

National Transportation Safety Board

Office of Aviation Safety
Central Region



CEN20LA197

WRECKAGE EXAMINATION SUMMARY

ACCIDENT

Location: Cambridge, Ohio
Date: May 27, 2020
Time: 1458 eastern daylight time
Airplane: Beech 35-A33, Registration No. N123JB

PARTICIPANTS

Investigator-In-Charge	Andrew Todd Fox National Transportation Safety Board Denver, Colorado
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ACCIDENT SYNOPSIS

On May 27, 2020, about 1458 eastern daylight time, a Beech 35-A33 airplane, N123JB, was substantially damaged when it collided with trees during a forced landing near Cambridge, Ohio. The pilot was fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* (CFR) Part 91 ferry flight.

WRECKAGE EXAMINATION TIMELINE

The National Transportation Safety Board (NTSB) Investigator-in-Charge (IIC) did not travel to the accident site due to COVID-19 restrictions in place at the time of the accident. However, Federal Aviation Administration (FAA) inspectors from the Columbus Flight Standards District Office (FSDO) traveled to the accident site on May

28-29, 2020, to conduct an initial examination before the airplane was recovered from the accident site. The wreckage was subsequently stored indoors by AMF Aviation, LLC, until the NTSB wreckage examination completed on June 9-10, 2021. The NTSB IIC was assisted by a FAA Airworthiness Inspector from the Nashville FSDO and a Textron Aviation Air Safety Investigator.

AIRPLANE DESCRIPTION

The airplane was a 1961 Beech 35-A33 (Debonair), serial number (s/n) CD-313, registration number N123JB. The 260 horsepower, fuel injected, normally aspirated, Continental IO-470-N engine, s/n 1036858, provided thrust through a three-blade, constant speed, McCauley 3A36C434/80VEA propeller, s/n 191236. The low-wing airplane was of conventional aluminum construction with a retractable tricycle landing gear and wing flaps. The airplane's empty and maximum takeoff weights were 2,082.8 lbs and 3,000 lbs, respectively.

The airplane was equipped with a 70-gallon capacity (63 gallons usable) fuel system, consisting of two 25-gallon main fuel tanks (22 gallons usable each) and a 20-gallon (19 gallons usable) auxiliary fuel system. The two 10-gallon auxiliary fuel tanks are combined before the fuel selector valve, which results in a 20 gallon (19 gallons usable) auxiliary fuel capacity. The fuel selector valve positions include left main, right main, auxiliary, and off.

According to the Beechcraft Debonair/Bonanza 33 Series Shop Manual, when equipped with a Continental IO-470-N engine, the fuel flow is about 22 gallons per hour (gph) when operated at the rated horsepower and manifold pressure. According to Beechcraft performance documentation, the fuel flow is about 13.4 gph when the engine is operated at 75% power and leaned for cruise flight.

MAINTENANCE SUMMARY

Recent Maintenance

According to maintenance documentation, on February 5, 2019, at 3,861.1 total airframe hours, the installed Continental IO-470-K engine was removed and replaced with a factory rebuilt Continental IO-470-N engine, s/n 1036858, in accordance with supplemental type certificate (STC) No. SA5527SW. Additionally, a McCauley 3A36C434/80VEA propeller, s/n 190011, and McCauley C290D3/T35 propeller governor, part number (p/n) D20309-31, s/n 180680, were installed in accordance with STC No. SA00718CH.

The last annual inspection of the airplane was completed on March 15, 2019, at 3,872.9 total airframe hours, at which time the engine had accumulated 11.8 hours since the factory rebuild.

According to FAA incident data, on February 3, 2020, the pilot inadvertently landed the airplane with the landing gear retracted at Ohio State University Airport (OSU), Columbus, Ohio. According to maintenance logbook documentation, after the wheels-up landing, the Continental IO-470-N engine, s/n 1036858, was shipped to Continental Services, Fairhope, Alabama, to be disassembled, inspected, and repaired for any propeller strike damage. After the engine was inspected, it was reinstalled on the airplane on May 22, 2020, at 4,056.8 total airframe hours, by the Ohio State University Airport certified repair station with a new McCauley 3A36C434/80VEA propeller, s/n 191236, and an overhauled McCauley C290D3-R/T35 propeller governor, s/n 180680.

A postaccident review of recorded engine data revealed that on May 22, 2020, following the engine/propeller installation, the engine was run at least twice, accumulating about 10.8 minutes. The first engine run was 9 minutes in duration and included a fuel flow of 22.3 gph during an evident max power cycle. The second engine run was about 1.8 minutes in duration and did not appear to include a max power cycle. A review of the engine data for both test runs did not reveal any anomalies, and the maximum fuel flow during the first test run was consistent with the manufacturer's specification of 22 gph for the engine at rated power.

On May 27, 2020, at 4,057 total airframe hours, the damaged flaps were removed, and a serviceable pair of flaps were installed by a mechanic representing Plane Care, LLC, a certified repair station at Hagerstown Regional Airport (HGR), Hagerstown, Maryland. The mechanic disabled the flaps in the up position by pulling and collaring the flap circuit breaker. The landing gear was disabled in the extended position by pulling and collaring the landing gear circuit breaker.

On May 27, 2020, the FAA issued a ferry permit for the airplane to be flown from OSU to HGR where additional airframe repairs were to be completed.

At the time of the accident, the airframe total time was about 4,058.1 hours. The engine had accumulated about 197 hours since the factory rebuild and 1.3 hours since it was reinstalled on the airframe after the propeller strike inspection.

WRECKAGE EXAMINATION AT ACCIDENT SITE (MAY 28-29, 2020)

According to the FAA inspectors who responded to the accident site, the airplane wreckage was at the edge of a field located about 3 nautical mile northeast of Cambridge Municipal Airport (CDI), Cambridge, Ohio, as shown in figures 1 and 2. There was no evidence that the airplane's wheels contacted the ground before the airplane flew into the trees at the eastern edge of the field on an east heading. Based on the damage to the trees and the airplane, the airplane impacted the trees a few feet above ground level in a level pitch attitude, as shown in figure 3.

