# Aviation Investigation Final Report

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| **Location:** | Sedona, Arizona | **Accident Number:** | WPR19LA128 |
| **Date & Time:** | May 1, 2019, 09:35 Local | **Registration:** | N6864Q |
| **Aircraft:** | Beech 35 | **Aircraft Damage:** | Substantial |
| **Defining Event:** | Loss of engine power (partial) | **Injuries:** | 2 None |
| **Flight Conducted Under:** | Part 91: General aviation - Personal | | |

## Analysis

About 1 week before the accident, the previous owner had flown the fuel-injected single-engine airplane about 70 miles for inspection before selling to the accident pilot. That flight was uneventful as was the pre-buy inspection. The sale was accomplished, and the airplane remained at the accident pilot's airport, which was at an elevation of about 4,800 ft. The accident pilot arranged to begin an airplane checkout process with a certificated flight instructor (CFI), and their flight was to be the first flight since the pre-buy inspection. The CFI and the pilot both reported that the preflight inspection, engine start, taxi out, and engine runup for the planned local flight were all normal. Based on the airport's high elevation, they leaned the fuel mixture for takeoff.

The takeoff roll and liftoff were normal, but just after the airplane lifted off, both pilots sensed a significant loss of engine power, the stall warning sounded, and the airplane began to roll right-wing down. The airplane drifted to the right and impacted the unpaved surfaces adjacent to the right side of the runway. The airplane traversed some rough terrain, the landing gear collapsed, and the airplane slid to a stop. The left wing sustained substantial damage.

Initial postaccident examination of the airplane did not reveal any pre-impact mechanical deficiencies or failures that would have precluded normal operation. The engine started and operated normally during a test run while it remained on the airframe. However, fuel was observed leaking from the throttle and metering assembly (T/MA), so testing was terminated. Visual inspection of the T/MA and nearby components revealed grime around the shaft-case penetrations and blue staining on the airframe structure below the T/MA. Both were evidence of pre-existing fuel leaks. Although the leak origination date could not be determined, the appearances of both signatures were consistent with their existence while the airplane was in service rather than as a result of the accident impact. The investigation could not determine how long the leak had been occurring or if it was present at the time of the last annual inspection, about 8 months before the accident. The visual evidence of the existing leak was likely not significant enough to have been identified during the pre-buy inspection.

Disassembly of the T/MA revealed that the fuel leaks were a result of O-rings that lacked normal flexibility and were non-resilient. At the time of the accident, the T/MA was 2 years beyond the manufacturer's overhaul schedule of 12 years, which resulted in age-related deterioration of the O-rings, and the consequent fuel leaks.

The fuel leaks in the T/MA had the potential to reduce fuel flow to the fuel manifold valve, resulting in uncommanded and imprecisely controlled leaning of the mixture. The airplane's previous owner reported that he rarely leaned the mixture for takeoff from high-elevation airports whereas the mixture was leaned for the accident takeoff. Thus, the mixture for the previous owner's takeoffs might have actually been unknowingly leaned due to the faulty T/MA but not so much that it prevented takeoff. In contrast, when the accident pilot and CFI leaned the mixture while the engine was at less than full power, the fuel leaks in the T/MA could have caused an overly lean mixture for full throttle operation, resulting in a significant power decrease.

## Probable Cause and Findings

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

The partial loss of engine power due to deteriorated O-rings in the throttle metering assembly. Contributing to the accident was non-compliance with the manufacturer's recommended throttle metering assembly overhaul schedule.

### Findings

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| **Aircraft** | (general) - Not serviced/maintained |
| **Aircraft** | Time limits - Not serviced/maintained |
| **Aircraft** | Time limits - Inadequate inspection |

# Factual Information

## History of Flight

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| **Initial climb** | Loss of engine power (partial) (Defining event) |
| **Prior to flight** | Powerplant sys/comp malf/fail |

On May 1, 2019, about 0935 mountain standard time, a Beech S35 airplane, N6864Q, was substantially damaged when it was involved in an accident at Sedona Airport (SEZ), Sedona, Arizona. The pilot and flight instructor were not injured. The airplane was being operated as a Title 14 *Code of Federal Regulations* Part 91 instructional flight.

According to the pilot, he had recently purchased the airplane. The previous owner had flown the airplane from Deer Valley Airport (DVT) Phoenix, Arizona, to SEZ for a pre-buy inspection about 1 week before the accident. That flight was uneventful. The inspection was completed, with no anomalies reported. The airplane remained at SEZ for the purchase and ownership transfer, and also because that was where the pilot planned to base it. The accident flight was the first flight since the flight from DVT to SEZ. The accident flight was the first in the process to familiarize and qualify the pilot in the airplane to comply with insurance and Federal Aviation Administration (FAA) experience requirements.

