Aviation Investigation Final Report

Location:	Buckhannon, West Virginia	**Accident Number:**	ERA14LA086
Date & Time:	January 4, 2014, 17:35 Local	**Registration:**	N450TX
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 private pilot was conducting a personal cross-country flight. Although recorded data from the airplane's flight displays indicated that, during the cruise portion of the flight, the airplane conducted several aerobatic maneuvers for which it was not certificated and which exceeded its published limitations, the data also showed that the engine operated normally during the maneuvers; therefore, they did not contribute to the loss of engine power.

According to the pilot, when the airplane was about 5 miles from touchdown and at approach speed, he performed his "prelanding" checklist, which he later stated he knew "by heart"; verifying that the fuel boost pump was on; lowering the wing flaps to 50 percent; and setting the fuel mixture to about 60 percent. About 3 miles from the runway threshold, between about 400 and 500 ft above ground level, the pilot increased the throttle to compensate for the normal airspeed loss on final approach; however, the engine did not respond. He reported that he then "moved his hand in a manner to manipulate both throttle and mixture at the same time" and increased both to maximum, but the engine still did not respond. The pilot determined that the airplane was at, or just below, the published minimums for deploying the ballistic parachute system, and he deployed it. After the parachute was deployed, the airplane struck terrain and a motor vehicle.

During examination of the airplane, the flaps were found fully extended, which was the correct configuration for landing. The throttle was found in the "max" position; however, the mixture control was found in a position about 2 inches forward of the idle "cutoff" position, which was consistent with a cruise setting and indicated that it was not in the "maximum" position as reported by the pilot. Recorded data showed that, during the descent, both a reduction in the manifold pressure and fuel flow occurred and that, subsequently, a distinct reduction in exhaust gas temperature for all six cylinders occurred, corroborating that the mixture control was not advanced to maximum for the descent and landing. This information would have been available to the pilot on the airplane's display system and would have provided him sufficient information to note that his improper positioning of the mixture control was causing the loss of engine power.

During the postaccident engine test run, the throttle was advanced and retarded multiple times with no hesitation or stumbling noted. A magneto check was also performed with minimal drop on either magneto. The engine was then set to about 1,800 rpm to simulate an approach to landing and the mixture control was moved to its as-found position. When the throttle was advanced, the engine stumbled and would not respond when the rpm was increased. Given this evidence, it is likely that the pilot's failure to move the mixture lever to the "full rich" position during the approach to landing led to the reduction in engine power.

According to airplane manufacturer, engine manufacturer, and Federal Aviation Administration guidance, during descent, the mixture was required to be adjusted for smooth engine operation, and before landing, the mixture control was required to be placed in the "full rich" position. As noted, the mixture control was not found in the "full rich" position. Postaccident examination and interviews revealed that the airplane's quick reference handbook and the Pilot's Operating Handbook were not available for the pilot to reference during the flight. Further, although an electronic set of checklists was available for use on the airplane's multifunction display, the pilot did not indicate that he had used them. If the pilot had referenced the landing checklist (on paper or on the multifunction display) or manuals, he might have recognized the reason the engine was nonresponsive and moved the fuel control mixture to the proper position for landing and prevented the loss of engine power.

Probable Cause and Findings

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

The pilot's improper in-flight fuel mixture management and failure to use the appropriate checklist or manuals during approach to landing, which resulted in a loss of engine power.

Findings

Personnel issues	Decision making/judgment - Pilot
Personnel issues	Use of manual - Pilot
Personnel issues	Use of checklist - Pilot
Personnel issues	Use of equip/system - Pilot
Aircraft	Mixture control - Incorrect use/operation
Environmental issues	(general) - Contributed to outcome
Environmental issues	Ground vehicle - Contributed to outcome

Factual Information

History of Flight

Enroute-descent	Miscellaneous/other
Approach	Loss of engine power (total) (Defining event)
Emergency descent	Off-field or emergency landing

On January 4, 2014 about 1735 eastern standard time, a Cirrus SR22, N450TX, was substantially damaged after the pilot deployed the Cirrus Airplane Parachute System (CAPS) and impacted a motor vehicle and then terrain in Buckhannon, West Virginia. The private pilot received minor injuries. The driver of the motor vehicle was not injured. The flight departed from Donegal Springs Airpark (N71) Marietta, Pennsylvania, about 1405, destined for Upshur County Regional Airport (W22), Buckhannon, West Virginia. Visual meteorological conditions prevailed, and no flight plan was filed for the personal flight, conducted under the provisions of Title 14 Code of Federal Regulations (CFR) Part 91.

