

National Transportation Safety Board

Office of Aviation Safety
Central Region



CEN23FA258

WRECKAGE EXAMINATION SUMMARY

ACCIDENT

Date: June 26, 2023
Time: 0805 central daylight time
Location: Hot Springs, Arkansas
Lat/Lon: 34.46725, -93.11536
Airplane: Cessna 177
Registration: N3138T

PARTICIPANTS

Investigator-In-Charge	Andrew Todd Fox National Transportation Safety Board Denver, Colorado
Group Member	Thomas Farago Federal Aviation Administration - Little Rock FSDO Little Rock Arkansas
Group Member	Ernest C. Hall Textron Aviation Wichita, Kansas
Group Member	Ryan M. Enders Lycoming Engines Williamsport, Pennsylvania

ACCIDENT SYNOPSIS

On June 26, 2023, about 0805 central daylight time (CDT), a Cessna 177 airplane, N3138T, was substantially damaged during an accident near Hot Springs, Arkansas. The pilot was fatally injured, and the passenger sustained serious injuries. The airplane was operated as a Title 14 *Code of Federal Regulations* (CFR) Part 91 personal cross-country flight.

WRECKAGE EXAMINATION TIMELINE

On June 27, 2023, the National Transportation Safety Board (NTSB) Investigator-in-Charge (IIC) traveled to the accident site and was present as the airplane wreckage was recovered to shore. The wreckage was subsequently transported by Dawson Aviation, Clinton, Arkansas, where a wreckage layout and examination was completed on June 28, 2023. The NTSB IIC was assisted by a FAA Airworthiness

Inspector from the Little Rock FSDO, a Textron Aviation Senior Air Safety Investigator, and a Lycoming Engines Supervisory Air Safety Investigator.

AIRPLANE DESCRIPTION

The airplane was a 1968-model-year Cessna 177 (Cardinal), serial number (s/n) 17700438, registration number N3138T. The 150 horsepower, 4 cylinder, carbureted, normally aspirated, Lycoming O-320-E2D engine, s/n L-20535-27A, provided thrust through a two-blade, fixed pitch, McCauley 1C172/TM propeller, s/n E8564. The strutless high-wing airplane was of conventional aluminum construction with a fixed tricycle landing gear and wing flaps. The airplane's maximum takeoff weight was 2,350 lbs when operated in the normal category. The FAA issued the airplane's airworthiness certificate on December 15, 1967.

According to Cessna 177 Owner's Manual, the airplane was equipped with a 49-gallon capacity (48 gallons usable) fuel system, consisting of two 24.5-gallon wing fuel tanks (24 gallons usable each), as depicted in figure 1. The fuel system included vent lines from each integral tank that terminated at each wingtip and vented fuel tank filler caps. Both wingtip vent lines incorporated a check valve. The fuel reservoir tank in the forward cockpit is vented to the right-wing vent line outboard of the right fuel tank. The fuel selector valve positions include left, right, both, and off.

The airplane's expected fuel consumption rate is 8 to 8.5 gph if the engine is operated at 75% brake horsepower and properly leaned for cruise flight, as shown in figure 2, which yields an airplane fuel endurance of 5.7 to 6 hours. Alternatively, if the engine is operated at less than 75% brake horsepower and leaned for cruise flight, the expected fuel consumption rate is 6 to 8 gph and the airplane has a fuel endurance of 6 to 8 hours.

