Aviation Investigation Final Report

Location:	Tuskegee, Alabama	**Accident Number:**	ANC18LA004
Date & Time:	October 15, 2017, 11:00 Local	**Registration:**	N289CM
Aircraft:	CIRRUS DESIGN CORP SR22T	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (partial)	**Injuries:**	3 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The private pilot reported that shortly after takeoff, during the initial climb, he sensed the airplane slow down and the climb rate diminish. A witness reported seeing grey smoke being emitted from the airplane's exhaust. Realizing that the engine had lost partial power, the pilot chose a sod field as an off-airport landing site. During the forced landing, the airplane's landing gear collapsed, and the airplane sustained substantial damage to the fuselage.

A postaccident examination, which included an engine run, revealed that when the throttle was advanced through a manifold pressure of about 36 inches of mercury (inHg), the fuel flow exceeded the engine manufacturer's full throttle high-side limit. Continued movement of the throttle resulted in a manifold pressure of about 39 inHg before the engine began experiencing fuel flows that were too excessive to support combustion. The slope controller was adjusted to reduce manifold pressure to that specified by Cirrus, and the engine test run continued with high fuel flows. After the manifold pressure adjustment, the engine throttle was rapidly advanced multiple times from idle to full throttle without any hesitation, stumbling, or interruption in power.

Thus, it is likely that the improperly adjusted slope controller and fuel pump resulted in an excessively high fuel flow, an extremely rich mixture, a rough-running engine, and a partial loss of engine power.

Probable Cause and Findings

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

An improperly adjusted slope controller and fuel pump that resulted in an excessively high fuel flow, an extremely rich mixture, a rough-running engine, and a subsequent partial loss of engine power.

Findings

Aircraft	Fuel pumps - Incorrect service/maintenance
Aircraft	Fuel pressure - Incorrect service/maintenance
Aircraft	(general) - Incorrect service/maintenance

Factual Information

History of Flight

Initial climb	Loss of engine power (partial) (Defining event)
Emergency descent	Off-field or emergency landing
Landing-flare/touchdown	Landing gear collapse

On October 15, 2017, about 1100 central daylight time, a Cirrus Design SR22T airplane, N289CM, sustained substantial damage during a forced landing following a partial loss of engine power shortly after takeoff from Moton Field Municipal Airport (06A), Tuskegee, Alabama. The airplane was registered to Skylane Partners, LLC and operated by the pilot as a visual flight rules flight under the provisions of 14 *Code of Federal Regulations* Part 91 when the accident occurred. The certificated private pilot and three passengers were not injured. Visual meteorological conditions prevailed, and an instrument flight plan had been filed.

The pilot reported that after completion of the preflight inspection and the before takeoff checks, he departed runway 13 from 06A. Shortly after takeoff, during the initial climb, he sensed the airplane slow down and the climb rate diminish. Realizing the airplane had suffered a partial loss of power well below 1,000 feet above ground level (AGL), and unable to return to the airport, he selected a sod field as an off-airport landing site. During the forced landing the airplane's landing gear collapsed and the airplane sustained substantial damage to the fuselage.

In a written statement, a fixed base operator (FBO) Line Service Technician at 06A reported that he observed a cloud of faint white smoke after the accident airplane's engine was started. He wrote that the engine sounded "choppy" throughout the entire takeoff. After liftoff, about midfield, he observed grey smoke being emitted from the airplane's exhaust. About 200 feet AGL, the airplane's speed began to decrease as it entered a gradual left bank and began to lose altitude. Concerned for the occupant's safety, he radioed the pilot and asked, "Is everything OK" and the pilot responded, "We have a field in sight." He continued to observe the airplane as it disappeared behind the trees, followed by the sounds of an airplane impacting the ground. Unable to contact the pilot on the radio, he immediately notified first responders of the accident.

In a separate conversation, the pilot reported that during the advancement of the throttle lever for takeoff, when the manifold pressure reached 36.5 in.Hg, he stopped the movement of the throttle lever, even though it was prior to the full forward limit stop.