According to the pilot, he departed N71, around 1405. About 10 miles from W22, the pilot called in on the UNICOM frequency, and verified the weather conditions. He was advised that there was no aircraft in the traffic pattern, so he opted for a straight in approach to runway 29.

About 5 miles from touchdown, he was at an approach speed of approximately 100 knots indicated airspeed. He performed his prelanding checklist. Both fuel tanks had approximately 25 gallons of fuel in them and he verified that the fuel selector was on fullest tank. He verified that the fuel boost pump was on, lowered the wing flaps to 50 percent, and set the mixture to about 60 percent. He then made a final approach call around 4 miles from touchdown, and verified the airport conditions on UNICOM once again.

Approximately 3 miles from the threshold of runway 29, at 400 to 500 feet above ground level, he increased throttle to compensate for the normal airspeed loss on final approach. To his surprise, nothing happened. He was expecting to hear a pitch change, feel a subtle change in vibration, and see his airspeed stabilize but, none of those events occurred.

He "moved his hand in a manner to manipulate both throttle and mixture at the same time" and increased both to maximum. Again, no response in engine noise, vibration, or gain in airspeed occurred.

The indicated airspeed had now decayed to below 80 knots. Knowing that he was just at, or just below, the published minimums for the Cirrus Airframe Parachute System (CAPS), he deployed it by pulling the red "T" handle with his right hand while maintaining control of the airplane with his left hand. He then transmitted a "Mayday" call over the radio. After the CAPS deployed, he tightened his restraint prior to impact. After impact he shut down the airplane's systems, and exited the airplane.

Pilot Information

Certificate:	Private	**Age:**	29,Male
Airplane Rating(s):	Single-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:**	May 14, 2012
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	May 3, 2013
Flight Time:	544 hours (Total, all aircraft), 501 hours (Total, this make and model), 364 hours (Pilot In Command, all aircraft), 58 hours (Last 90 days, all aircraft), 13 hours (Last 30 days, all aircraft), 6 hours (Last 24 hours, all aircraft)		

According to Federal Aviation Administration and pilot records, the pilot held a private pilot certificate with ratings for airplane single-engine land, and instrument airplane. His most recent FAA third-class medical certificate was issued on May 5, 2012. He reported 544 hours of total flight experience of which 501 were in the accident airplane make and model.

Aircraft and Owner/Operator Information

Aircraft Make:	CIRRUS DESIGN CORP	**Registration:**	N450TX
Model/Series:	SR22	**Aircraft Category:**	Airplane
Year of Manufacture:	2004	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	1063
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	February 20, 2013 Annual	**Certified Max Gross Wt.:**	3400 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	979 Hrs at time of accident	**Engine Manufacturer:**	CONT MOTOR
ELT:	C126 installed, activated, did not aid in locating accident	**Engine Model/Series:**	IO-550-N
Registered Owner:	On file	**Rated Power:**	310 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

According to FAA and airplane maintenance records, the airplane was manufactured in 2004 and was certificated in the "NORMAL" category. The airplane's most recent annual inspection was completed on February 20, 2013. At the time of the accident, the airplane had accrued 979 total hours of operation.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Dusk
Observation Facility, Elevation:	W22,1635 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	17:35 Local	**Direction from Accident Site:**	275°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	30.09 inches Hg	**Temperature/Dew Point:**	6°C / -5°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Marietta, PA (N71)	**Type of Flight Plan Filed:**	None
Destination:	Buckhannon, WV (W22)	**Type of Clearance:**	None
Departure Time:	15:23 Local	**Type of Airspace:**	Class G

The recorded weather at W22 at 1735, included: winds calm, 10 miles visibility, clear, temperature 04 degrees C, dew point -15 degrees C, and an altimeter setting of 30.10 inches of mercury.

Airport Information

Airport:	Upshur County Regional Airport W22	**Runway Surface Type:**	Asphalt
Airport Elevation:	1635 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	29	**IFR Approach:**	None
Runway Length/Width:	4201 ft / 75 ft	**VFR Approach/Landing:**	Forced landing;Full stop;Straight-in

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:**	38.998889,-80.253334(est)

Accident Site

Examination of the accident site revealed that after the CAPS deployment, the airplane first struck a pickup truck that was traveling on a roadway, then terrain, with the canopy of the parachute coming to rest on top of three vehicles at an automobile dealership. Fuel from the airplane was observed to be present on the surface of the roadway.