The right wing impacted a tree outboard of the fuel tank crushing the leading edge aft into the main wing spar, as shown in figure 4. The left wing tip also exhibited a semicircular crush zone near the wingtip consistent with a tree impact. The empennage appeared to be undamaged.

Fuel was observed in both main fuel tanks and the fuel filter assembly, and there was no water or particulate matter observed in fuel samples recovered from both main fuel tanks. The fuel selector valve handle was found in the left main tank position. The FAA inspector moved the fuel selector valve to the off position. About 16 gallons of fuel remained in the fuel system when the airplane was recovered from the accident site.

Visual examination of the fuselage's exterior revealed fuel streaks emerging from a louvered vent and access panel at the lower right side of the engine compartment, continuing aft along the lower right fuselage, as shown in figures 5-7. The source of the fuel leak was not identified during the onsite examination.

The throttle and mixture controls were in the full aft position, and the propeller control was full forward. A visual examination of the engine crankcase did not reveal any holes or cracks, as shown in figure 8. The crankshaft was not seized, but a damaged propeller blade prevented a full rotation of the crankshaft at the accident site. All six fuel injector lines were observed attached to their respective fuel injector nozzles. There was no visible sign of fuel leakage at any of the fuel injector nozzles.

FOLLOW-UP EXAMINATION (JUNE 9-10, 2021)

Flight Controls

Flight control cable continuity was established from the cockpit to each flight control surface through cuts made during wreckage recovery. The elevator trim tab actuators measured 1.75 inch which equated to 15-20° tab-down. The elevator trim tab indicator in the cockpit was observed about 4° tab-up. The flaps were found disabled in the retracted position, with the circuit breaker pulled and zip tied for the ferry flight.

Landing Gear

The landing gear was disabled in the down position, with the circuit breaker pulled and zip tied for the ferry flight. The main landing gear were retracted by recovery personnel for transport and storage. The nose gear separated from the forward fuselage.

Cockpit

The throttle was found full aft (closed), the mixture control was full lean, and the propeller control was full forward (high rpm). The auxiliary fuel pump switch was OFF.

A JPI 700 digital engine monitor was removed and successfully downloaded using the manufacturer's software utility. The downloaded data was retained by the NTSB IIC for additional analysis.

The airplane was equipped with a digital tachometer, but it was not powered-on during the examination.

The emergency locator transmitter was installed and was in the armed position.

The left-and-right cockpit seats were found installed in the aircraft. The left forward (pilot) 3-point restraint was found cut, likely to facilitate occupant removal. The right forward seat (passenger) lap belt remained buckled across the seat. The back of the right seat was fractured near the base. The aft seats were not documented during the examination.

Engine Cowling

There was no evidence of pooling or streaking of fuel on the internal surfaces of the engine cowling; however, there were a few rivet bucktails that exhibited fuel staining. The fuel streaks previously observed on the exterior of the airplane traced back to the louvered vent and access panel at the lower right side of the engine compartment, as shown in figures 9 and 10.

Fuel System

The airframe fuel system was tested by blowing air through the fuel supply line at the firewall. The fuel lines were free of obstructions from each tank through the fuel selector valve to the fuel supply line at the firewall. The fuel selector valve functioned as designed, with a positive detent felt in all selector positions. The fuel samples that were recovered from the airplane at the accident site had a blue tint consistent with 100 octane low lead aviation fuel with no evidence of water or particulate matter.

Beginning at the firewall and moving forward, the following observations were made regarding the fuel system:

- Fuel pressure gauge line impact separated at firewall.
- Fuel supply line was disconnected at firewall during wreckage recovery.
- Fuel supply line into engine driven fuel pump had an intact torque stripe and the b-nut was tight.

- Fuel supply line from engine driven pump into fuel control unit had an intact torque stripe and tight b-nut at both ends.
- Fuel return line from engine driven fuel pump toward the firewall was fractured and cut near the firewall during wreckage recovery.
- Fuel return line from fuel control unit to engine driven fuel pump fractured at fuel control unit fitting, but the fuel return line remained attached at the fuel pump.
- Fuel control unit inlet screen was clear of debris.
- Fuel line fitting from fuel control unit to fuel flow transducer fractured at fuel control unit, but the b-nut torque stripe remained intact.
- B-nut on short fuel line from fuel control unit to fuel flow transducer remained tight, the outlet b-nut from fuel flow transducer to fuel manifold was finger tight. Due to fracture separation of the inlet fitting from the fuel control unit to the fuel flow transducer, it could not be determined if the movement at the b-nuts were impact related or due to postaccident handling.
- The thermal protective sleeve covering the fuel flow transducer was removed during the examination at the accident site. There was no indication of fuel staining on the internal surface of the fire shield sleeve.
- The fuel supply line into the fuel manifold had an intact torque stripe and tight b-nut connection.
- The fuel manifold cover was removed, the filter screen was clear, and the baffle was intact.
- The fuel lines forward of the firewall exhibited no evidence of fuel leaks.
- All fuel lines from the firewall to the fuel manifold were clear of obstructions when air was blown through them.
- There was no evidence of fuel staining at the fuel injector nozzle or spark plug ports.

Engine

The engine was separated from the firewall before the examination, as shown in figure 11. The engine mounts exhibited impact related damage. A borescope examination of each cylinder confirmed no anomalies with the cylinders, pistons, valves, or valve seats.

Internal engine and valve train continuity were confirmed while the engine crankshaft was rotated. Cylinder compression was confirmed by placing a finger over the open spark plug holes and feeling suction and expelled air from each cylinder while the crankshaft was rotated. Additional testing using shop air and a cylinder pressure tester yielded the values listed in table 1.

