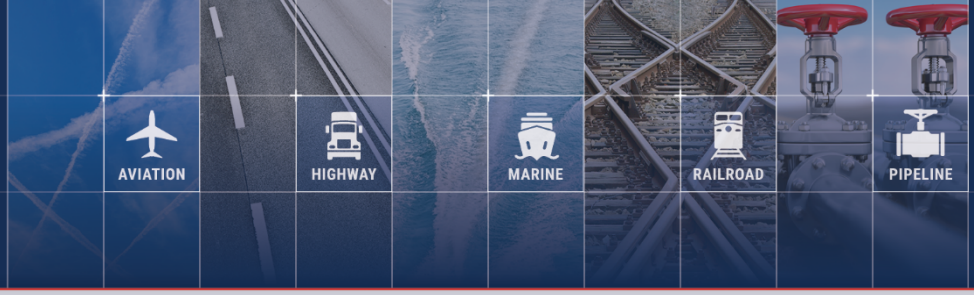

Aviation Investigation Final Report

Location:	Ontario, California	**Accident Number:**	WPR10LA284
Date & Time:	June 10, 2010, 16:27 Local	**Registration:**	N121HJ
Aircraft:	Piper PA-46-310P	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (total)	**Injuries:**	1 Serious, 1 Minor
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

The pilot was conducting a cross-country flight with a certified flight instructor (CFI). During the climb-to-cruise phase of the flight, as the airplane was ascending through 16,000 feet mean sea level (msl), the pilot noticed a reduction in manifold pressure. He advanced the throttle and observed an increase of one or two inches of manifold pressure. Shortly thereafter, the pilot heard a loud bang originate from the engine followed by an immediate loss of engine power.

The pilot and CFI attempted to troubleshoot the engine anomalies and noted that it seemed to respond with the low boost "on", however it began to run rough whenever the throttle was advanced more than half way. They diverted to a nearby airport and conducted an emergency descent. As the airplane approached the airport, the pilot descended through an overcast cloud layer and attempted to enter the airport traffic pattern. While on final approach to the airport, the pilot thought the airplane was high and extended the landing gear and applied flaps. Shortly thereafter, the airspeed and altitude decreased drastically and the pilot realized he was too low. The pilot applied throttle and noticed no change in engine performance. The airplane subsequently struck a fence and landed hard in an open field just short of the airport, which resulted in structural damage to the fuselage and wings.

A postaccident examination of the engine revealed that the induction elbow for cylinders 1-3-5 (right side) was displaced from the throttle and metering assembly where the elbow couples with the throttle and metering assembly by an induction hose and clamp. The clamp was secure to the induction hose, however, the portion of the clamp that should have been installed beyond the retention bead on the throttle and control assembly was observed on the inboard

side of the bead on the induction elbow. Review of the aircraft maintenance logbooks revealed that cylinders 4 and 5 were recently replaced prior to the accident flight due to low compression. The replacement of these cylinders required removal of the induction system to allow for cylinder removal and installation. In addition, a manufacturer service bulletin stated that during the reinstallation of the induction system, one must slide the induction hose and clamp(s) onto one of the tubes to be joined and that the connection joint and both tube beads are to be positioned in the center of the induction hose. The clamps should be installed in a position centered between the tubing bead and end of the induction hose.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: A loss of engine power due to the in-flight separation of the 1-3-5 cylinder induction tube elbow, which was caused by the improper installation of the induction tube elbow by maintenance personnel.

Findings

Aircraft	Air intake - Failure
Aircraft	Air intake - Incorrect service/maintenance
Personnel issues	Installation - Maintenance personnel

Factual Information

History of Flight

Prior to flight	Aircraft maintenance event
Enroute-climb to cruise	Loss of engine power (total) (Defining event)
Landing-flare/touchdown	Off-field or emergency landing
Landing-flare/touchdown	Collision with terr/obj (non-CFIT)

On June 10, 2010, about 1627 Pacific daylight time, a Piper PA-46-310P airplane, N121HJ, was substantially damaged during a forced landing near the Ontario International Airport (ONT), Ontario, California, following a loss of engine power during cruise flight. The airplane was owned and operated by the pilot. The instructional flight was conducted under the provisions of 14 Code of Federal Regulations Part 91. The private pilot sustained minor injuries and the certificated flight instructor (CFI) was seriously injured. Visual meteorological conditions prevailed at the time of the accident and no flight plan was filed for the cross-country flight. The flight originated from the Santa Monica Airport, Santa Monica, California, about 1550, with an intended destination of Lake Havasu, Arizona.

In a written statement, the pilot reported that prior to the accident flight he and his flight instructor conducted a thorough preflight inspection on the airplane and noted no mechanical issues. The pilot stated that after departure, they flew to the northeast towards the Van Nuys VOR and then turned to an easterly heading to remain out of the Class Bravo airspace. He added that during the climb, the climb rate was stabilized at an amount greater than 500 feet per minute and that he intended on leveling off at 17,500 feet mean sea level (msl). The pilot further reported that as the airplane was passing through an altitude of 16,000 feet, he noticed that the manifold pressure "had fallen back to approx[imately] 26" inches of manifold pressure. The pilot advanced the throttle forward, and noticed an increase of only one or two inches of manifold pressure. About a minute later, the pilot heard a loud bang originate from the engine area followed by a loss of engine power.