Airplane Examination

Examination of the airplane revealed that it had sustained substantial damage during the impact sequence after the CAPS deployment prior to coming to rest.

Impact damage was visible on the left wing leading edge, ahead of the Pitot tube mounting location which had exposed the composite skin underneath the paint. This exposed section of skin continued aft on the bottom surface of the wing to the trailing edge. A portion of the Pitot tube near this exposed section had also been separated from its mounting location. The left wing lower skin also exhibited impact damage directly above the left main landing gear where the left main landing gear had penetrated the bottom of the left wing and left main fuel tank.

The nose landing gear had separated from the airplane, and two of the blades on the four-bladed propeller were bent back. Both the left and right wing flaps had remained attached to their mounting locations, with the right wing flap being bent back on the outboard portion, and the left wing flap also displaying impact damage. The fuselage was damaged from the CAPS deployment and displayed peeling of a composite strip layer (as designed) on both sides of the fuselage.

Further examination of the airplane revealed that the wing flaps were in the 100 percent (full extension) position, the ignition switch was in the "BOTH" position, the fuel pump was on "BOOST," the power lever was in the "MAX" position, and the mixture control was found to be in a position approximately 2 inches forward of the idle "CUTOFF" position.

Flight recorders

The accident airplane did not have a flight recorder installed nor was one required to be installed under the applicable CFRs. It did however have data recording capability incorporated in the Primary Flight

Display and Multi-Function Display.

The Primary Flight Display (PFD)

The PFD unit included a solid state Air Data and Attitude Heading Reference System (ADAHRS) and displayed aircraft parameter data including altitude, airspeed, attitude, vertical speed, and heading. The PFD unit had external pitot/static inputs for altitude, airspeed, and vertical speed information. The PFD contained two flash memory devices mounted on a riser card. The flash memory stored information the PFD unit used to generate the various PFD displays. Additionally, the PFD had a data logging function, which was used by the manufacturer for maintenance and diagnostics. Maintenance and diagnostic information recording consisted of system information, event data and flight data.

The PFD exhibited damage to the lower left control knob but was otherwise undamaged. The damage to the lower left control knob did not permit the NTSB to make selections within the PFD's internal menu when powered on. The PFD was therefore dismantled and the unit's data card was removed and installed in a surrogate unit. The surrogate unit functioned normally with the installed data card and the data was downloaded using an NTSB laboratory procedure.

The PFD recording contained records of 25 power cycles. The accident flight was associated with the 22nd power cycle. The duration of the 22nd power cycle was approximately 2 hours and 38 minutes. Timing of the PFD data was measured in seconds from power-on.

The Multi-Function Display (MFD)

The MFD unit was able to display the pilot checklist, terrain/map information, approach chart information and other aircraft/operational information depending on the specific configuration and options that were installed. One of the options available was a display of comprehensive engine monitoring and performance data.

The MFD contained a compact flash (CF) memory card located in a slot on the side of the unit. This memory card contained all of the software that the MFD needed to operate. Additionally, this card contained all of the checklist, approach charts, and map information that the unit would use to generate the various cockpit displays.

During operation, the MFD display received information from several other units that were installed on the aircraft. Specifically, the MFD received GPS position, time and track data from the aircraft's GPS receiver. The MFD also received information from the aircraft concerning altitude, engine and electrical system parameters, and outside air temperature. This data was also stored on the unit's CF memory card.

The MFD CF card contained 105 data files. One data file was identified as recorded during the incident flight. The data file was approximately 2 hours and 38 minutes in duration.

Review of PFD and MFD Data

The recorded data began at 14:56 and ended at 17:41. Data showed that the airplane performed a normal takeoff and climb. The airplane then entered a slower than normal cruise flight for the first portion of the recording. During the first portion of the cruise flight, between 15:24 and 15:59, the engine was at a low power setting with the recording showing an average of around 2,000 rpm.

Around 15:59, the airplane began a series of high performance 360 degree turns. During this time the pilot utilized various higher power settings which resulted in higher rpm recordings. The pilot performed eight 360 degree turns. During the eight 360 degree turns, recorded vertical acceleration showed an average of about 2 Gs during most maneuvers. During the sixth and seventh 360 degree turns, the airplane reached about 70 degrees of bank angle. During the eighth 360 degree turn, vertical acceleration was recorded at a peak of approximately 3.3 Gs. During this turn, the airplane reached nearly 80 degrees of bank. The recorded rpm setting remained steady around 2,700 rpm during most of the high rate 360 degree turns.