Cylinder No.	Compression (psi)	Remarks
1	5-18	Air heard leaking past piston rings into crankcase
2	70	
3	0-5	Air heard leaking past piston rings into crankcase
4	72	
5	60	
6	74	

Table 1 - Cylinder Compression Test Results

The compression values for cylinder Nos. 1 and 3 did not change appreciably after lubricant oil was sprayed into the cylinders to help seat the piston rings and the valve rocker arms struck with a rubber mallet. Shop air was heard leaking past the piston rings into the crankcase.

The right and left magnetos produced spark in the proper firing order while the engine crankshaft was rotated. The upper and lower spark plugs exhibited features consistent with normal engine operation, as shown in figure 12.

The engine driven fuel pump drive coupling remained intact, and the fuel pump discharged fuel normally when tested.

There was no damage, debris, or obstructions to the fuel manifold, stainless steel injector lines, or fuel injector nozzles Nos. 1-4 and No. 6. The No. 5 fuel injector nozzle exhibited impact related damage but appeared clear of debris.

The No. 3 cylinder head exhibited blue fuel stains on several cooling fins located on the forward-facing side of the intake port, as shown in figures 13 and 14. There were no apparent cracks or fuel stains around the fuel injector nozzle or spark plug ports. The inter-cylinder baffle between cylinders Nos. 3 and 5 exhibited blue fuel staining, as shown in figure 15. The intake flange gasket compression faces were flattened around the inner diameter hole and there were no apparent kinks or tears. The No. 3 cylinder intake elbow and cylinder intake port flange face did not exhibit any fuel stains. The remaining cylinders and engine components did not exhibit any visible fuel stains.

The oil sump pan remained intact, as shown in figure 16. The oil quick-drain installed at the bottom of the oil sump pan was damaged during impact, leaving a fractured portion of an aluminum plug with O-ring loose in the oil sump pan, as shown in figure 17. There was no evidence that the fractured aluminum plug had been damaged by engine operation. No additional metal debris was observed in the sump pan. Disassembly of the oil pump revealed no mechanical issues. The oil filter remained installed on the engine with no evidence of an oil leak. The oil filter was cut open and the paper filter element contained a few small metallic flakes.

The postaccident engine examination did not reveal a mechanical failure that would have prevented normal operation.

Propeller

The propeller remained attached to the crankshaft flange. The spinner displayed minimal rotational impact signatures and no fore-aft crush damage. The propeller blades exhibited various impact related damage, as shown in figure 18. The outboard 1/3 of the No. 1 blade was bent slightly aft. The No. 2 blade was relatively straight, exhibited leading edge scuff marks near the blade tip, and a small leading-edge gouge about 2" from the blade tip. The No. 3 blade was fractured in hub, bent slightly aft and under the engine cowlings, and exhibited light spanwise scratches.

