Aviation Investigation Final Report

Location:	Twin Lakes, Colorado	**Accident Number:**	CEN22LA176
Date & Time:	April 13, 2022, 07:04 Local	**Registration:**	N112TR
Aircraft:	CIRRUS DESIGN CORP SR22	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (total)	**Injuries:**	1 Minor
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot reported that he initially leveled off at 17,000 ft mean sea level (msl) but ultimately climbed to flight level (FL) 230 to stay above the cloud tops. During the climb to FL230, the pilot recalled a brief alternate air indication on the primary flight display (PFD). The engine was performing normally and producing full power at that time. Upon leveling off, he reduced engine power to approximately 65% to 75% and adjusted the fuel flow. The alternate air indication extinguished, and all engine indications were normal.

The pilot noted that, after leveling off at FL230, a “drastic reduction” in engine power occurred, and he observed an indication of 10% to 15% engine power. He immediately set the mixture to full rich and the fuel pump to high boost. He then adjusted the power lever in an attempt to restore engine power. None of the actions had any effect. During the descent the flight reentered instrument meteorological conditions (IMC). After declaring an emergency and establishing best glide airspeed, the pilot established a course toward a valley east of the current position. About that time, smoke started to enter the cabin and he recalled thinking that restarting the engine was not going to be possible. As the airplane descended through the minimum safe altitude for the mountainous terrain in the area, he noticed a small circle of yellow/mountain peak appear on the multi-function display (MFD) indicating terrain was near; he decided to set the engine mixture control to idle/cutoff and deploy the Cirrus Airframe Parachute System (CAPS). Once the parachute fully deployed, he turned off the electrical system and secured the cabin for touchdown. He recalled contacting the ground “hard” a few seconds later.

Review of the available engine data revealed initial reductions in engine power that were likely associated with the airplane leveling off at cruise altitudes. However, three of those power

reductions were accompanied by further momentary reductions that appeared to be consistent with the pilot's attempts to close the alternate air door. Each consisted of a single power reduction followed by a return to cruise engine speed, indicating that the alternate air door likely closed and the indication cleared.

A subsequent fluctuation in engine power occurred that lasted about 90 seconds. This fluctuation was accompanied by a substantial loss in manifold pressure, exhaust gas temperatures (EGT), and turbine inlet temperatures (TIT). Afterward, the engine speed stabilized about 2,600 rpm and then gradually increased until it abruptly decreased and went to zero consistent with the pilot shutting down the engine. (This is when the pilot decided to shut down the engine due to cabin smoke and approaching terrain.) The subsequent increase in engine speed and relatively stable fuel flow suggest that engine power may have been recovering as the pilot leaned the mixture. This would be consistent with a complete loss of engine power due to an overly rich fuel-air mixture. Although leaning would potentially have restored a proper fuel-air mixture and allowed the engine to regain power, the pilot's decision to shut down the engine precluded this possibility.

A postaccident examination of the right turbocharger assembly revealed that it appeared intact and was unremarkable. However, the examination of the left turbocharger revealed that the left turbocharger compressor vanes were curled with corresponding scraping damage to the housing inlet consistent with contact while the vanes were rotating. The turbine vanes appeared intact with no scraping damage noted. The compressor and turbine vanes rotated freely; however, the shaft exhibited a slight amount of axial play. The curled blade tips and scraping damage to the housing inlet suggest that the damage occurred when the engine was operating. The engine was not operating during ground impact since the pilot had shut down the engine. Had the turbocharger hit sufficiently hard to make contact marks, it is likely that the impact marks would be static in nature, with single impact marks for each blade, and not showing rotation like the scraping marks. Therefore, it is likely that the turbocharger failed in flight.

The cause of the initial reductions in engine power were likely the result of an inadvertent opening of the alternate air door and intentional power adjustments made by the pilot when leveling at cruise altitudes. The subsequent failure of the left turbocharger after reaching FL230 likely resulted in a loss of engine power as a result the failure combined with the rapid reduction of manifold pressure and rich mixture setting. However, the pilot's action of establishing a full rich mixture and activating the fuel pump on high boost may have contributed to an overly rich fuel-air mixture and a complete loss of engine power. There was no evidence of an engine fire or oil leak and the source of the cabin smoke was not determined, although it may have been associated with the rotational damage of the left turbocharger. Under the circumstances, the pilot's decision to shut down the engine and deploy the airframe parachute was reasonable.

