Aviation Investigation Final Report

Location:	Fort Lauderdale, Florida	**Accident Number:**	ERA15LA332
Date & Time:	August 30, 2015, 10:55 Local	**Registration:**	N864KM
Aircraft:	Lancair IV	**Aircraft Damage:**	Destroyed
Defining Event:	Powerplant sys/comp malf/fail	**Injuries:**	1 Serious, 1 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot stated that, during the climb to cruise altitude, he noticed a loss of engine oil pressure. He declared an emergency with air traffic control (ATC) and requested to return to the airport. After ATC acknowledged, the pilot advised ATC that he lost all engine power and had to make an emergency landing. During the forced landing, the airplane collided with a ditch and was destroyed by postcrash fire. An examination of the engine revealed that it failed catastrophically, displaying signatures of lubrication distress; further, no measurable quantity of oil could be recovered from within the engine. Detailed examination of the engine's turbochargers revealed that one of the two units displayed evidence of burnt oil on the external surface and evidence of a foreign material in the unit's center housing, on the thrust bearing, and on the thrust collar. The foreign material was identified as polyethylene (plastic), similar to that used to protect the exposed orifices of the engine during shipment.

Review of maintenance records revealed that the pilot/mechanic had replaced both turbochargers with overhauled units two days before the accident flight. The turbocharger overhauler provided installation instructions and warnings that, in part, stated, "Remove all protective caps and plugs BEFORE installing this turbocharger." The foreign material discovered within the turbocharger's center housing suggests that the protective plastic cap at the oil outlet was likely not removed during the installation. It is likely that the turbocharger center housing filled with oil, which then flowed out of the engine via the turbocharger housing backplate, resulting in oil starvation and the subsequent total loss of engine power.

Probable Cause and Findings

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

The mechanic's improper installation of the turbocharger assembly, which resulted in oil starvation and a subsequent total loss of the engine power.

Findings

Aircraft	Turbocharger - Incorrect service/maintenance
Aircraft	Recip engine power section - Failure
Personnel issues	Installation - Maintenance personnel

Factual Information

History of Flight

Prior to flight	Aircraft maintenance event
Initial climb	Powerplant sys/comp malf/fail (Defining event)
Initial climb	Loss of engine power (partial)
Emergency descent	Loss of engine power (total)
Emergency descent	Off-field or emergency landing
Landing-landing roll	Collision with terr/obj (non-CFIT)

On August 30, 2015, about 1055 eastern daylight time, an experimental amateur-built Lancair IV-P, N564KM, was destroyed by collision with terrain and a postcrash fire during a forced landing after takeoff from the Fort Lauderdale Executive Airport (FXE), Fort Lauderdale, Florida. The commercial pilot sustained serious injuries, and the passenger was not injured. The privately owned and operated airplane was operated under the provisions of 14 *Code of Federal Regulations* Part 91 as a personal flight. Visual flight rules conditions were reported at the airport about the time of the accident, and an instrument flight rules flight plan had been filed for the flight destined for Lynchburg Regional Airport (LYH), Lynchburg, Virginia.

According to the pilot, during a climb to cruise he noticed that the engine's oil pressure dropped to 9 psi. He declared an emergency with air traffic control (ATC) due to the low oil pressure indication and requested to return to FXE. ATC provided radar vectors and cleared the airplane for the visual approach to runway 9. Shortly thereafter, the pilot contacted the FXE tower controller and reported an "engine failure." The pilot made a forced landing on a levee located 5 miles west of the approach end of runway 9. During the landing rollout, the airplane veered off the levee, collided with a ditch, and caught fire.

The airplane was recovered and the engine was retained for examination. During the examination of the engine puncture holes were discovered in both upper crankcase halves. Further examination revealed that no measurable amount oil could be drained from the engine. All of the spark plugs were removed and displayed a sooty appearance. The cylinders were removed and the cylinder attaching hardware torque and break away torque was checked and found within manufactures specifications; the No. 1, No. 2 and No. 3 pistons and cylinder skirts were damaged. The No. 1 piston exhibited signatures consistent with a valve strike on the dome. The oil sump was removed and contained pieces of connecting rod, rod bolts, rod bearing, and aluminum material in the bottom of the sump.

The crankcase was separated and the main bearings were not damaged. All of the bearing tabs were intact and no fretting was noted on the thru-bolt bosses. There was no evidence of bearing shift and the crankcase mating surfaces were machined. Puncture holes were also noted on bottom right crankcase half below the No. 1 cylinder. No obstructions were found in the crankcase oil galleries. Prior to removal, the camshaft was bent forward of the rear journal.

The crankshaft was removed and disassembled, the main journals had a normal operating appearance. The No. 1 connecting rod journal was found burnt and deformed. The No. 4 connecting rod journal was found burnt; the No. 2, No. 3, No. 5 and No. 6 connecting rod journals had a normal operating appearance. Examination of the connecting rod bearings revealed the No. 1 rod bearing was located in oil sump and found burnt and wiped. The No. 4 rod bearing was found burnt and wiped but was still contained within the rod and cap; No.2, No. 3, No. 5, and No.6 rod bearings indicated signs of lubrication distress.

The oil pump was disassembled and scoring was present in the internal oil pump housing and oil pump gear facing. Metal contamination was present in the oil relief valve. The oil filter was removed and opened for examination. The filter element exhibited metal contamination (aluminum & steel).

A visual examination of both turbochargers revealed one turbocharger had a normal grayish coloration on the internal turbine blades, while the other turbocharger was found blackend and oily on the turbine and compressor impeller blades.