FIGURES

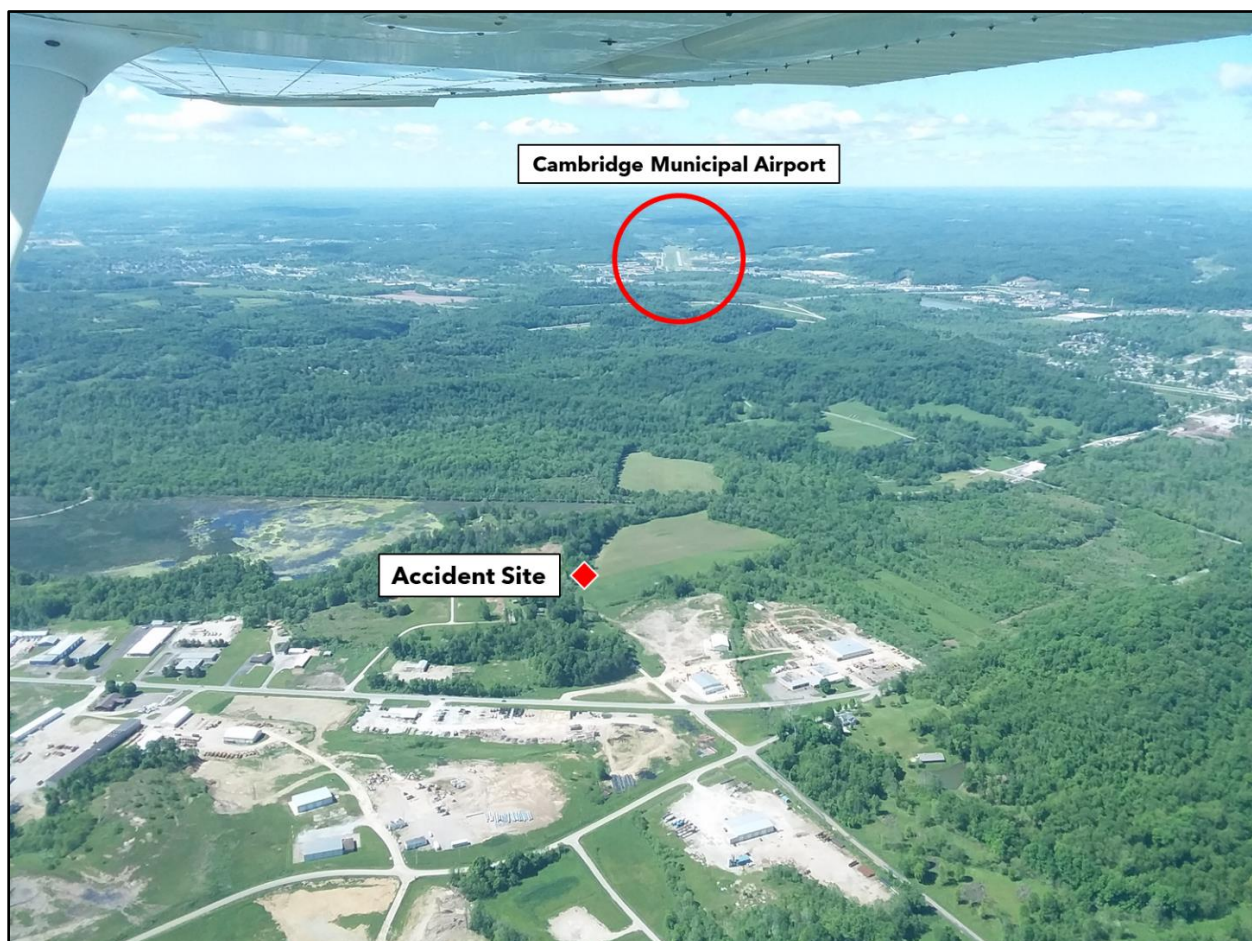


Figure 1 - Aerial Photograph Showing Accident Site Location (FAA Photo)



Figure 2 - Aerial Photograph Showing Accident Site Location (FAA Photo)



Figure 3 - Main Wreckage at Accident Site (AMF Aviation Photo)



Figure 4 - Right Wing and Fuselage at Accident Site (FAA Photo)

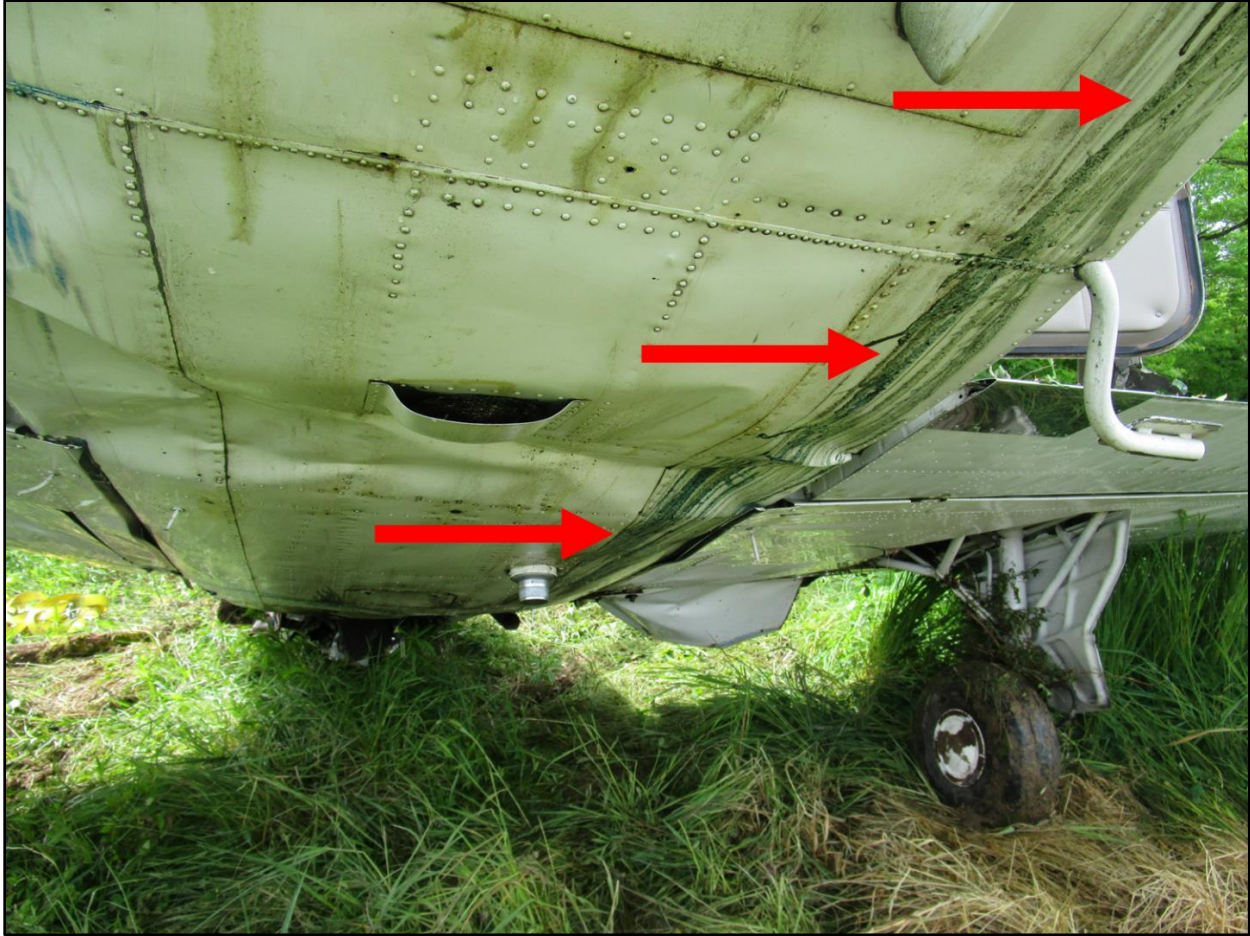


Figure 5 - Fuel Streaks on Lower Right Side of Fuselage (FAA Photo)



Figure 6 - Fuel Streaks on Lower Right Side of Fuselage (FAA Photo)



Figure 7 - Fuel Streaks on Lower Right Side of Fuselage (AMF Aviation Photo)



Figure 8 - Engine at Accident Site (FAA Photo)