Both pilots reported that the preflight inspection, engine start, taxi out, and engine runup were all normal. The pilots planned to depart from runway 21, practice some airwork away from SEZ, and then return to SEZ. They leaned the engine for takeoff. The takeoff roll and liftoff were normal, but just after the airplane lifted off, both pilots sensed a significant loss of engine power, the stall warning sounded, and the airplane began to roll right wing down. In response, both pilots pushed the nose down. The combination of right roll and left crosswind resulted in the airplane drifting to the right, and the airplane impacted the unpaved surface adjacent to the right side of the runway. The airplane traversed some rough terrain and slid to a stop on its belly.

The airplane came to rest near the intersection of runway 21 and taxiway A8. The undercarriage was collapsed and partially torn away, and the left wing sustained substantial damage.

## Pilot Information

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| **Certificate:** | Private | **Age:** | 75,Male |
| **Airplane Rating(s):** | Single-engine land | **Seat Occupied:** | Left |
| **Other Aircraft Rating(s):** | None | **Restraint Used:** | 3-point |
| **Instrument Rating(s):** | None | **Second Pilot Present:** | Yes |
| **Instructor Rating(s):** | None | **Toxicology Performed:** | No |
| **Medical Certification:** | Class 3 None | **Last FAA Medical Exam:** | June 15, 2017 |
| **Occupational Pilot:** | No | **Last Flight Review or Equivalent:** | November 14, 2016 |
| **Flight Time:** | (Estimated) 1075 hours (Total, all aircraft), 1 hours (Total, this make and model), 998 hours (Pilot In Command, all aircraft), 0 hours (Last 90 days, all aircraft), 0 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft) | | |

## Check pilot Information

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| **Certificate:** | Airline transport; Flight instructor | **Age:** | 83,Male |
| **Airplane Rating(s):** | Single-engine land; Multi-engine land | **Seat Occupied:** | Right |
| **Other Aircraft Rating(s):** | None | **Restraint Used:** | 3-point |
| **Instrument Rating(s):** | Airplane | **Second Pilot Present:** | Yes |
| **Instructor Rating(s):** | Airplane single-engine; Instrument airplane | **Toxicology Performed:** | No |
| **Medical Certification:** | BasicMed Without waivers/limitations | **Last FAA Medical Exam:** | |
| **Occupational Pilot:** | Yes | **Last Flight Review or Equivalent:** | September 17, 2017 |
| **Flight Time:** | 10309 hours (Total, all aircraft), 5 hours (Total, this make and model), 9908 hours (Pilot In Command, all aircraft), 12 hours (Last 90 days, all aircraft), 3 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft) | | |

## Aircraft and Owner/Operator Information

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| **Aircraft Make:** | Beech | **Registration:** | N6864Q |
| **Model/Series:** | 35 S35 | **Aircraft Category:** | Airplane |
| **Year of Manufacture:** | 1964 | **Amateur Built:** | |
| **Airworthiness Certificate:** | Normal | **Serial Number:** | D-7479 |
| **Landing Gear Type:** | Retractable - Tricycle | **Seats:** | |
| **Date/Type of Last Inspection:** | August 25, 2018 Annual | **Certified Max Gross Wt.:** | |
| **Time Since Last Inspection:** | 21 Hrs | **Engines:** | 1 Reciprocating |
| **Airframe Total Time:** | 5906 Hrs at time of accident | **Engine Manufacturer:** | Continental |
| **ELT:** | Installed, not activated | **Engine Model/Series:** | IO-520BA |
| **Registered Owner:** | | **Rated Power:** | 285 Horsepower |
| **Operator:** | On file | **Operating Certificate(s) Held:** | None |

The airplane had a total time (TT) in service of about 5,906 hours, and the engine had a TT of about 877 hours since major overhaul. The airplane's most recent annual inspection was completed in August 2018.

## Meteorological Information and Flight Plan

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| **Conditions at Accident Site:** | Visual (VMC) | **Condition of Light:** | Day |
| **Observation Facility, Elevation:** | 4830 ft msl | **Distance from Accident Site:** | 0 Nautical Miles |
| **Observation Time:** | 09:35 Local | **Direction from Accident Site:** | |
| **Lowest Cloud Condition:** | | **Visibility** | 10 miles |
| **Lowest Ceiling:** | Broken / 4300 ft AGL | **Visibility (RVR):** | |
| **Wind Speed/Gusts:** | 7 knots / | **Turbulence Type Forecast/Actual:** | / |
| **Wind Direction:** | 160° | **Turbulence Severity Forecast/Actual:** | / |
| **Altimeter Setting:** | 30.03 inches Hg | **Temperature/Dew Point:** | 18°C / 5°C |
| **Precipitation and Obscuration:** | No Obscuration; No Precipitation | | |
| **Departure Point:** | Sedona, AZ (SEZ ) | **Type of Flight Plan Filed:** | None |
| **Destination:** | Sedona, AZ (SEZ ) | **Type of Clearance:** | None |
| **Departure Time:** | 09:35 Local | **Type of Airspace:** | Unknown |