Probable Cause and Findings

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

The failure of the left turbocharger at FL230, which resulted in a rapid loss of manifold pressure and subsequent complete loss of engine power due to an overly rich fuel-air mixture setting. Contributing was the smoke in the cabin in IMC, which caused the pilot to proactively shut down the engine and deploy the airframe parachute.

Findings

Not determined	(general) - Unknown/Not determined
Aircraft	Turbocharger - Failure
Environmental issues	Mountainous/hilly terrain - Decision related to condition
Personnel issues	Incorrect action performance - Pilot

Factual Information

History of Flight

Enroute-change of cruise level	Loss of engine power (partial)
Enroute-cruise	Fire/smoke (non-impact)
Enroute-cruise	Loss of engine power (total) (Defining event)
Emergency descent	Off-field or emergency landing

On April 13, 2022, at 0704 mountain daylight time, a Cirrus Design SR22 airplane, N112TR, was substantially damaged when it was involved in an accident near Twin Lakes, Colorado. The pilot sustained minor injuries. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

The pilot reported that he initially leveled off at a cruise altitude of 17,000 ft msl. However, to remain above the cloud tops, he requested to climb to FL210 and then FL230. The climb segments were conducted at full power and full rich mixture. The fuel pump was set to low boost. During the climb from FL210 to FL230, the pilot noted a brief alternate air indication on the PFD. The engine was performing normally and producing full power at that time. Upon leveling off, he reduced engine power to approximately 65% to 75% and adjusted the fuel flow. The alternate air indication extinguished and all engine indications were normal. The pilot noted that he had seen the alternate air indication before and typically reduced engine power "a bit," which extinguished the indication.

The pilot noted that, about 0657, a "drastic reduction" in engine power occurred. He observed an engine power indication of 10% to 15%. He immediately set the mixture to full rich and the fuel pump to high boost. He then adjusted the power lever in an attempt to restore engine power. None of the actions had any effect. During the descent the flight reentered IMC. After declaring an emergency with Denver Center and establishing best glide airspeed, he turned to a course toward a valley east of the airplane's current position. About that time, smoke started to enter the cabin and he recalled thinking that restarting the engine was not going to be possible. As the airplane descended through the minimum safe altitude for the mountainous area, the pilot noticed a small circle of yellow/mountain peak appear on the multi-function display (MFD) indicating terrain was near; he decided to set the engine mixture control to idle/cutoff and deploy the CAPS. Once the parachute fully deployed, he turned off the electrical system and secured the cabin for touchdown. He recalled contacting the ground "hard" a few seconds later. The airplane came to rest upright in a mountain valley consisting of rocky terrain and low brush. The left wing was damaged at the main landing gear mounting point during the CAPS assisted touchdown.

A postaccident examination did not reveal any anomalies with respect to the engine itself. The induction air filter and ducting appeared intact and unobstructed. The induction air system alternate air door was intact and secure. It remained closed when magnetically latched and opened when hand/finger pressure was applied. The right turbocharger assembly appeared intact and was unremarkable. The left turbo compressor vanes were curled with corresponding scraping damage to the housing inlet consistent with contact while the vanes were rotating. The turbine vanes appeared intact with no scraping damage noted. The compressor and turbine vanes rotated freely; however, the shaft exhibited a slight amount of axial play.

Data downloaded from the recoverable data module (RDM) revealed several distinct reductions in engine power during the flight which preceded the final loss of engine power and shutdown. About 0636, the engine speed dropped from about 2,625 rpm to about 2,460 rpm with associated drops in manifold pressure and fuel flow. About 2 minutes later, the engine regained power. This power reduction appeared to coincide with the airplane leveling off at 17,000 ft msl before beginning a climb to FL210.

Then, about 0641, a second reduction in engine speed, manifold pressure, and fuel flow occurred that lasted about one minute. This reduction occurred during the climb to FL210. A third reduction in engine power occurred about 0644 and lasted for about 9 minutes. This reduction appeared to coincide with the airplane leveling off at FL230.

About 0657, another loss of engine power occurred. RDM data indicated that the EGT of the six cylinders dropped from about 1,300-1,400° F to about 150° F. Similarly, the TIT of the left and right turbochargers dropped from about 1,550° F to about 150° F. The manifold pressure dropped from about 30 inches of mercury (in Hg) to about 11 in Hg. The fuel flow initially dropped from about 35 gallon per hour (gph) to 9-15 gph, and then it increased to about 25 gph. During this time, the airplane descended from FL23 to about 16,500 ft msl. The airplane's airspeed decreased from about 125 knots to about 100 knots.