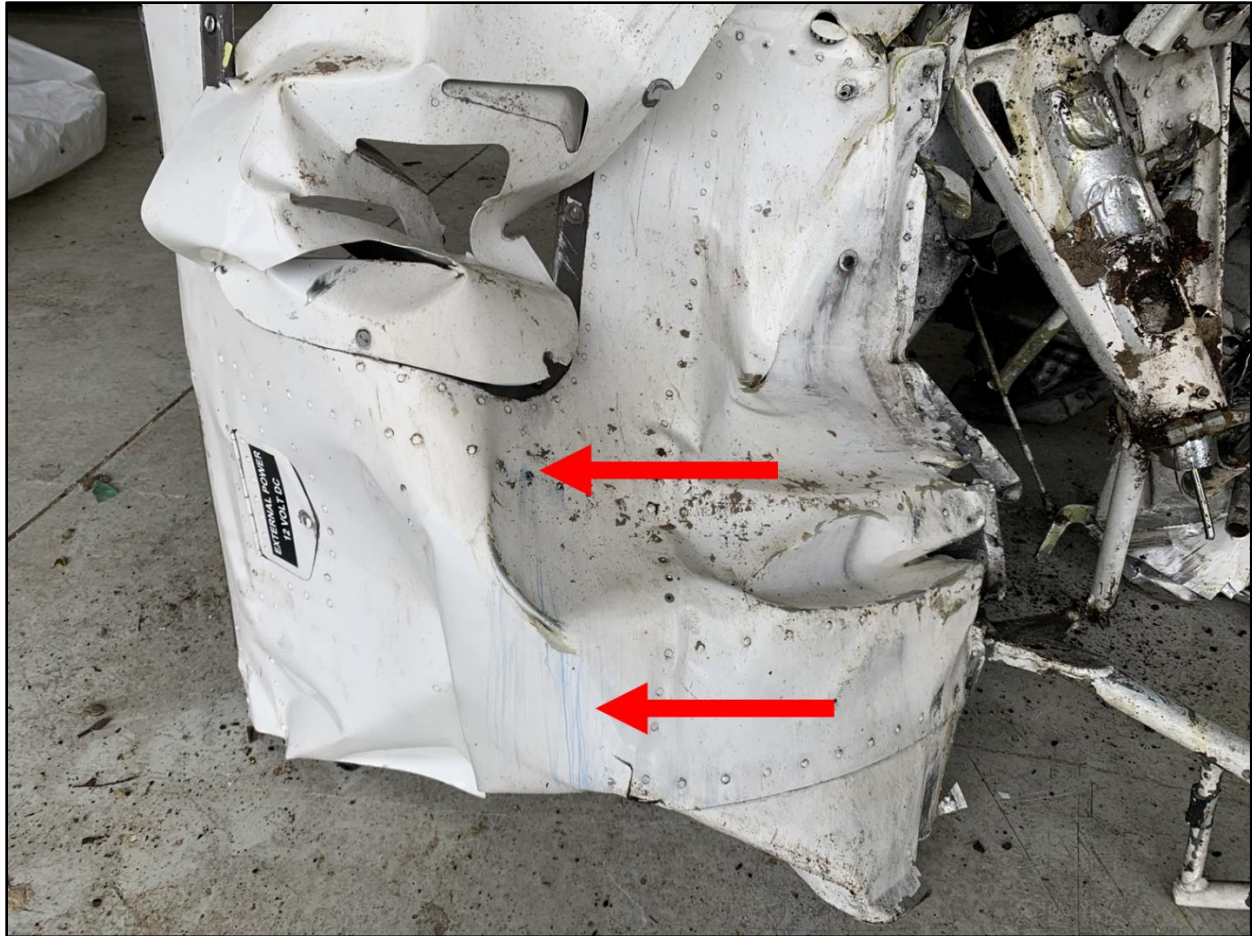


Figure 9 - Fuel Streaks on Lower Right Engine Cowl

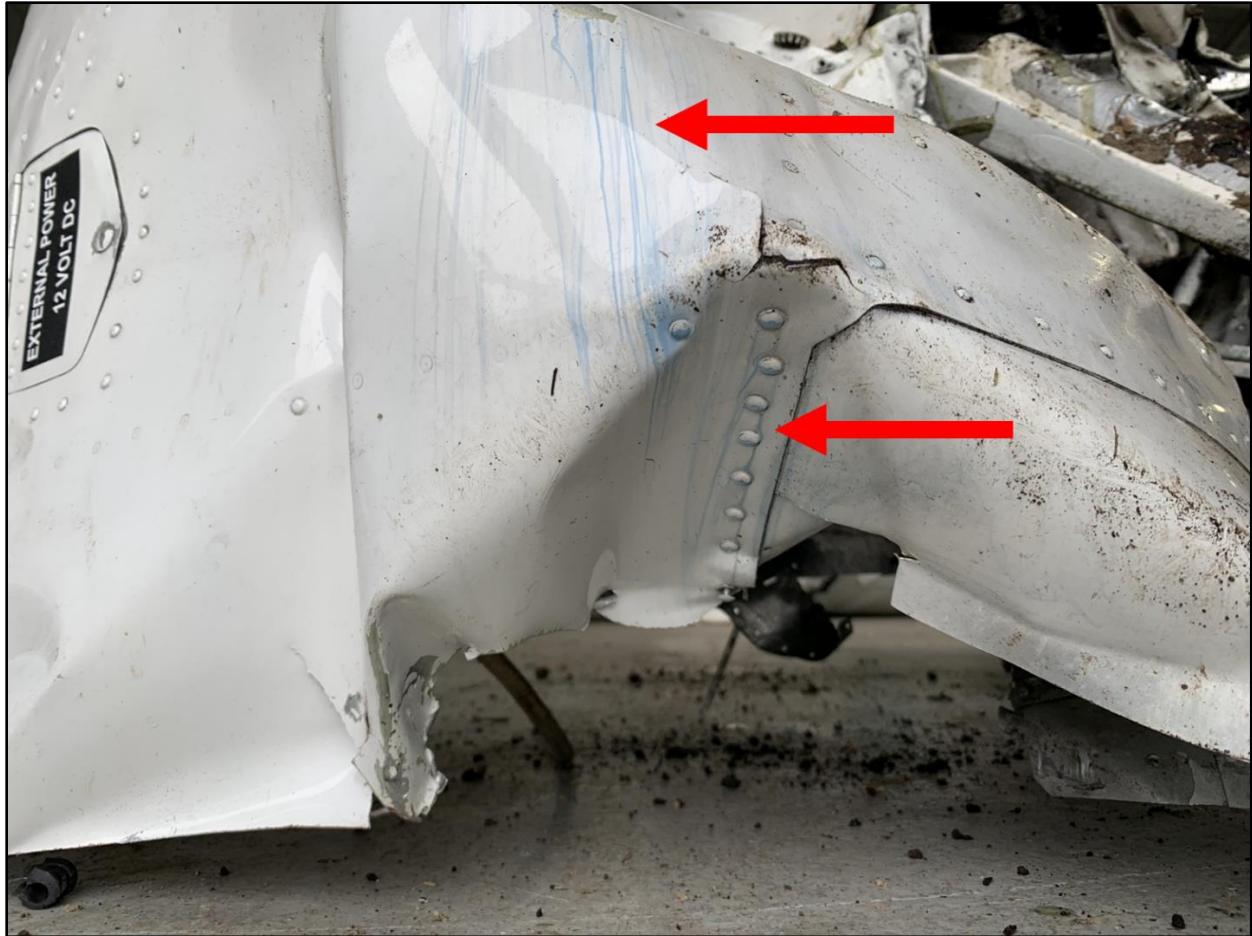


Figure 10 - Fuel Streaks on Lower Right Engine Cowl



Figure 11 - Engine and Propeller