At approximately 16:47:35, the pilot performed an aileron roll to the left. The airplane entered this maneuver from approximately a level attitude. During this maneuver, the airplane experienced about 2.5 positive Gs (+2.5) and 0.5 negative Gs (-0.5). As the airplane completed the roll, the pitch became close to -30 degrees and rpm was reduced to under 2,000 rpm. As the airplane stabilized, the rpm returned to about 2,500 rpm. The loss of altitude during this maneuver was about 900 feet.

At approximately 16:51:36, the pilot performed a second aileron roll to the left. The airplane entered this maneuver from a positive pitch attitude of about 19 degrees while pulling approximately 2.7 Gs in vertical acceleration. During the roll, the airplane experienced about 2.5 positive Gs (+2.5) and 0.5 negative Gs (-0.5). The pitch and rpm setting were more stable throughout as compared to the first roll. As the pilot completed the maneuver, a high performance 360 degree turn was immediately entered to the left. During this 360 degree turn, vertical acceleration averaged about 2.0 Gs. The flight continued with a low rpm setting of about 2,000 RPM and a recorded airspeed of about 100 knots. During this last portion of cruise flight the altitude varied between 6,000 and 7,000 feet.

The airplane began to descend around 17:30. The rpm initially increased slightly during the descent, but later decreased to under 2,000 rpm for the remainder of the flight. The aircraft continued to descend until about 17:34:33 when the CAPS deployed which caused excursions in pitch and roll, among other flight parameters. At the time of CAPS deployment, pressure altitude indicated 1,928 feet.

Review of recorded engine parameters revealed that during the entire flight. Engine rpm, oil pressure, fuel flow, manifold pressure, cylinder head temperature (CHT) and exhaust gas temperature (EGT) appear to respond nominally when viewed in relation to each other during the cruise portion of flight. Around 16:51:44, there was a rapid, but brief, drop in recorded oil pressure (32 psi). This occurred during the negative G portion of the second aileron roll.

The flight continued normally until the airplane began to descend for landing. Recorded data showed manifold pressure was reduced as well as fuel flow. Two distinct drops in EGT were noted just prior to CAPS activation. As the airplane was descending, data shows an excitement of the vertical G parameter begin 17:32:38. A few seconds later, manifold pressure and fuel flow begin to decrease. EGT for cylinders 1 through 6 showed a distinct drop at 17:32:48 and recovery by 17:33:30. Immediately thereafter, a second distinct drop in EGT for cylinders 1 through 6 was noted. Engine data from the MFD terminated at 17:34:24.

Review of CAPS Data

Review of CAPS data revealed that the CAPS activated on the airplane approximately 0.76 nautical miles from the threshold of runway 29. Indicated airspeed at the time of deployment was approximately 82 knots, and the airplane was in a generally wings level attitude. True altitude at time of deployment was approximately 2,048 feet above mean sea level (msl). Ground elevation at the approximate location of activation was 1,411 feet msl. CAPS deployment height was approximately 637 feet above ground level.

Tests and Research

Engine and Fuel Injection System

Most small airplanes are designed with spark ignition reciprocating engines. The name is derived from the back-and-forth, or reciprocating, movement of the pistons that travel the length of the cylinders to convert linear motion into the rotary motion of the crankshaft which produces the mechanical energy necessary to accomplish work. Reciprocating engines operate on the basic principle of converting chemical energy (fuel) into mechanical energy. This conversion occurs within the cylinders of the engine through the process of combustion which occurs when a spark plug ignites a pre-mixed fuel/air mixture (Fuel/air mixture is the ratio of the "weight" of fuel to the "weight" of air in the mixture to be burned.), of which in this case, the fuel was delivered by a fuel injection system controlled by the pilot through the use of manual mixture control lever in the cockpit.