The pilot further stated that after establishing best glide airspeed, his flight instructor and himself began troubleshooting the problem. He engaged the engine fuel boost pump and noted that it "seemed to make matters worse, then switched to the low boost position." The pilot contacted Southern California Approach Control, notified them of their situation and elected to divert to ONT. During the emergency descent, the pilot and flight instructor continued to troubleshoot the engine and "…believed that we were getting partial power." He noted that the propeller was windmilling and that no smoke or oil was visibly originating from the engine. The pilot reported that as they neared ONT, they "attempted to fit into the traffic pattern" and were "above or in an overcast layer" while attempting to avoid traffic below their altitude. The pilot stated that they broke out of the overcast cloud layer about 4 miles from Runway 26L. During the approach to landing, the pilot was advised that runway 26L was out of

service and to land on Runway 26R. As the flight was about 1 mile from the approach end of Runway 26R, the pilot thought the airplane was high and extended the landing gear and selected 10 degrees of flaps. He further stated that "…at that point, the airspeed dropped and our altitude decreased drastically. We realized that we were too low and advanced the throttle to get any available power that was left. At that point, the engine produced no power whatsoever. We avoided the attempt to land on the runway and turned slightly north due to a crossing semi truck on a road running perpendicular to the east end of Runway 26." Subsequently, the airplane struck a fence about one-half mile from the approach end of Runway 26R and landed hard in an open field.

The flight instructor reported that during the initial climb to cruise flight, while passing through 1,000 feet above ground level (agl), power was reduced to 30 inches of manifold pressure. As the flight continued climbing, he noted that the pilot observed the manifold pressure drop to 26 inches of manifold pressure. The flight instructor stated that shortly after the pilot increased the throttle to 28 inches of manifold pressure, "...a loud pop occurred and thrust immediately fell off." The flight instructor further stated that as the auxiliary fuel boost pump was applied, the engine seemed to "choke" prior to selecting "low boost." The flight instructor further reported that the engine appeared to be producing partial power and that the mixture and propeller lever positions were in the full forward position at the time of the loss of engine power. He added that during the descent, the pilot and himself continued to troubleshoot the engine and noted that the engine seemed to respond, "…but became rough whenever the throttle was advance[d] more than half way."

Examination of the airplane by a Federal Aviation Administration (FAA) inspector revealed that the fuselage and wings were structurally damaged, and that the left and right main landing gear were separated. The airplane was recovered to a secure location for further examination.

AIRCRAFT INFORMATION

The low-wing, retractable-gear airplane, serial number (S/N) 46-8508105, was manufactured in 1985. It was powered by a Continental Motors TSIO-550-C1 engine, serial number 814565-R, rated at 310 horse power engine and was equipped with a Hartzell PHC-G3YF-1E variable-pitch propeller.

Review of copies of maintenance logbook records revealed an annual inspection was completed on September 23, 2009, at a recorded tachometer reading of 4,803 hours, HOBBS time of 1,967 hours, airframe total time of 4,803 hours, and engine time since major overhaul of 1,236.1 hours. The most recent maintenance logbook book entry within the engine logbook and work order was recorded on June 4, 2010, at a HOBBS time of 2025.3 hours. The logbook entry stated in part "...Removed oil filter, cut and inspected for metal, and replaced with new. No metal found at this time. Run up and no leaks noted. Perform engine compression check 1) 66/80, 2) 70/80, 3) 54/80, 4) 5/80, 5) 34/80, 6) 64/80....Replaced cylinder #4 and #5 with overhauled exchange due to low compression...Performed engine run-up, no leaks noted."

TESTS AND RESEARCH

The recovered engine and airframe were examined on July 20, 2010, at the facilities of Aircraft Recovery Services, Pearblossom, California, by representatives from Piper Aircraft, Teledyne Continental Motors, and the FAA under the supervision of the Safety Board investigator-in-charge (IIC).

Examination of the recovered aircraft revealed continuity from the left and right fuel inlets through the fuel selector to the engine firewall outlet. The HOBBS hour meter was observed at 2028.4 hours.

Examination of the recovered engine revealed that all engine accessories were attached to the engine. Three of the four engine mounts were separated. The top spark plugs and rocker box covers were removed. The crankshaft was rotated by hand using the propeller. Rotational continuity was established throughout the engine and valve train. Equal movement of the intake and exhaust rocker arms for all cylinders was noted. Thumb compression was obtained on all six cylinders. When the crankshaft was rotated, the left and right magneto impulse couplings actuated. Spark was observed on all ignition harness leads when the crankshaft was rotated. The top spark plugs exhibited moderate to severe wear and were black within the electrode area. The right hand 1-3-5 cylinder side induction elbow was observed displaced from the throttle and metering assembly where the elbow couples with the throttle and metering assembly by an induction hose and clamp. The clamp was secure to the induction hose. The portion of the clamp that should have been installed beyond the retention bead on the throttle and control assembly was observed on the inboard side of the bead on the induction elbow. No surrounding impact damage was observed to the area surrounding the separation or right side intercooler.