Figure 12 - Upper and Lower Spark Plugs

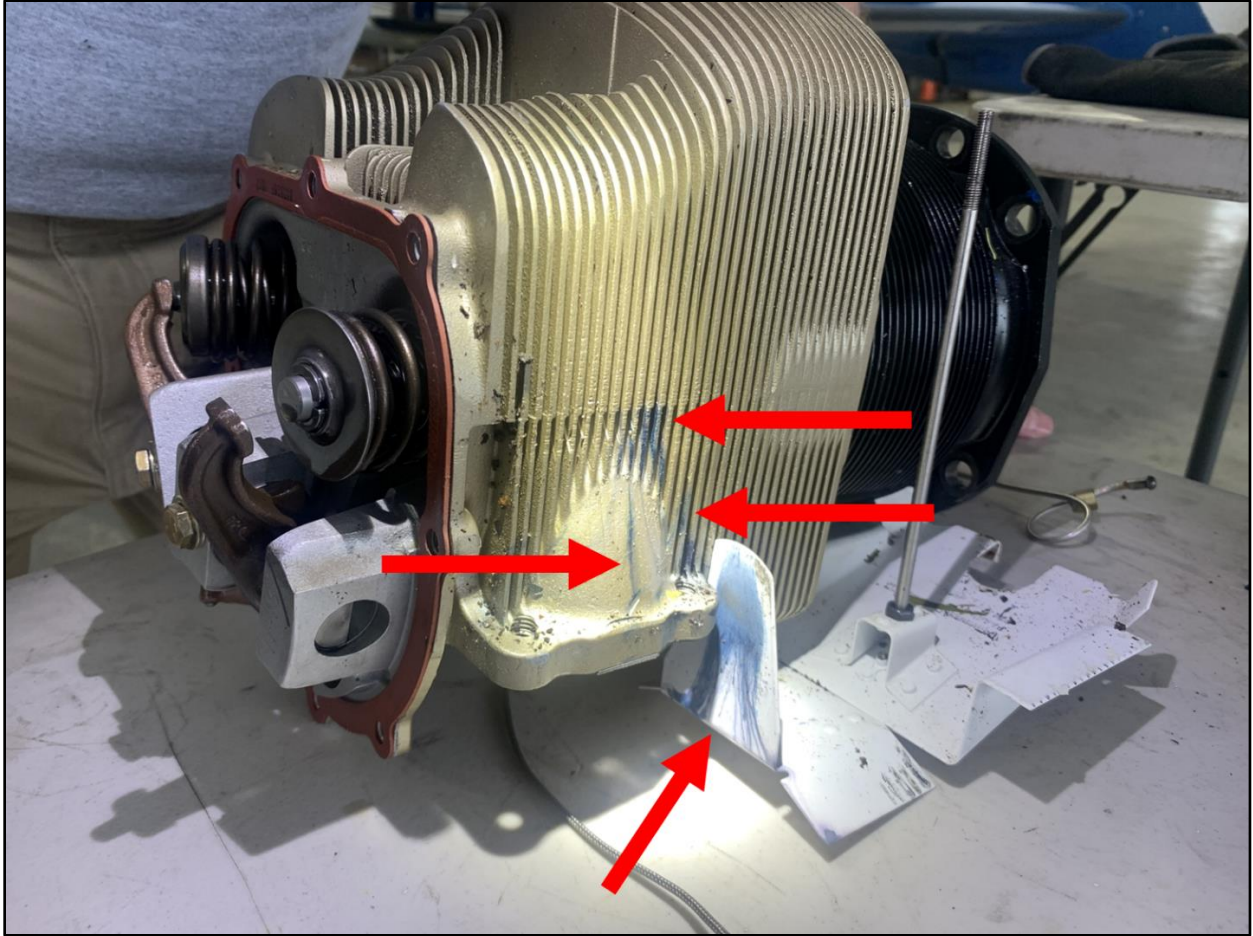


Figure 13 - Fuel Stains on Cylinder No. 3 and Inter-Cylinder Baffle

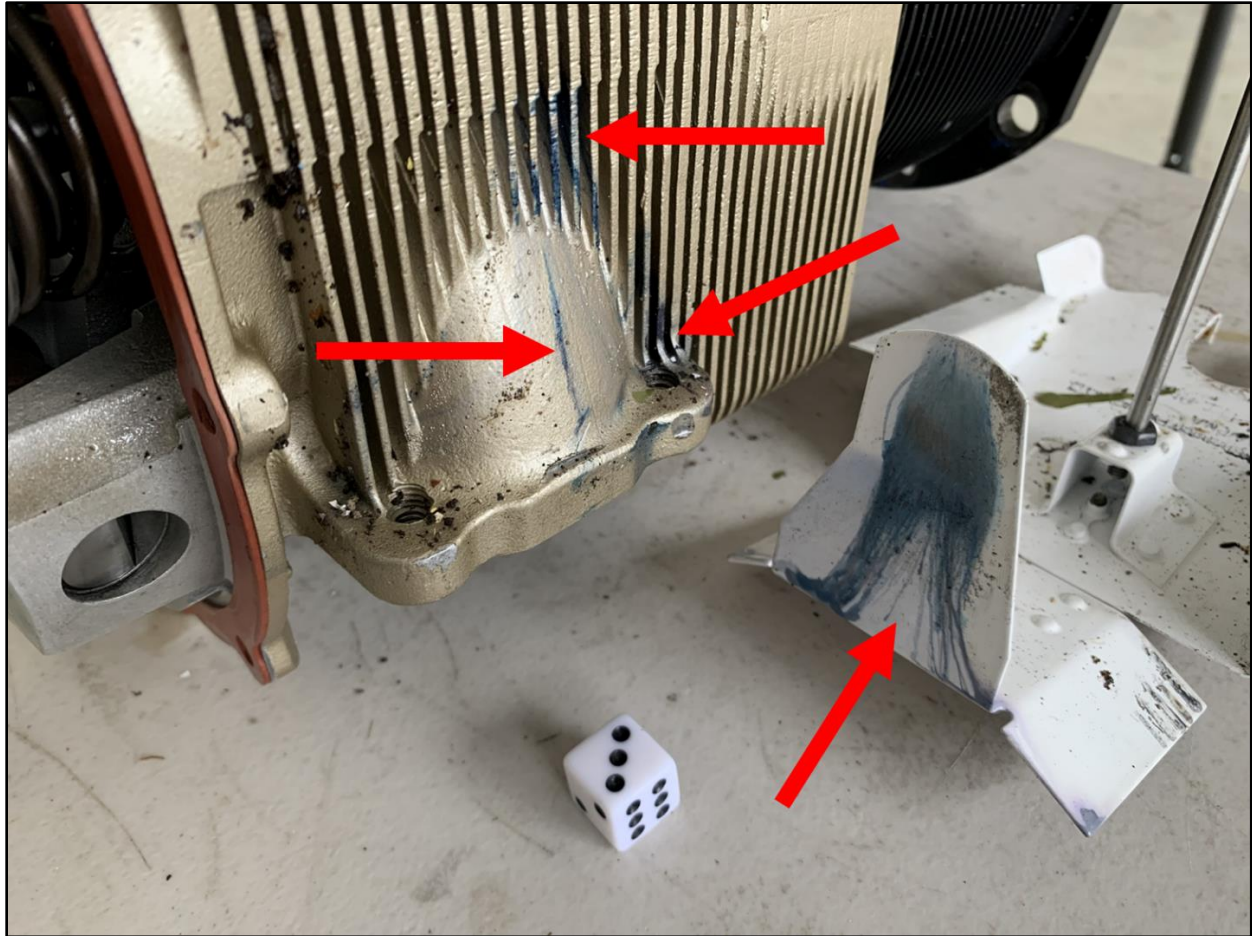