From about 0659 to 0703, the engine appeared to be recovering; the manifold pressure, TITs, and EGTs were intermittently rising, but the engine ultimately lost power completely when the pilot decided to shut down the engine and deploy the CAPS.

The airplane was equipped with a turbonormalizing system, which incorporated a magnetically latched alternate air door to allow warm, unfiltered air to enter the dual turbocharger units in the event of any restrictions to induction air flow. The Pilot's Operating Handbook supplement noted that in some instances, if there is an unusual surge in engine power, especially at high altitude, the alternate air door may become unlatched. In that event, the door may be relatched by retarding the throttle momentarily.

The airplane flight manual (AFM) supplement for the turbonormalizing system noted the following engine limitation:

"Do not reduce manifold pressure below 15 inches when above 18,000 ft msl."

The AFM supplement for the turbonormalizing system Section 3 – Emergency Procedures, Unexpected Loss of Manifold Pressure, stated:

“If for any reason the aircraft experiences an unexpected loss of normal manifold pressure the aircraft will typically revert to operation similar to a normally aspirated aircraft at approximately the same altitude.”

Immediate Action:

1. Adjust power to the minimum power setting required for continued flight to a suitable landing location.
2. Adjust mixture so that the EGTs are between 1,300°F and 1,400°F. Depending on the circumstances, this may require substantial readjustment (either richer or leaner) of the mixture after loss of manifold pressure.
3.

The AFM supplement for the turbonormalizing system Section 3A – Abnormal Procedures, Engine Failure in Flight – Retarding Power Lever to Idle, stated:
Below 18,000 feet:

“Retarding the power lever to idle at or near a full rich mixture setting may cause engine combustion to cease, depending on the position of the fuel pump and altitude.”

WARNING

Inadvertent use of the HIGH BOOST/PRIME position of the electric fuel pump with the power lever near or in the idle position may prevent the engine from regaining power when the power lever is advanced.

Above 18,000 feet:

The manifold pressure should be maintained at or above 15” Hg when the aircraft is operating above 18,000 feet. If the manifold pressure is reduced below 15” Hg and the power lever positioned close to or at idle, the engine may cease combustion.

Pilot Information

Certificate:	Commercial	**Age:**	38,Male
Airplane Rating(s):	Single-engine land; Single-engine sea	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	June 1, 2021
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	September 14, 2021
Flight Time:	4122 hours (Total, all aircraft), 830 hours (Total, this make and model), 3999 hours (Pilot In Command, all aircraft), 119 hours (Last 90 days, all aircraft), 46 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	CIRRUS DESIGN CORP	**Registration:**	N112TR
Model/Series:	SR22	**Aircraft Category:**	Airplane
Year of Manufacture:	2010	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	3669
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	January 22, 2022 Annual	**Certified Max Gross Wt.:**	3400 lbs
Time Since Last Inspection:	42.4 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	2071.8 Hrs at time of accident	**Engine Manufacturer:**	Continental
ELT:	Installed	**Engine Model/Series:**	IO-550-N
Registered Owner:	Tango Tango Romeo LLC	**Rated Power:**	310 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None
Operator Does Business As:	N/A	**Operator Designator Code:**	N/A

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KLXV,9943 ft msl	**Distance from Accident Site:**	8 Nautical Miles
Observation Time:	07:03 Local	**Direction from Accident Site:**	17°
Lowest Cloud Condition:		**Visibility**	0.75 miles
Lowest Ceiling:	Overcast / 2900 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots / 0 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	340°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.71 inches Hg	**Temperature/Dew Point:**	-14°C / -17°C
Precipitation and Obscuration:	Light - None - Snow		
Departure Point:	Grand Junction, CO (GJT)	**Type of Flight Plan Filed:**	IFR
Destination:	Englewood, CO (APA)	**Type of Clearance:**	IFR
Departure Time:	06:21 Local	**Type of Airspace:**	Class G

Airport Information

Airport:	N/A N/A	**Runway Surface Type:**	
Airport Elevation:		**Runway Surface Condition:**	Vegetation
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:	N/A	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Minor	**Latitude, Longitude:**	39.094174,-106.36934

Administrative Information

Investigator In Charge (IIC):	Sorensen, Timothy
Additional Participating Persons:	Roy Dandy; FAA Flight Standards; Denver, CO Brad Miller; Cirrus Aircraft; Duluth, MN
Original Publish Date:	July 5, 2024
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=104945

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