



# Aviation Investigation Final Report

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<b>Location:</b>	Des Moines, Iowa	<b>Accident Number:</b>	CEN16LA320
<b>Date &amp; Time:</b>	August 13, 2016, 10:01 Local	<b>Registration:</b>	N314BF
<b>Aircraft:</b>	CIRRUS DESIGN CORP SR20	<b>Aircraft Damage:</b>	Destroyed
<b>Defining Event:</b>	Loss of engine power (partial)	<b>Injuries:</b>	3 Minor, 1 None
<b>Flight Conducted Under:</b>	Part 91: General aviation - Personal		

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## Analysis

The pilot and three passengers departed on a personal cross-country flight when the pilot heard and felt a sudden reduction in engine power during initial climb. He told the tower controller that he had engine trouble and requested an immediate landing. The pilot was unable to maintain altitude and, as a result, deployed the airplane's emergency parachute system. After a successful parachute deployment, the airplane contacted power lines shortly before it impacted the ground in a nose-level attitude. After the airplane landed, the occupants egressed, and a fire erupted that destroyed the airframe.

A postaccident engine examination revealed that the induction tube coupler closest to the No. 1 cylinder was partially disconnected from its associated induction tube. Although both coupler clamps were tight, the clamp closest to the No. 1 cylinder did not overlap its associated induction tube. Additionally, the cylinder No. 3 induction tube was fractured at the cylinder mounting flange. A laboratory examination of the cylinder No. 3 induction tube revealed multiple areas of fatigue; however, the cause of the fatigue could not be conclusively determined due to postfracture damage. The material properties of the induction tube were consistent with the manufacturer's specification for an annealed aluminum alloy. A review of the engine logbook was inconclusive as to whether the induction system tubes had been removed for maintenance in the 7.4 years since the engine had been rebuilt. The two separations in the induction system likely caused an imbalance of the intake pressures and the partial loss of engine power during initial climb.

## Probable Cause and Findings

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

The two separations in the induction system due to improper installation and/or maintenance, which resulted in a partial loss of engine power during initial climb.

## Findings

<b>Aircraft</b>	Recip eng cyl section - Failure
<b>Aircraft</b>	Recip eng cyl section - Incorrect service/maintenance
<b>Environmental issues</b>	Wire - Contributed to outcome

## Factual Information

### History of Flight

<b>Initial climb</b>	Powerplant sys/comp malf/fail
<b>Initial climb</b>	Loss of engine power (partial) (Defining event)
<b>Initial climb</b>	Miscellaneous/other
<b>Landing</b>	Off-field or emergency landing
<b>Landing</b>	Collision with terr/obj (non-CFIT)
<b>Post-impact</b>	Fire/smoke (post-impact)

On August 13, 2016, about 1001 central daylight time, a Cirrus Design Corporation SR20 airplane, N314BF, had a partial loss of engine power shortly after takeoff from Des Moines International Airport (DSM), Des Moines, Iowa. The pilot deployed the Cirrus Airframe Parachute System (CAPS) and descended into power lines and terrain. The airplane was subsequently destroyed by a postimpact fire. The pilot and 2 passengers sustained minor injuries. An additional passenger was not injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

The pilot reported that he did not observe any airframe or engine anomalies during his preflight inspection. He also noted that the fuel tanks were completely full, and that he did not observe any contamination in the fuel samples that he obtained during his preflight inspection. The pilot reported that the engine started without hesitation and idled normally before taxi, and that he did not observe any anomalies during his before takeoff engine run-up.

A normal takeoff was made on runway 31 from the taxiway Romeo intersection with the wing flaps set at 50%, the electric fuel pump selected to boost, and the mixture-control set to full rich. The pilot reported that the engine instrumentation indicated normal readings during the takeoff run and that liftoff was achieved at 70 knots indicated airspeed (KIAS). After liftoff, the pilot reduced airplane pitch and accelerated to 90-95 KIAS before he retracted the wing flaps. The pilot reported that during the initial climb, about 500 ft above ground level (agl), he heard and felt a sudden reduction in engine power. He told the tower controller that he had engine trouble and requested an immediate landing. The tower controller cleared the pilot to enter a right downwind for landing on runway 31. The pilot reported that he was unable to maintain altitude and, as a result, he deployed the CAPS. After a successful parachute deployment, the airplane contacted power lines shortly before it impacted the ground at the intersection of Park Avenue and SW 56th Street. The pilot remarked that the airplane had landed "remarkably soft" in a nose level attitude. After landing, a fire erupted from under the left wing and the pilot told his passengers to evacuate from the right cabin door. The airplane was subsequently destroyed by the postimpact fire.