Figure 14 - Fuel Stains Near No. 3 Cylinder Intake and on Inter-Cylinder Baffle

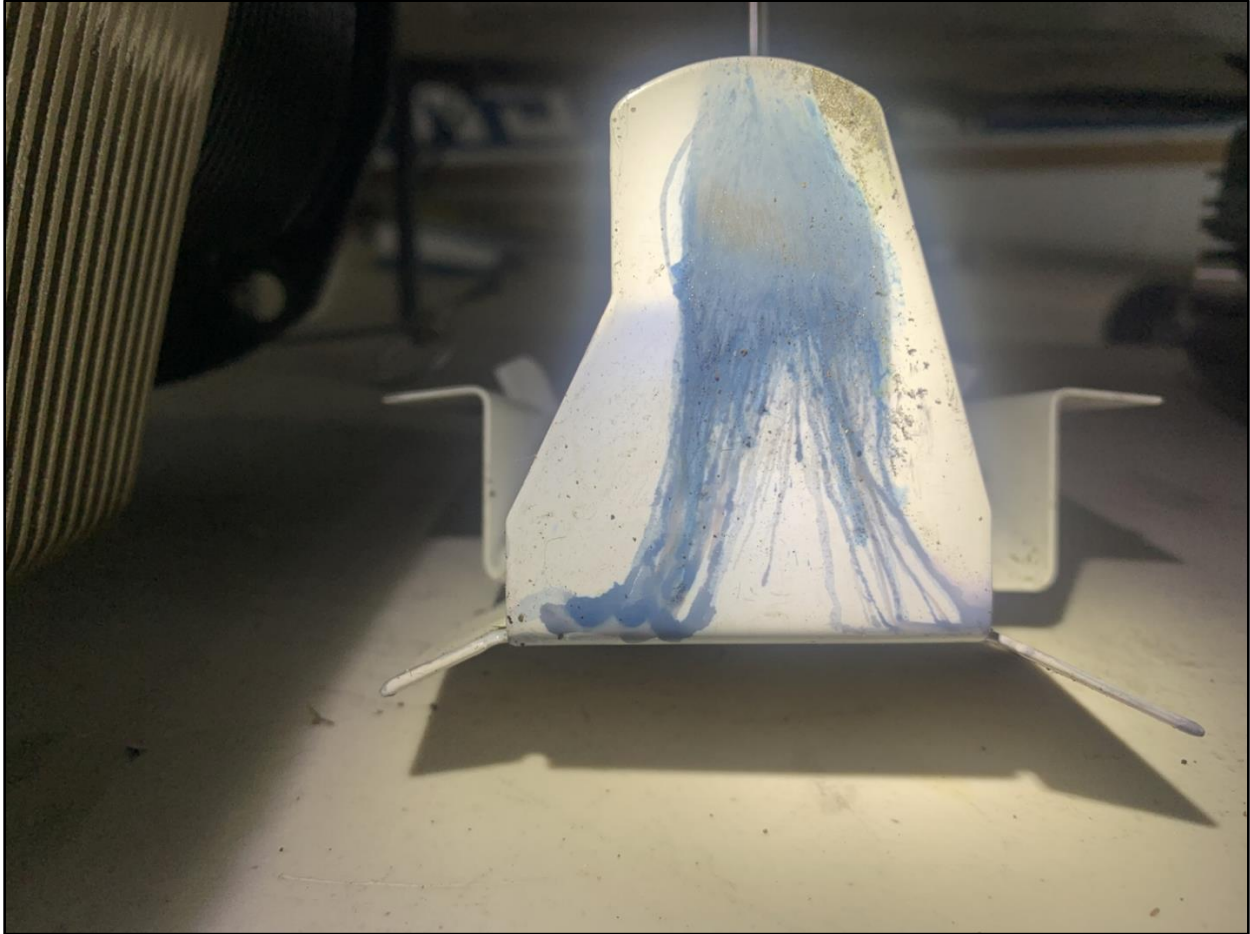


Figure 15 - Fuel Streaking on Inter-Cylinder Baffle Between Cylinders Nos. 3 and 5