The Cirrus SR22T Pilot's Operating Handbook and FAA Approved Flight Manual, the section titled *Takeoff Power Check*, states in part: "Check full-throttle engine operation early in takeoff run. The engine should run smoothly and turn approximately 2500 RPM. All engine parameters are not in caution or warning ranges. Discontinue takeoff at any sign of rough operation or sluggish acceleration. Make a thorough full-throttle static run-up before attempting another takeoff. Manifold pressure may temporarily increase to 36.0 - 37.0 in.Hg on first flight of the day due to cooler oil temperatures and

associated higher oil pressures. This is acceptable under these conditions but normal full throttle manifold pressure should be 36.0 in.Hg. The fuel flow will normally also increase in proportion to the increase in manifold pressure. If manifold pressure exceeds 37.0 in.Hg on takeoff or during full power climbs, reduce power to maintain no more than 37.0 in.Hg."

The Continental Motors, Continental Aircraft Engine Maintenance Manual, Standard Practice For Spark Ignited Engines, Engine Inspection and Service, 6-4.7.4.3 Fuel System Operational Checkout Procedure, states in part:

Manifold Pressure ..... Check

RESULT: Manifold pressure should equal the value specified for the engine model in Section 6-4.7.1. If manifold pressure is not within the specified limits, adjust the Wastegate Controller according to instructions in Section 6-4.10.3.

Section 6-4.10.3.3 Sloped Controller Adjustment states in part:

Applicable Engines: TSIO-520-BE; TSIO-550-A, B, C, E, G, K, N TSIOL-550-C

CAUTION: Instructions in this section were verified on TSIO-550-C engine models. For all other engine models, consult the Aircraft Maintenance Manual before proceeding.

The sloped controller limits oil flow through the wastegate, which determines the position of the butterfly valve in the wastegate. Adjustment of the sloped controller may be required after an engine is installed, rebuilt, serviced, or overhauled, or sloped controller replacement. Procedure 1. Orient the aircraft nose into the prevailing wind and run the engine at 1500 to 1800 RPM until the oil temperature is 160 to 180° F (71 to 82°C). 2. Using a handheld digital tachometer set the propeller controls according to the Section 6-4.7.1. 3. With the throttle in the FULL FORWARD position, set the intake manifold pressure according to the value in Section 6-4.7.1 for the engine model by turning the adjusting screw on the bottom of the slope controller (Figure 6-56) using a wide blade common screwdriver. Turning the screw clockwise (***CW***) increases manifold pressure, counter-clockwise (***CCW***) decreases manifold pressure. NOTE: 1/8 turn of the adjusting screw=@1.0 inch Hg.

Idle and FULL POWER Fuel Pressures and Flows						
Engine[1]	Prop. RPM	Manifold Absolute Pressure (MAP)	Unmetered Pump PSI[2]	Metered Nozzle PSI[3]	Fuel (lbs/hr)[4]	Fuel (gal/hr)[4]
TSIO-550- K, N	600 2500	- 37.5	7.0 - 9.0 20.5 - 28.5	- 14.2 - 14.8	- 210 - 220	- 35.8 - 37.5

Table 6-4. Fuel System Adjustment Values

On March 29, 2018, an engine examination was performed by Continental Motors, Mobile, Alabama, under the supervision of the NTSB. Due to limited damage, an engine test run was conducted. The engine was fitted with a test club propeller for the TSIO-550 series engine.

The engine experienced a normal start without hesitation or stumbling in observed rpm. The warm-up sequence was completed over a span of about 20 minutes before the engine throttle was advanced to the full open position. As the throttle was advanced it was noted that the fuel flow exceeded the Continental Motors' full throttle highside limit once the manifold pressure surpassed 36 in.Hg. Continued movement of the throttle resulted in a manifold pressure of around 39 in.Hg before the engine began experiencing fuel flows that were too excessive to support combustion.

During the engine test, the magnetos were checked and a drop of 38 rpm was noted for the left magneto and a drop of 56 rpm was noted for the right magneto.

The slope controller was adjusted to reduce manifold pressure to that specified by Cirrus and the engine test run continued with high fuel flows. Following the manifold pressure adjustment, the engine throttle was rapidly advanced multiple times from idle to full throttle without any hesitation, stumbling or interruption in power.