The turbochargers were sent to Hartzell Engine Technologies for further examination and identified as urbo A (serial No. tKL01420), and turbo B (serial No. KFN00434). Examination of the turbo A revealed the turbocharger was overhauled by Main Turbo Systems. The turbocharger rotating assembly spun freely with no indication of compressor or turbine rub. Both the axial and radial end play was within specification. The turbocharger assembly was consistent with the design data and there was no evidence of mechanical malfunction. The internal lubrication passages were present with no indications of concern. The turbocharger was dry and displayed evidence of internal and external corrosion.

Examination of turbo B revealed that it was also overhauled by Main Turbo Systems. The turbocharger rotating assembly spun freely with no indication of compressor or turbine rub. Both the axial and radial end play was within specification. The turbocharger assembly was consistent with the design data and there was no evidence of mechanical malfunction. The internal lubrication passages were present with no indications of concern. There was evidence of foreign material in the center housing, on the thrust bearing, and on the thrust collar. Evidence of "burnt" oil was discovered on the external surfaces of turbocharger. The turbo was dissembled and it was revealed that oil residue was evident on the backside of the compressor wheel. Further examination also revealed oil residue on the turbo backplate.

A review of the engine logbook entries revealed that both turbochargers were removed and replaced by the pilot/mechanic with overhauled units two days prior to the accident flight. The entry in the logbook noted, "three engine test runs/operational checks and conducted leak check in accordance with SB no. 23, dated Feb 8, 2006. No leak/discrepancies noted at this time."

An examination of the foreign material located in the center housing of the turbo was conducted. The unknown material was examined using a Fourier Transform Infrared (FTIR) spectrometer with a diamond attenuated total reflectance (ATR) accessory in accordance to ASTM E1252-98 (American Society for Testing Materials E1252- 98). The spectrum was consistent with a straight-chained aliphatic hydrocarbon. A spectral library search found a very strong spectral match to polyethylene.

During the shipment of the turbochargers, polyethylene protective caps and plugs were used to plug the oil line openings. These protective caps and plugs must be removed before installation. The turbocharger

overhauler provided instruction and warning tags with the units, one of which stated, "Remove all protective caps and plugs BEFORE installing this turbocharger."

Pilot Information

Certificate:	Airline transport	**Age:**	52,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	November 24, 2014
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	March 12, 2015
Flight Time:	(Estimated) 6954 hours (Total, all aircraft), 114 hours (Total, this make and model), 4399 hours (Pilot In Command, all aircraft), 77 hours (Last 90 days, all aircraft), 31 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Lancair	**Registration:**	N864KM
Model/Series:	IV P	**Aircraft Category:**	Airplane
Year of Manufacture:	1997	**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	LIV-166
Landing Gear Type:	Tricycle	**Seats:**	2
Date/Type of Last Inspection:	April 10, 2015 Annual	**Certified Max Gross Wt.:**	2200 lbs
Time Since Last Inspection:	167 Hrs	**Engines:**	Reciprocating
Airframe Total Time:	1617 Hrs at time of accident	**Engine Manufacturer:**	Continental
ELT:	C126 installed, not activated	**Engine Model/Series:**	TSIO-550-E1B
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:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	FXE,13 ft msl	**Distance from Accident Site:**	10 Nautical Miles
Observation Time:	10:53 Local	**Direction from Accident Site:**	360°
Lowest Cloud Condition:	Scattered / 2300 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	Broken / 12000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	17 knots / 24 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	140°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.01 inches Hg	**Temperature/Dew Point:**	28°C / 24°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Fort Lauderdale, FL (FXE)	**Type of Flight Plan Filed:**	IFR
Destination:	Lynchburg, VA (LYH)	**Type of Clearance:**	IFR
Departure Time:	10:35 Local	**Type of Airspace:**	Class E

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 None	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Serious, 1 None	**Latitude, Longitude:**	26.197221,-80.170829(est)

Preventing Similar Accidents

Mechanics Manage Risk and Follow Procedures (SA-022)

The Problem

Mistakes made while performing aircraft maintenance and inspection procedures have led to in-flight emergencies and fatal accidents. System or component failures are among the most common defining events for fatal general aviation accidents.

What can you do?

- Remember that well-meaning, motivated, experienced technicians can make mistakes. Learning about and adhering to sound risk management practices can help prevent common errors that can lead to tragic consequences.
- Understand the safety hazards associated with human fatigue and strive to eliminate fatigue contributors in your life. Fatigue has been linked to forgetfulness, poor decision making, reduced vigilance, and other factors that can interfere with your ability to do your job safely.
- Pay particular attention to the safety and security of the items that undergo maintenance and any surrounding components that may have been disconnected or loosened (possibly to ease access) during that maintenance.
- Carefully follow manufacturers' instructions to ensure that the work is completed as specified. Always refer to up-to-date instructions and manuals when performing a task, and ask questions of another qualified person if something is unfamiliar to you.
- Have a qualified person, other than the person who performed the maintenance, inspect the safety and security of critical items that have received maintenance.
- Be thorough when performing routine inspections. Ensure that items needing immediate attention are addressed rather than deferred.

See https://www.ntsb.gov/Advocacy/safety-alerts/Documents/SA-022.pdf for additional resources.

The NTSB presents this information to prevent recurrence of similar accidents. Note that this should not be considered guidance from the regulator, nor does this supersede existing FAA Regulations (FARs).

Administrative Information

Investigator In Charge (IIC):	Alleyne, Eric
Additional Participating Persons:	Lester Abreu; FAA; Orlando, FL John Kent; Continental Motors; Mobile, AL
Original Publish Date:	October 2, 2017
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=91886