The left and right turbo chargers were intact and undamaged. Both the left and right turbine wheels rotated freely by hand. The waste gate was observed intact and in the open position.

The engine was removed from the airframe and subsequently shipped to TCM for further examination.

The engine was examined at the facilities of Teledyne Continental Motors on November 30 and December 1, 2010. The engine mount legs, turbocharger hoses, left and right turbocharger reservoirs were replaced to facilitate the engine run. The induction tubes 2, 4, and 6, and the bottom 3 and 5 ignition leads were repaired to facilitate the engine run. In addition, the right hand 1-3-5 cylinder side induction elbow was reinstalled and securely attached to the throttle and metering assembly.

The engine was installed on an engine test stand. The engine was started and run for about 15 minutes at various power settings with no anomalies noted. The engine run "demonstrated the ability to produce rated horsepower." During the engine run, a magneto check was successfully performed with no abnormalities noted. The engine was shut down manually

using the test cell control panel. The right hand 1-3-5 cylinder side induction elbow was manually disconnected from the throttle and metering assembly where the elbow couples with the throttle and metering assembly by an induction hose and clamp. The engine was successfully started a second time and ran throughout various engine power settings. However, the engine did not "produce rated horsepower" during this phase of the engine run.

ADDITIONAL INFORMATION

Review of Teledyne Continental Motors (TCM) Service Bulletin SB08-13, Induction System Hose and Clamp Installation, issued on September 30, 2008, states in part that "the following instructions must be utilized in the installation of induction system hoses:

1. Each tube or component to be joined incorporates a 'bead' at the end or joint of the induction tube... Care must be taken to ensure the induction tubes are installed squarely and in alignment.

2. Prior to installation, inspect the tubes and/or components to be connected. Any erosion of sealing bead, dents, deep scratches or cracks in the sealing area of the tube or component will cause induction leaks. Any tube or component that exhibits any of these signs must be repaired or replaced prior to installation.

3. See current revision of SIL99-2 for approved assembly lubricants. Slide the induction hose and clamp(s) onto one of the tubes to be joined. The induction hose and clamp(s) must fit onto the tube far enough to allow installation of the tube, hose and clamps without interference.

4. Move the induction hose to position the induction hose over the connection joint of the two tubes. The connection joint and both tube beads are to be positioned in the center of the induction hose.

5. Slide the clamps into place, centering the clamps between the tubing bead and the end of the induction hose to ensure the hose correctly seals the tubes. The ends of the induction hose must extend beyond the clamp(s) on both ends of the induction hose.

6. Torque the clamps to 25-35 Inch-Lbs"

The Service Bulletin further states that "Failure to properly install induction system clamps and hoses may lead to failure of the hose to seal, loss of manifold pressure, and loss of engine power."

Pilot Information

Certificate:	Private	**Age:**	41,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	March 9, 2010
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	April 20, 2010
Flight Time:	850 hours (Total, all aircraft), 1 hours (Total, this make and model), 2 hours (Last 30 days, all aircraft)		

Flight instructor Information

Certificate:	Commercial; Flight instructor	**Age:**	63,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane multi-engine; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	June 2, 2009
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	February 8, 2010
Flight Time:	5735 hours (Total, all aircraft), 192 hours (Total, this make and model), 5685 hours (Pilot In Command, all aircraft), 24 hours (Last 90 days, all aircraft), 17 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N121HJ
Model/Series:	PA-46-310P	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	468508105
Landing Gear Type:		**Seats:**	6
Date/Type of Last Inspection:	September 23, 2009 Annual	**Certified Max Gross Wt.:**	4100 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	4803 Hrs as of last inspection	**Engine Manufacturer:**	CONT MOTOR
ELT:	Installed, not activated	**Engine Model/Series:**	IO-550 SERIES
Registered Owner:	THEODORE JOSEPH POELKING	**Rated Power:**	300 Horsepower
Operator:	THEODORE JOSEPH POELKING	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	ONT,944 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	16:51 Local	**Direction from Accident Site:**	260°
Lowest Cloud Condition:	3700 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	Broken / 3700 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	8 knots / 16 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	260°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.85 inches Hg	**Temperature/Dew Point:**	22°C / 13°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Santa Monica, CA (SMO)	**Type of Flight Plan Filed:**	None
Destination:	Lake Havasu, AZ (HII)	**Type of Clearance:**	VFR
Departure Time:	15:50 Local	**Type of Airspace:**	

Airport Information

Airport:	Ontario International Airport ONT	**Runway Surface Type:**	
Airport Elevation:	944 ft msl	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 Serious, 1 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Serious, 1 Minor	**Latitude, Longitude:**	34.055831,-117.601112(est)

Administrative Information

Investigator In Charge (IIC):	Cawthra, Joshua
Additional Participating Persons:	Nathan C Dickinson; Federal Aviation Administration; Riverside, CA Charles Little; Piper Aircraft; Vero Beach, FL Andrew Swick; Teledyne Continental Motors; Mobile, AL
Original Publish Date:	May 11, 2011
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=76295