A review of the airplane's maintenance records revealed that the last annual inspection was completed on January 11, 2017, at a total time in service of 725.5 flight hours.

The airplane was equipped with a Cirrus Perspective integrated avionics from Garmin and a Heads Up Technologies recoverable data module (RDM) data recorder. Flight data recorded by the RDM was downloaded by the NTSB's Vehicle Recorder Division in Washington DC. Review of the data revealed that the engine was started about 10:41:20 CDT and run up to 1700 rpm about 90 seconds later. The run up lasted approximately 30 seconds. The aircraft began to taxi at 10:44:55 and turned on to the runway heading and began to accelerate for takeoff at 10:47:20.

At 10:47:45, the aircraft rotated for takeoff at 75 knots. Pitch stabilized at 11 degrees and airspeed reached a peak of 85 knots, although airspeed began to decrease about one knot per second, slowing to 79 knots. The engine was stable during the initial climb at about 2,480 rpm and manifold pressure of 35.2 inHg. Fuel flow was about 41 gph.

At 10:48:07, the climb was interrupted at 250 ft pressure altitude (487 ft GPS altitude). Airspeed began to increase again, at about two knots per second. At 10:48:10 the aircraft began a turn to the left, and engine manifold pressure and fuel flow increased to a peak of 40.3 inHg and 48.1 gph, respectively. Within one second, both engine EGT and TIT began to decrease.

At 10:48:30, engine RPM began to decrease along with manifold pressure and fuel flow. The aircraft was descending at this time. At 10:48:39, the aircraft reached ground level and groundspeed decelerated from 89 knots to 0 at 10:48:48. The engine also stopped turning at that time.

The closest weather reporting facility was Auburn University Regional Airport (AUO), Auburn, Alabama, about 16 miles northeast of the accident site. At 1056, a METAR from AUO was reporting, in part: wind from 180 °at 5 knots; visibility, 10 statute miles; clouds and sky condition, few clouds at 1,100 feet, broken clouds at 5,500 feet; temperature, 77 °F; dew point 70° F; and altimeter, 30.20 inches of mercury.

Pilot Information

Certificate:	Private	**Age:**	49,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:**	
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	November 11, 2015
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	August 26, 2017
Flight Time:	2128 hours (Total, all aircraft), 732 hours (Total, this make and model), 8 hours (Last 90 days, all aircraft), 8 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	CIRRUS DESIGN CORP	**Registration:**	N289CM
Model/Series:	SR22T	**Aircraft Category:**	Airplane
Year of Manufacture:	2010	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	0014
Landing Gear Type:	Tricycle	**Seats:**	
Date/Type of Last Inspection:	January 11, 2017 Annual	**Certified Max Gross Wt.:**	
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	725.5 Hrs as of last inspection	**Engine Manufacturer:**	CONT MOTOR
ELT:	Installed	**Engine Model/Series:**	TSIO-550 -K1B
Registered Owner:	On file	**Rated Power:**	0 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:	KAUO	**Distance from Accident Site:**	16 Nautical Miles
Observation Time:	15:56 Local	**Direction from Accident Site:**	45°
Lowest Cloud Condition:	Few / 1100 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	Broken / 5500 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	180°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.2 inches Hg	**Temperature/Dew Point:**	25°C / 21°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Tuskegee, AL (06A)	**Type of Flight Plan Filed:**	IFR
Destination:	MILLINGTON, TN (NQA)	**Type of Clearance:**	None
Departure Time:	11:00 Local	**Type of Airspace:**	Class G

Airport Information

Airport:	Moton Field Muncipal Airport 06A	**Runway Surface Type:**	
Airport Elevation:	264 ft msl	**Runway Surface Condition:**	Unknown
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:	2 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 None	**Latitude, Longitude:**	32.460556,-85.68(est)

Administrative Information

Investigator In Charge (IIC):	Banning, David
Additional Participating Persons:	Robert Bullock; Federal Aviation Administration Bradley Miller; Cirrus Design Corporation; Duluth, MN Nicole L Charnon; Continental Motors; Mobile, AL
Original Publish Date:	April 13, 2020
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=96208