The airplane was a four-place single engine low-wing airplane of primarily composite construction. The airplane was powered by a 6-cylinder, 200 horsepower, Continental Motors IO-360-ES16B engine, serial number 1000059, which drove a two-blade Hartzell model BHC-J2YF-1BF/F7694 constant speed

propeller. According to airplane logbook entries, the most recent annual inspection was completed on May 19, 2016, at 1,565.6 hours total airframe time. As of the annual inspection, the engine had accumulated 555.1 hours since it was rebuilt at the factory on March 20, 2009. A review the engine logbook only revealed one maintenance entry, dated February 10, 2012, at 181.5 hours total engine time, in which the induction system was specifically mentioned as having been inspected. However, further review the engine logbook was inconclusive if the induction system tubes had been removed for maintenance in the 7.4 years since the engine had been rebuilt. According to the pilot, the airplane had accumulated about 66.5 flight hours since the last annual inspection.

The engine and propeller were not damaged by the postimpact fire. The engine remained attached to the firewall and the propeller remained attached to the crankshaft flange. The propeller exhibited torsional twisting, S-shaped spanwise bends, leading edge damage, and burnishing of the blade face and back. Internal engine and valve train continuity was confirmed as the engine crankshaft was rotated. Compression and suction were observed on all cylinders in conjunction with crankshaft rotation, and both magnetos provided spark at all leads. The sparkplugs for cylinder Nos. 4 and 5 exhibited excessive black soot, consistent with an over-rich fuel/air mixture. The remaining sparkplugs exhibited features consistent with normal engine operation. A borescope inspection of each cylinder did not reveal any anomalies. Additionally, no anomalies were observed with the fuel servo, mechanical fuel pump, fuel flow divider, or fuel injectors. A disassembly of the oil filter did not reveal any metal debris. The induction tube coupler closest to the No. 1 cylinder, part number (p/n) 654439-16, was observed partially disconnected from its associated induction tube. Although both coupler clamps were tight, the clamp, p/n AN737TW74, closest to the No. 1 cylinder did not overlap its associated induction tube. Additionally, the cylinder No. 3 induction tube, p/n 655224-1, was fractured at the cylinder mounting flange.

The fractured No. 3 induction tube, p/n 655224-1, was submitted to the National Transportation Safety Board (NTSB) Materials Laboratory for additional examination. A visual examination confirmed that the mounting flange of the induction tube had fractured from the main body of the tube. An additional attachment flange that had been installed between the induction tube flange and the engine cylinder did not exhibit any discernible damage. Several measurements of the induction tube revealed it was deformed in multiple directions such that the measurements at various locations produced inconsistent data. The tube inner diameter measured 1.624 inches, and the outer diameter measured between 1.742 and 1.767 inches. The tube thickness ranged between 0.705 and 0.735 inches. The manufacturer drawing dimension AB measured 2.822 inches, and the AC line measured about 2.6 inches. The fracture between the flange and the remaining tube was circumferential in orientation and perpendicular to the tube direction. The flange had also fractured in two additional locations longitudinally, creating two flange fragments. In general, the mating fracture surfaces exhibited a flat orientation, with some other areas exhibiting a 45° fracture orientation. The fracture surfaces exhibited smearing and rub marks, consistent with post-fracture damage. Examination of the flange-side fracture surface with a scanning electron microscope revealed fatigue striations, consistent with fatigue crack propagation. The character and spacing of the striations were consistent with high-cycle fatigue. The likely initiation sites of the fatigue had been destroyed by the post-fracture smearing. The chemical composition of the fractured induction tube flange was determined by energy dispersive x-ray spectroscopy (EDS) and was consistent with an AA 6061-series aluminum alloy. The results of material electrical conductivity and hardness testing were consistent with those typical of the 6061-O aluminum alloy in the annealed condition. The chemical composition, electrical conductivity, and hardness values were consistent with the engine manufacturer's part specification.