Figure 16 - Engine Oil Sump Pan Containing Portion of Quick-Drain Plug

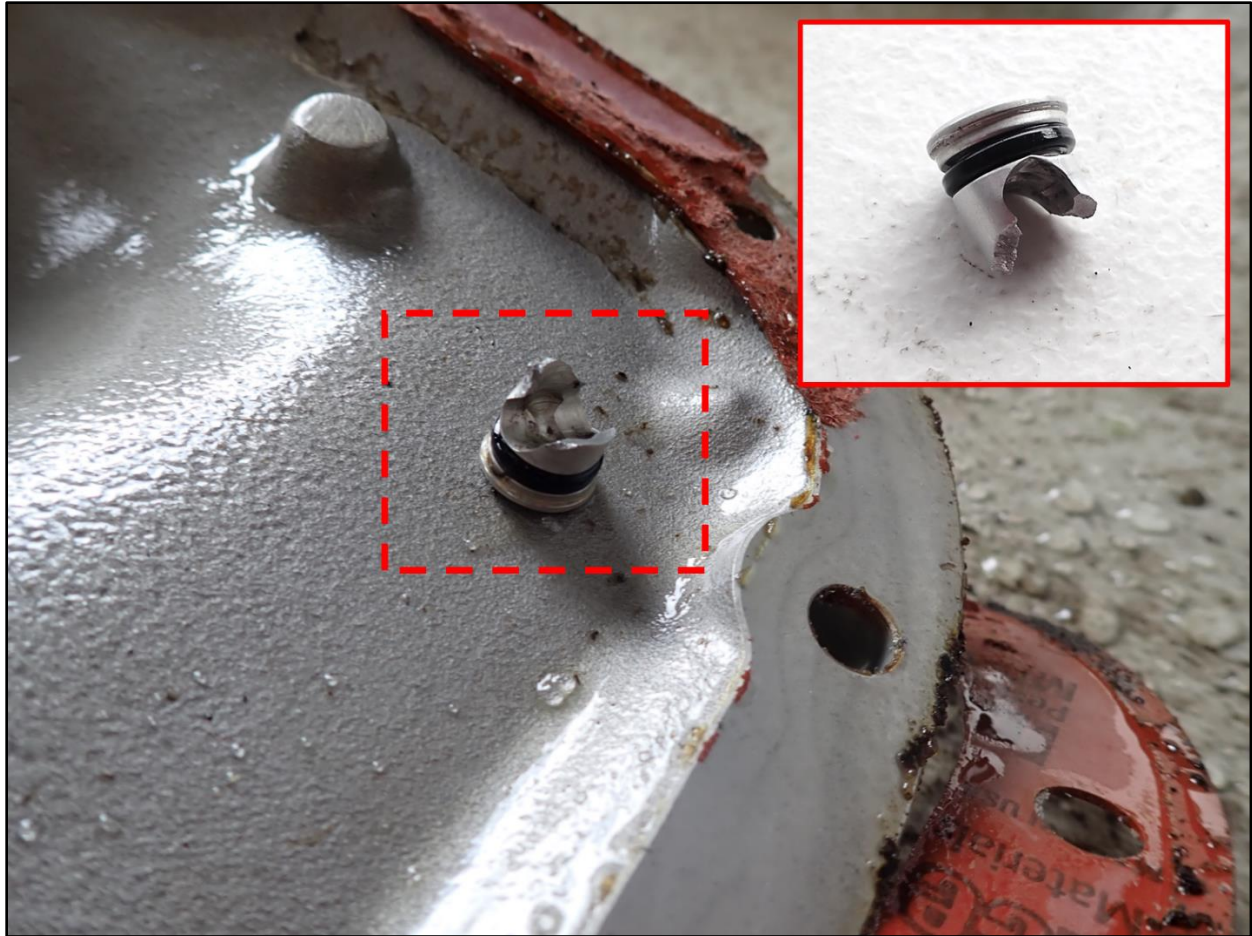


Figure 17 - Quick-Drain Plug Found in Oil Sump Pan (Textron Aviation Photos)



Figure 18 - Propeller and Spinner