Review of the airplane's fuel system revealed that the airplane was equipped with an 81-gallon usable wet-wing fuel storage system that provided fuel for engine operation. The system consisted of a 42-gallon capacity (40.5 gallon usable) vented integral fuel tank and a fuel collector/sump in each wing, a three position selector valve, an electric boost pump, and an engine-driven fuel pump. Fuel would gravity fed from each tank to the associated collector sumps where the engine-driven fuel pump would draw fuel through a filter and selector valve to pressure feed the engine's continuous flow fuel injection system's fuel control unit (FCU). The fuel would then then flow from the FCU to the fuel manifold valve where it was distributed to the six fuel injector nozzles.

Fuel would enter the fuel pump at the swirl well of the vapor separator. Here, vapor would be separated by a swirling motion so that only liquid fuel was fed to the pump. The vapor would be drawn from the top center of the swirl well by a small pressure-jet of fuel and would be fed into the vapor return line. This line would carry the vapor back to the fuel tank.

There were no moving parts in the vapor separator, and the only restrictive passage used was in connection with vapor removal. Thus, there was no restriction of main fuel flow.

The use of a positive displacement, engine-driven fuel pump meant that changes in engine speed would affect total pump flow proportionally, and since the fuel pump provided greater capacity than was required by the engine, a recirculation path was provided. A calibrated adjustable orifice and a relief valve located in this path would maintain the pump delivery pressure proportional to engine speed.

These provisions assured proper pump pressure and delivery for all engine operating speeds. A check valve was also provided so that boost pump pressure to the system, could by-pass the engine driven fuel pump during engine priming and starting. This feature also aided in the suppression of vapor formation during high ambient temperature conditions. The check valve also permitted the use of the airplane's fuel boost pump should the engine driven fuel pump fail.

The Air Throttle and FCU would control engine air intake and set the metered fuel pressure for proper fuel/air ratio. The air throttle was mounted at the air manifold inlet. The throttle valve would control the flow of air to the engine as positioned by the cockpit throttle control lever.

Fuel would enter the FCU through a strainer and pass to the metering valve. The rotary metering valve had a cam shaped edge across the fuel delivery port. The position of the cam at the port would control fuel flow to the fuel manifold valve, and fuel nozzles. The fuel mixture was controlled by the manual mixture control lever in the cockpit that was connected to the FCU mixture control valve.

The FCU body was made of SAE 88 Brass. The fuel metering shaft and mixture control shaft were made of stainless steel. The metering valve was located at one end, and the mixture control valve was located at the other end of the control valve central bore. The valves rode in bushings that were sealed against leakage by O-rings. Loading springs would force the valve ends against a fixed plug installed in the center of the central bore. This bronze plug had one passage that mated to the fuel return port, and one passage that connected the mixture control valve chamber with the metering valve chamber. O-rings sealed this plug in the central bore. Each valve included a groove which formed a fuel chamber. The contoured end face of the mixture control valve aligned with the passages in the metering plug to regulate the fuel flow from the fuel chamber.

A control lever was installed on the mixture control valve shaft for connection to the cockpit mixture control. In the metering valve, a cam shaped cut was made on the outer part of the end face. A control lever on the metering valve shaft was connected to the air throttle valve shaft with linkage. The fuel return port in the control body connected to the return passage of the metering plug and alignment of the mixture control valve face with this passage determined the amount of fuel returned to the fuel pump. A removable plug at the fuel inlet port also included a filter screen to prevent admittance of foreign debris.

Engine Examination and Run

Examination of the wreckage revealed that the engine had remained attached to the airframe. Further examination of the engine and fuel injection system using the information obtained during the review of the fuel system revealed that the fuel injection system appeared to be functional and the engine exhibited no external damage.

The top spark plugs on the 2-4-6 side of the engine and the bottom spark plugs on the 1-3-5 side of the engine were removed, and examination of the spark plugs did not reveal the presence of any anomalies. The cylinder combustion chambers were inspected with a lighted borescope and no discrepancies were observed. The crankshaft was then rotated by hand using the damaged four bladed composite propeller, and continuity to the accessory section was observed. When the crankshaft was rotated, spark was noted on all six top spark plug leads and thumb compression was obtained on all six cylinders.

The damaged four blade propeller was removed and replaced with a controllable pitch two bladed test propeller. An external fuel tank was then plumbed into the fuel system aft of the fuel selector valve.

The engine was primed with the aircraft boost pump, started and allowed to warm up. The throttle was then advanced and retarded multiple times with no hesitation or stumbling noted. The throttle was advanced to full for approximately one minute and 2,400 rpm was observed. A magneto check was performed with minimal drop on either magneto. The engine was set at approximately 1,800 rpm and the mixture lever was then moved to a position similar to the as found position that was observed at the accident site. The throttle was then advanced. The engine stumbled, and would not respond with an increase in rpm.