## Pilot Information

<b>Certificate:</b>	Private	<b>Age:</b>	42, Male
<b>Airplane Rating(s):</b>	Single-engine land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	4-point
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>	Class 3 Without waivers/limitations	<b>Last FAA Medical Exam:</b>	February 8, 2013
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	March 23, 2016
<b>Flight Time:</b>	(Estimated) 252 hours (Total, all aircraft), 66 hours (Total, this make and model), 211 hours (Pilot In Command, all aircraft), 66 hours (Last 90 days, all aircraft), 37 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft)		

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	CIRRUS DESIGN CORP	<b>Registration:</b>	N314BF
<b>Model/Series:</b>	SR20 NO SERIES	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>	2000	<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Normal	<b>Serial Number:</b>	1055
<b>Landing Gear Type:</b>	Tricycle	<b>Seats:</b>	4
<b>Date/Type of Last Inspection:</b>	May 19, 2016 Annual	<b>Certified Max Gross Wt.:</b>	3000 lbs
<b>Time Since Last Inspection:</b>	66 Hrs	<b>Engines:</b>	1 Reciprocating
<b>Airframe Total Time:</b>	1632 Hrs at time of accident	<b>Engine Manufacturer:</b>	Continental
<b>ELT:</b>	Installed, not activated	<b>Engine Model/Series:</b>	IO-360-ES16B
<b>Registered Owner:</b>	Alidade Partners, LLC	<b>Rated Power:</b>	200 Horsepower
<b>Operator:</b>	Alidade Partners, LLC	<b>Operating Certificate(s) Held:</b>	None

## Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Day
<b>Observation Facility, Elevation:</b>	DSM,958 ft msl	<b>Distance from Accident Site:</b>	2 Nautical Miles
<b>Observation Time:</b>	09:54 Local	<b>Direction from Accident Site:</b>	130°
<b>Lowest Cloud Condition:</b>	Clear	<b>Visibility</b>	10 miles
<b>Lowest Ceiling:</b>	None	<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	8 knots /	<b>Turbulence Type Forecast/Actual:</b>	None / None
<b>Wind Direction:</b>	350°	<b>Turbulence Severity Forecast/Actual:</b>	N/A / N/A
<b>Altimeter Setting:</b>	29.96 inches Hg	<b>Temperature/Dew Point:</b>	25°C / 18°C
<b>Precipitation and Obscuration:</b>	No Obscuration; No Precipitation		
<b>Departure Point:</b>	Des Moines, IA (DSM )	<b>Type of Flight Plan Filed:</b>	IFR
<b>Destination:</b>	Lebanon, OH (I68 )	<b>Type of Clearance:</b>	IFR
<b>Departure Time:</b>	10:01 Local	<b>Type of Airspace:</b>	Class C

## Airport Information

<b>Airport:</b>	Des Moines International Arpt DSM	<b>Runway Surface Type:</b>	Asphalt,Concrete
<b>Airport Elevation:</b>	958 ft msl	<b>Runway Surface Condition:</b>	Dry
<b>Runway Used:</b>	31	<b>IFR Approach:</b>	None
<b>Runway Length/Width:</b>	9002 ft / 150 ft	<b>VFR Approach/Landing:</b>	Forced landing

## Wreckage and Impact Information

<b>Crew Injuries:</b>	1 Minor	<b>Aircraft Damage:</b>	Destroyed
<b>Passenger Injuries:</b>	2 Minor, 1 None	<b>Aircraft Fire:</b>	On-ground
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	3 Minor, 1 None	<b>Latitude, Longitude:</b>	41.555557,-93.69139

## Administrative Information

<b>Investigator In Charge (IIC):</b>	Fox, Andrew
<b>Additional Participating Persons:</b>	Josh M Rohrer; Federal Aviation Administration, Des Moines FSDO; Ankeny, IA Brannon Mayer; Cirrus Aircraft; Duluth, MN Kurt Gibson; Continental Motors Group; Mobile, AL
<b>Original Publish Date:</b>	June 8, 2020
<b>Last Revision Date:</b>	
<b>Investigation Class:</b>	<a href="#">Class</a>
<b>Note:</b>	The NTSB did not travel to the scene of this accident.
<b>Investigation Docket:</b>	<a href="https://data.nts.gov/Docket?ProjectID=93827">https://data.nts.gov/Docket?ProjectID=93827</a>

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available [here](#).