Aviation Investigation Final Report

Location:	GAINESVILLE, Texas	**Accident Number:**	FTW01LA026
Date & Time:	November 26, 2000, 23:13 Local	**Registration:**	N9298Y
Aircraft:	Piper PA-46-310P	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	1 Minor
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

While in cruise on a night cross-country flight, the airplane's engine lost power. The pilot attempted a forced landing to a nearby airport, however, the airplane touched down in a field short of the runway. The engine had accumulated 265.5 hours since factory remanufacture. During examination of the engine, the number 3 connecting rod was found separated from the crankshaft. The number 4 piston exhibited a hole burned through the crown structure of the piston. The hole was located along a crack that extended across the top of the piston, in-line with the piston pin. Metallurgical examination determined that fatigue cracking of the piston initiated from a stamp mark "4" on the top surface of the piston. The stamp mark, which was made by the manufacturer during engine buildup, acted as a stress raiser and was responsible for initiation of the crack. Once the crack extended to the interior surface of the piston, hot combustion gasses created the burn through hole and escaped into the crankcase, leading to engine failure. The accident airplane had experienced a previous in-flight engine failure in which an engine teardown revealed a piston with a burned through hole in the crown structure of the piston. This engine had accumulated 640 hours since factory remanufacture; however, this piston did not have any stamp marks on its top surface. The Turbine Inlet Temperature (TIT) gauge, thermocouple, and probes were removed from the accident airplane, and the thermocouple leads were found spliced in two locations. According to the aircraft's maintenance manual, faulty thermocouple leads should be replaced. They should never be spliced, as this will change the resistance of the leads, which is critical for the proper operation of the TIT gauge. The pilot stated that he followed the leaning procedure in the airplane's operating handbook and leaned the engine by referencing the TIT gauge.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

the loss of engine power due to improper splicing of the TIT thermocouple leads by unknown persons, which led to over temperature operation of the engine due to inaccurate TIT gauge readings. Contributing factors were the manufacturer's stamp on the top of the piston, which created a stress riser leading to fatigue cracking of the piston, and the lack of suitable terrain for the forced landing.

Findings

Occurrence #1: LOSS OF ENGINE POWER(TOTAL) - MECH FAILURE/MALF
Phase of Operation: CRUISE - NORMAL

Findings
1. (C) ENGINE INSTRUMENTS,TIT GAGE - INACCURATE
2. (C) MAINTENANCE - IMPROPER - UNKNOWN
3. (C) MISCELLANEOUS,ENGINE - OVERTEMPERATURE
4. (F) ENGINE ASSEMBLY,PISTON - FATIGUE
5. (F) MATERIAL DEFECT - MANUFACTURER
6. ENGINE ASSEMBLY,PISTON - CRACKED

Occurrence #2: FORCED LANDING
Phase of Operation: EMERGENCY DESCENT/LANDING

Occurrence #3: ON GROUND/WATER ENCOUNTER WITH TERRAIN/WATER
Phase of Operation: LANDING - ROLL

Findings
7. (F) TERRAIN CONDITION - NONE SUITABLE

Factual Information

On November 26, 2000, at 2313 central standard time, a Piper PA-46-310P Malibu single-engine airplane, N9298Y, was substantially damaged during a forced landing following a loss of engine power near Gainesville, Texas. The instrument-rated commercial pilot, sole occupant of the airplane, received minor injuries. The airplane was owned and operated by D and L Flyers Inc., of Dallas, Texas. Night visual meteorological conditions prevailed and a visual flight rules flight plan was filed for the 14 Code of Federal Regulations Part 91 personal flight. The flight departed Wiley Post Airport (PWA) near Oklahoma City, Oklahoma, approximately 2220, and was destined for Addison, Texas.

During a telephone interview conducted by an NTSB investigator, the pilot stated that approximately 15 to 20 miles north of Gainesville, Texas, the airplane experienced a "severe" vibration. The engine oil pressure began to rise, then dropped, and the engine lost power. The pilot attempted a forced landing to runway 17 at Gainesville Municipal Airport. The airplane touched down short of the runway and came to rest in a grassy field approximately 200 yards from the runway threshold. During the landing, the airplane's right wing separated, and the landing gear collapsed.

The engine was disassembled under the supervision of the NTSB investigator-in-charge on December 19, 2000, at the facilities of Air Salvage of Dallas, Lancaster, Texas. The examination revealed a hole in the top of engine crankcase between the number 3, 4, 5, and 6 cylinders. The number 3 connecting rod was found separated from the crankshaft and its connecting rod bolts were found fractured and displayed "necking" near the fractured area. The number 4 piston exhibited a hole in the crown structure of the piston. The hole was burned through the crown structure along a crack that extended from the forward side just past the center of the piston, in-line with the piston pin. The number "4" was stamped in the top of the crown, and the fracture ran through the stamped number. The piston was retained and sent to the NTSB Materials Laboratory in Washington D.C. for further examination.

In addition to examining the engine, on December 19, 2001, NTSB investigators removed the turbine inlet temperature (TIT) gauge, thermocouple, and temperature probes from the accident aircraft for examination. The thermocouple leads were found spliced in two locations.

