Aviation Investigation Final Report

Location:	Pickens, South Carolina	**Accident Number:**	ERA12LA473
Date & Time:	July 22, 2012, 17:05 Local	**Registration:**	N138CK
Aircraft:	CIRRUS DESIGN CORP SR-22	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (total)	**Injuries:**	4 None
Flight Conducted Under:	Part 91: General aviation		

Analysis

A few minutes after leveling the airplane at a cruise altitude of 9,000 feet mean sea level, the pilot felt the engine slightly vibrate or "wiggle." The propeller rpm then began to rise rapidly, and the pilot noted an engine oil pressure warning on the primary flight display. After unsuccessfully troubleshooting the engine problems, the pilot secured the engine and declared an emergency. An air traffic controller informed the pilot of an airport 4 miles from his location, and he turned the airplane toward that airport and prepared for an emergency landing. The pilot again unsuccessfully attempted to restart the engine and then resecured it while on the downwind leg of the airport traffic pattern. When the pilot turned the airplane toward the base leg of the traffic pattern at 1,200 feet, he added one notch of flaps, at which point, he felt the handling characteristics of the airplane change, and it began to feel "mushy." He then retracted the flaps, and the condition worsened. As the airplane descended through 1,000 feet, the pilot thought that he had "lost control of the airplane" and decided to activate the airframe emergency parachute. The parachute deployed, and, within seconds, the airplane settled into trees about 2 miles from the airport. The airplane remained suspended in the trees until emergency personnel arrived on scene and rescued the occupants.

After the accident, the presence of oil was noted on the underside of the airplane. After the airplane was recovered from the trees, examination of the oil dipstick revealed small pieces of metal in the engine oil. Examination of the engine revealed that the crankshaft was fractured and that the crankcase exhibited varying degrees of fretting and lock-slot elongation on the main bearing supports, which is consistent with the application of insufficient torque on the cylinder through-bolts by maintenance personnel. New cylinders had been installed on the engine 113 hours before the accident. Because the cylinders were loose, the oil supply at the No. 2 main journal was shut off and the crankshaft broke, which resulted in the subsequent loss of oil pressure to the engine.

Probable Cause and Findings

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

A total loss of engine power due to the failure of the crankshaft, which resulted from the application of insufficient torque on the cylinder through-bolts by maintenance personnel.

Findings

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

Factual Information

History of Flight

Enroute	Loss of engine power (total) (Defining event)
Emergency descent	Off-field or emergency landing
Emergency descent	Miscellaneous/other
Emergency descent	Collision with terr/obj (non-CFIT)

On July 22, 2012, at 1705 eastern daylight time, N138CK, a Cirrus SR-22, was substantially damaged during a forced landing in Pickens, South Carolina. The commercial pilot and three passengers were not injured. Visual meteorological conditions prevailed and an IFR flight plan was filed for the flight that departed Cobb County Airport-Mc Collum Field (RYY), Atlanta, Georgia, and was destined for Piedmont Triad International Airport (GSO), Greensboro, North Carolina. The business flight was conducted under the provisions of 14 CFR Part 91.

According to the pilot, he began the day flying the airplane alone from Shelby County Airport (EET), Alabaster, Alabama to Gulfport-Biloxi International Airport (GPT), Gulfport, Mississippi, where he picked up 3 passengers. Prior to departure from GPT, the airplane was fueled "to the tabs" and 1 quart of oil was added to the engine. He and the 3 passengers then departed GPT, destined for RYY. As the airplane was descending enroute to RYY, the engine experienced a "brief misfire," which the pilot reported he had experienced in other airplanes before and was not concerned about. The airplane also experienced an ALT 2 failure enroute. The pilot attempted to troubleshoot the problem, without success, and then shed some of the electrical load. He continued to RYY and landed without incident.

The landing at RYY was a planned fuel stop, enroute to the final destination of GSO, where the airplane was based. Prior to departure from RYY, the airplane was fueled with 60 gallons of 100LL aviation fuel, which again filled the tanks "to the tabs." The pilot checked the oil (about 6 1/2 quarts) and examined the engine and underside of the airplane for any abnormal conditions which would have explained the earlier engine misfire. He found no anomalies and proceeded with the departure.

The takeoff from RYY was normal, and as the airplane climbed through an altitude of 800 feet, the pilot noted the oil temperature was "in the green" (about 190 deg) and the airspeed was about 130 knots.

The pilot leveled the airplane at 9,000 feet, at a cruise speed of 165 knots. A few minutes later, the pilot felt a "wiggle," or a slight vibration from the engine. The prop RPM began to rise rapidly and he noted an engine oil pressure warning on the primary flight display (PFD). The pilot disengaged the autopilot, applied full mixture, and turned the fuel pump on. He also assured the magnetos were in the "on" position. The pilot thought he may have had a propeller overspeed condition, so he reduced the throttle; however, the RPMs remained high. He then secured the engine and declared an emergency with Greer Approach Control, with whom he had been communicating. The air traffic controller informed the pilot that Pickens County Airport (LQK) was at his "10:00 and 4 miles," and the pilot turned toward the field and prepared for a forced landing. He noted the RPMs were not decreasing as he pitched the airplane

down for the descent (the airspeed was about 110-120 knots). The pilot attempted unsuccessfully to restart the engine, and then re-secured it while on the downwind leg of the traffic pattern for runway 23 at LQK. He believed he had plenty of airspeed and altitude, when he turned base at 1,200 feet, and added one notch of flaps.