## Airport Information

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| **Airport:** | Sedona SEZ | **Runway Surface Type:** | |
| **Airport Elevation:** | 4830 ft msl | **Runway Surface Condition:** | Dry |
| **Runway Used:** | 21 | **IFR Approach:** | None |
| **Runway Length/Width:** | 5132 ft / 100 ft | **VFR Approach/Landing:** | Forced landing |

## Wreckage and Impact Information

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| **Crew Injuries:** | 2 None | **Aircraft Damage:** | Substantial |
| **Passenger Injuries:** | | **Aircraft Fire:** | None |
| **Ground Injuries:** | | **Aircraft Explosion:** | None |
| **Total Injuries:** | 2 None | **Latitude, Longitude:** | 34.848609,-111.78833(est) |

Initial Examination

Primary damage sites included the outboard left wing and the lower nose area, as well as all 3-landing gear and their supporting structure. Two of the three blades of the propeller were damaged from impact. One of those two was loose in the hub, but the third blade was intact and secure in the hub. Aside from minor damage to the air intake, the engine appeared undamaged. For recovery, both wings had been unbolted and removed.

Initial examination of the airframe, engine, and propeller at the recovery facility did not reveal any pre-impact mechanical deficiencies that would have precluded continued operation and flight. Because the engine appeared intact, it was decided to attempt some engine test runs prior to further disassembly of the engine or airframe.

Engine Test Runs

All three cockpit engine controls (throttle, mixture, propeller) remained attached to their respective engine components, and all operated smoothly through their full travel ranges. The damaged propeller was removed and replaced with an undamaged one, and a fuel supply was plumbed in upstream of the fuel selector valve. When the engine was initially primed, fuel was observed to be leaking/dripping/pooling under the fuel control unit (FCU, also referred to as the metering assembly) below the throttle body. The engine was started and run three separate times. On all occasions, fuel was observed leaking from each side of the FCU where the control shafts (throttle (R) and mixture (L)) exited the FCU body. The third engine run was conducted for about 2 minutes, and the engine appeared to run normally. However, the FCU fuel leaks continued, and the engine was shut down for safety reasons.

Three fuel system components were removed for shipment to the engine manufacturer (Continental) in Mobile, Alabama for testing. These components were the throttle and metering assembly (T/MA, including throttle body and FCU), the fuel manifold valve assembly (including lines and injectors), and the engine-driven fuel pump (EDP). All components were securely attached. The following mechanical anomalies were noted:

- The FCU body had some accumulated grime (unknown particulate matter and sludgy material) surrounding the exit locations of the throttle and mixture control shafts from the FCU body. This location was the same as the observed leak sources.
- The grime was consistent with long-term fuel leakage
- There was evidence of prior (partially dirt/debris-covered) fuel staining on the airframe structure below the FCU
- Manual rotation of the mixture control shaft in the FCU revealed a variation in resistance, similar to a partial 'dead band' (region of little or no resistance)

Throttle Metering Assembly (T/MA) Examination and Testing

Records and hardware examination indicated that the T/MA was the original device delivered with the engine, which was 14 years prior to the accident, and it had not been overhauled. The manufacturer's recommended overhaul interval was every 12 calendar years or 1,700 hours in service, whichever comes first.

When tested on a test bench, the T/MA displayed leakage similar to that observed during the on-airframe engine tests. All test points were completed, but the T/MA did not pass 4 of the 7 test points that were evaluated.

After the bench test, the metering unit was disassembled, and its shaft-sealing O-rings were examined. The O-rings lacked normal flexibility and were non-resilient, conditions that are the result of aging.

The fuel manifold valve assembly and the engine driven fuel pump were both examined and tested, with no anomalies noted.

## Additional Information

Communications with the airplane's previous owner indicated that he typically flew out of SEZ and other high elevation airports in the morning and didn't "recall ever leaning for takeoff." He stated that on occasions when he operated out of such airports when "temp[erature]s was high," he "always leaned the engine before takeoff on the runway by taking the runway, running the engine to full rich and power and

then leaning to takeoff power." He did not provide any further details.

According to the CFI on the accident takeoff, they "adjusted the mixture for best operation considering the density altitude at the Sedona Airport." The pilot stated that his recollection was that "we leaned to roughness and then enriched from this point. Also looked for maximum power (RPM's)." He did not recall how far the mixture control was backed out after leaning.

## Administrative Information

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| **Investigator In Charge (IIC):** | Huhn, Michael | | |
| **Additional Participating Persons:** | John Schroeder; FAA FSDO; Scottsdale, AZ<br>Kurt Gibson; Continental Motors; Mobile, AL<br>Henry Soderlund; Textron Aviation; wichita, KS | | |
| **Original Publish Date:** | January 20, 2022 | **Investigation Class:** | 3 |
| **Note:** | The NTSB did not travel to the scene of this accident. | | |
| **Investigation Docket:** | https://data.ntsb.gov/Docket?ProjectID=99358 | | |