A review of the aircraft's maintenance records revealed that the Continental TSIO-550-C (1) remanufactured engine, serial number 814533-R, was installed on the airplane on June 26, 2000, and at the time of the accident, it had accumulated 265.5 total hours. At the same time the remanufactured engine was installed, maintenance personnel replaced the TIT probes with new probes. The records did not reveal any maintenance performed on the TIT thermocouple during that installation or prior to that date.

The number 4 piston was examined by the NTSB Materials Laboratory on March 7, 2001. The crack through the piston contained crack arrest marks typical of fatigue cracking that emanated from the stamp mark "4" at the top surface of the crown. The fatigue crack propagated into the crown as well as laterally across the crown. According to TCM, the stamp mark "4" was made at the TCM facility during build up of the engine.

During the investigation, it was learned that the accident airplane experienced an in-flight engine failure approximately 7 months prior to the November 26, 2000, accident, in which the same pilot executed a forced landing on a road. The aircraft landed on the road without incident and the pilot was not injured. The Continental TSIO-550-C (1) remanufactured engine, serial number 814506-R, was disassembled on May 11, 2000, at the Teledyne Continental Engine (TCM) facilities in Mobile, Alabama. According to the TCM report, the engine had accumulated 640 total hours. The examination revealed that the engine crankcase displayed holes above the number 2, 4, and 6 cylinders. All of the connecting rods, except the number 1 connecting rod, were found disconnected from the crankshaft. The number 6 piston exhibited a hole in the crown structure of the piston, and the hole was burned through the crown structure along a crack that extended from the forward side just past the center of the piston, in-line with the piston pin. A TCM metallurgist examined the crack and determined the fracture originated at the upper crown structure and progressed through the structure in fatigue. There were no marks stamped in the crown of the piston.

According to the Pilot's Operating Handbook for the PA-46-310P, during cruise flight, "maximum continuous Turbine Inlet Temperature (TIT) is 1,750 degrees Fahrenheit. Temporary operation up to 1,800 degrees Fahrenheit is permitted in order to define peak TIT. In no case should the aircraft be operated more than 30 seconds with a TIT in excess of 1,750 degrees Fahrenheit. The engine has been designed to attain the maximum possible fuel efficiency while maintaining the desired cruise power. This requires operating on the lean side of peak TIT. Although this procedure is different from conventional leaning procedures, it will produce the maximum fuel efficiency and will actually produce cooler engine temperatures than conventional peak TIT or rich of peak operation. The cruise mixture setting is 50 degrees Fahrenheit lean of peak TIT." The airplane flight manual supplement for installation of the TSIO-550-C engine in the PA-46-310P states, "insure cylinder head temperatures and Turbine Inlet Temperatures, as stated in the Basic Flight Manual, are not exceeded." The pilot stated he leaned the engine by referencing the TIT gauge. He further stated that he "never believed in running [engine temperature] high."

The Piper PA-46-310P Aircraft Maintenance Manual states, "if the [thermocouple] leads to the gauge are faulty in any way they should be replaced. When replacing the leads, it is important to use the same type and length of wire, as the resistance of the leads is critical for the proper operation of the gauge." According to the Glencoe Aviation Technology Series textbook, Aircraft Electricity & Electronics, "since thermocouple leads are made with a specific resistance, they must never be cut or spliced."

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	31,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:**	No
Instructor Rating(s):	Airplane single-engine	**Toxicology Performed:**	No
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	July 31, 2000
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	1933 hours (Total, all aircraft), 531 hours (Total, this make and model), 1849 hours (Pilot In Command, all aircraft), 180 hours (Last 90 days, all aircraft), 61 hours (Last 30 days, all aircraft), 4 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N9298Y
Model/Series:	PA-46-310P PA-46-310P	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	86-8608034
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	January 3, 2000 Annual	**Certified Max Gross Wt.:**	4300 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:		**Engine Manufacturer:**	Continental
ELT:	Installed, not activated	**Engine Model/Series:**	TSIO-550-C(1)
Registered Owner:	D AND L FLYERS INC.	**Rated Power:**	310 Horsepower
Operator:		**Operating Certificate(s) Held:**	None
Operator Does Business As:		**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Night/dark
Observation Facility, Elevation:		**Distance from Accident Site:**	
Observation Time:		**Direction from Accident Site:**	
Lowest Cloud Condition:	Scattered / 10000 ft AGL	**Visibility**	6 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	0°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:		**Temperature/Dew Point:**	45°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	OKLAHOMA CITY , OK (PWA)	**Type of Flight Plan Filed:**	VFR
Destination:	ADDISON , TX (ADS)	**Type of Clearance:**	VFR
Departure Time:	22:20 Local	**Type of Airspace:**	Class E

Airport Information

Airport:	GAINESVILLE MUNICIPAL GLE	**Runway Surface Type:**	Asphalt
Airport Elevation:	839 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	35	**IFR Approach:**	None
Runway Length/Width:	5000 ft / 100 ft	**VFR Approach/Landing:**	Forced landing

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:**	33.630111,-97.150917(est)

Administrative Information

Investigator In Charge (IIC):	Lemishko, Alexander
Additional Participating Persons:	LARRY J PRENTISS; FORT WORTH , TX JOHN KENT; MOBILE , AL
Original Publish Date:	January 2, 2002
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=50681