As the pilot added the flaps, he felt the handling characteristics of the airplane change, and it began to feel "mushy." He then retracted the notch of flaps and the condition became worse. As the airplane descended through 1,000 feet, the pilot felt as if he had "lost control of the airplane" and decided to activate the airframe emergency parachute. The parachute deployed and within seconds the airplane settled into the trees. The airplane remained suspended in the trees until emergency personnel arrived on-scene and rescued the occupants.

Pilot Information

Certificate:	Flight instructor	**Age:**	38
Airplane Rating(s):	Single-engine land; Single-engine sea; 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 multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	May 1, 2012
Occupational Pilot:		**Last Flight Review or Equivalent:**	December 13, 2011
Flight Time:	1800 hours (Total, all aircraft), 350 hours (Total, this make and model), 1700 hours (Pilot In Command, all aircraft), 250 hours (Last 90 days, all aircraft), 100 hours (Last 30 days, all aircraft), 10 hours (Last 24 hours, all aircraft)		

The pilot held a commercial pilot certificate and a flight instructor certificate with multiple ratings including: instrument airplane, airplane single-engine land, and multiengine land. His most recent first-class medical certificate was issued on May 1, 2012. The pilot reported 1,800 hours of total flight experience, 350 of which were in the make and model of the accident airplane.

Aircraft and Owner/Operator Information

Aircraft Make:	CIRRUS DESIGN CORP	**Registration:**	N138CK
Model/Series:	SR-22	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	3492
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	September 1, 2011 Annual	**Certified Max Gross Wt.:**	3400 lbs
Time Since Last Inspection:	402 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	1365 Hrs at time of accident	**Engine Manufacturer:**	CONT MOTOR
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	IO-550-N
Registered Owner:	CAIR LLC	**Rated Power:**	310 Horsepower
Operator:	CAIR LLC	**Operating Certificate(s) Held:**	None

The airplane was manufactured in 2009 and equipped with a Continental IO-550 engine. The following entries were noted in the airplane and engine logbooks:

On April 28, 2010, all six cylinders were removed from the engine and sent to a repair station. According to the work order, maintenance to the cylinders included, "checking the guides and resealing the valves." The cylinders were reinstalled on May 4, 2010, and an operational check revealed no leaks or other anomalies.

The most recent annual inspection was completed on the airframe and engine on September 1, 2011 at a tachometer time of 963 hours. No anomalies were noted during the inspection.

On April 4, 2012, a new crankshaft seal and new cylinders were installed on the engine at a tachometer time of 1,252 hours. According to the logbook entry, an operational check was performed after installation, with no anomalies noted.

The next entry in the logbook was on May 3, 2012. This entry described compression checks on all 6 cylinders with the following values: "1. 78/80; 2. 74/80; 3. 76/80; 4. 77/80; 5. 75/80; 6. 75/80." According to the entry, another operational check was performed with "no leaks noted."

An oil change was performed on July 18, 2012. According to the logbook entry, the oil filter was cut and no metal was noted.

The tachometer time noted at the accident site was 1,365 hours.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	LQK,1013 ft msl	**Distance from Accident Site:**	2 Nautical Miles
Observation Time:	17:15 Local	**Direction from Accident Site:**	50°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	230°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.15 inches Hg	**Temperature/Dew Point:**	35°C / 22°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Atlanta, GA (RYY)	**Type of Flight Plan Filed:**	IFR
Destination:	Greensboro, NC (GSO)	**Type of Clearance:**	IFR
Departure Time:	16:00 Local	**Type of Airspace:**	Class E

Airport Information

Airport:	Pickens County Airport LQK	**Runway Surface Type:**	
Airport Elevation:	1013 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 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	3 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	4 None	**Latitude, Longitude:**	34.810001,-82.702774(est)

Examination of the airplane by a Federal Aviation Administration inspector revealed the airplane impacted trees about 2 miles from LQK. The airplane remained suspended in the trees during the inspector's examination; however, he did note the presence of oil on the underside of the airplane. After the airplane was recovered from the trees, examination of the oil dipstick revealed approximately 4 quarts of oil in the engine. There were also small pieces of metal noted on the dipstick.

Tests and Research

Recoverable Data Module (RDM) Examination

The airplane was equipped with a Heads Up Technology Recoverable Data Module (RDM) mounted in the empennage, which was intended to record various flight and aircraft parameters. The device was retained after the accident, and forwarded to the NTSB Vehicle Recorders Laboratory, Washington, D.C., for data recovery.

According to the RDM data, the engine lost power at 1659, and the airplane began a descent immediately after. The CAPS handle was pulled at 1704:55, and the CAPS rocket deployed at the same time. The last data points were recorded at 1705:20

Engine Teardown Inspection

The engine was sent to Teledyne Continental Motors in Mobile, Alabama for a teardown inspection. The inspection revealed the crankshaft was fractured through the number 3 cheek between the number 2 rod journal and the number 2 main journal. The camshaft exhibited mechanical damage and was fractured in two places; forward of the second lobe and at the center of the second main journal. The crankcase exhibited varying degrees of fretting and lock slot elongation on the main bearing supports. The number 2 main bearing support exhibited signs of bearing rotation.

Additionally, low torque values were noted for the cylinder through-bolts.

No indications of fatigue were noted on any of the fractured components (For additional information regarding the engine teardown, see the Continental Motors Teardown Report and the FAA Inspector Teardown Report in the public docket for this accident).

Administrative Information

Investigator In Charge (IIC):	Demko, Jill
Additional Participating Persons:	Scott Camp; FAA/FSDO; Columbia, SC John Kent; Continental Engines; Mobile, AL Brannon Mayer; Cirrus Aircraft; Duluth, MN
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Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=84417