Pilot's Handbook of Aeronautical Knowledge

According to the Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25A), at sea-level pressure, the correct fuel-to-air mixture ratio is established with the mixture control set in the FULL RICH position. However, as altitude increases, the density of air decreases, while the density of the fuel remains the same. This creates a progressively richer mixture, which can result in engine roughness and an appreciable loss of power. The roughness normally is due to spark plug fouling from excessive carbon buildup on the plugs. Carbon buildup occurs because the rich mixture lowers the temperature inside the cylinder, inhibiting complete combustion of the fuel. This condition may occur during the pretakeoff engine runup at high-elevation airports and during climbs or cruise flight at high altitudes. To maintain the correct fuel/air mixture, the mixture must be leaned using the mixture control. Leaning the mixture decreases fuel flow, which compensates for the decreased air density at high altitude. During a descent from high altitude though, the mixture must be enriched, or it may become too lean. An overly lean mixture causes detonation, which may result in rough engine operation, overheating, and a loss of power. The best way to maintain the proper mixture is to monitor the engine temperature and enrich the mixture as needed. Proper mixture control and better fuel economy for fuel-injected engines can be achieved by use of an exhaust gas temperature (EGT) gauge. Since the process of adjusting the mixture can vary from one aircraft to another, it is important to refer to the airplane flight manual or the POH to determine the specific procedures for a given airplane.

Engine and Airplane Manufacturers Guidance

According to the Continental IO-550 Installation and Operation Manual (Publication OI-16), the minimum cruise rpm for the engine series was 2,300 rpm. During descent the mixture control was required to be adjusted for smooth engine operation, and during landing it was required to be placed in the "FULL RICH" position.

According to Teledyne Continental Aircraft Engine Critical Service Bulletin CSB09-11, which was issued on September 25, 2009, to inform operators of the possible long term effects of low engine RPM in cruise conditions, crankshaft counterweight release and subsequent engine stoppage had occurred, in two high time IO-520 and two high time TSIO-520 engine models. Investigation and reported service history lead Continental to believe that these occurrences were associated with engine operation at sustained cruise engine rpm of less than 2,300 rpm. As a result, Continental "strongly recommended" in the service bulletin that, "Engine cruise RPM settings should be no lower than 2300 RPM."

According to the Cirrus SR22 POH, the mixture control should be set "AS REQUIRED" for both Descent and Landing. Published minimum cruise rpm was listed as 2,500 rpm.

According to the Cirrus SR22 Quick Reference Checklist that was onboard the airplane, during descent the mixture should be set "AS REQUIRED" and before landing should be set to the "FULL RICH" position.

Pilot's Post Accident Internet Web Posts

Using an internet search engine, review of postaccident web posts by the pilot revealed that on the day of the accident, he had flown from Tennessee to N71 with friends onboard to pick up another airplane (a "Grumman"). The flight to W22 was actually conducted as a flight of two airplanes, and he was the first airplane to attempt to land in the flight of two. Additionally, despite the pilot's statements that the loss of engine power occurred after selecting flaps to 50 percent, He advised in a web post that the loss of engine failure occurred after selection of flaps to 100 percent.

Location of Quick Reference Checklist and Pilot's Operating Handbook

During the wreckage examination, the airplane's Quick Reference Checklist was discovered to have been out of reach of the pilot in the seat back pocket on the back of the pilot's seat. An electronic set of checklists was available on the MFD though, should the pilot have chosen to use them. During postaccident interviews however, the pilot did not indicate that he had used them, and advised that he did not review the landing checklist stating that "I know it by heart." When asked if he had the Cirrus POH he stated that it was in the cargo compartment storage area.

Additional Information

Safety Improvements

In order to improve safety, Cirrus aircraft began the process of adding expanded mixture management procedures to the pilot operating handbooks for the SR20, SR22, and SR22T, for use by pilots. This guidance has and will be added upon the revision update of each POH.
.

Administrative Information

Investigator In Charge (IIC):	Gunther, Todd
Additional Participating Persons:	Greg Travis; FAA/FSDO; Charleston , WV Brad Miller; Cirrus Aircraft; Duluth, MN Chris Lange; Continental Motors Incorporated; Mobile, AL
Original Publish Date:	June 16, 2016
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=88628