FUEL SYSTEM SCHEMATIC

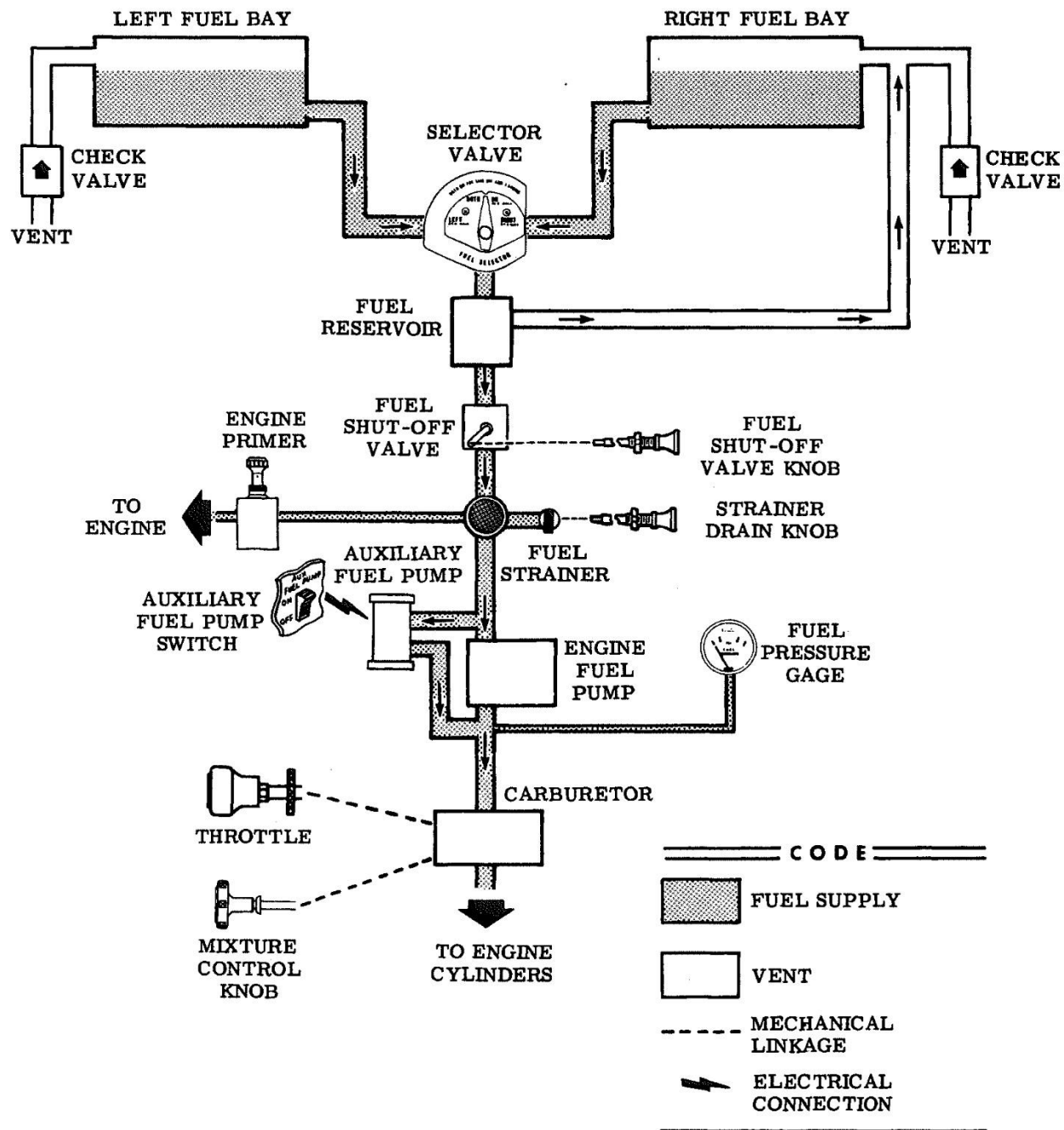


Figure 1. Cessna 177 fuel system schematic.

CRUISE & RANGE PERFORMANCE

CARDINAL

Gross Weight- 2350 Lbs.
Standard Conditions
Zero Wind Lean Mixture
48 Gal. of Fuel (No Reserve)

NOTE: Maximum cruise is normally limited to 75% power. Cruise speeds for the standard Model 177 are 3 to 4 MPH less than shown below for the Cardinal configuration.

ALT.	RPM	% BHP	TAS MPH	GAL / HOUR	ENDR. HOURS	RANGE MILES
2500	2700	89	138	9.9	4.8	670
	2600	81	132	8.9	5.4	710
	2500	73	126	8.1	5.9	750
	2400	65	119	7.3	6.6	785
	2300	58	112	6.6	7.3	815
	2200	52	104	6.0	7.9	825
	2100	46	94	5.7	8.5	795
5000	2700	84	137	9.3	5.2	710
	2600	76	131	8.4	5.7	745
	2500	69	125	7.6	6.3	785
	2400	61	118	6.9	7.0	820
	2300	55	110	6.3	7.6	840
	2200	48	100	5.8	8.2	820
7500	2700	79	136	8.7	5.5	745
	2600	71	130	7.9	6.1	785
	2500	64	123	7.2	6.7	820
	2400	57	115	6.5	7.4	845
	2300	51	105	6.0	8.0	840
10000	2650	70	131	7.8	6.2	805
	2600	67	127	7.4	6.5	825
	2500	60	120	6.8	7.1	850
	2400	54	110	6.2	7.7	855
	2300	48	98	5.8	8.3	810
12500	2600	62	124	7.0	6.9	855
	2500	56	115	6.4	7.5	865
	2400	50	103	5.9	8.1	830

Figure 2. Cessna 177 cruise and range performance data.

MAINTENANCE SUMMARY

The maintenance logbooks were not recovered while onsite, during wreckage recovery, or located with personal items that were collected by the Garland County Sheriff's Office.

The airplane's recording tachometer indicated 1,584.1 hours at the time of the accident.

There was a maintenance logbook entry for a transponder test found with the airplane registration and airworthiness certificate. The transponder test was dated May 31, 2023, at a recording tachometer time of 1,573 hours.

The pilot's family subsequently provided excerpts from the airframe logbook. The pilot had obtained these airframe logbook excerpts before he purchased the airplane. According to the logbook information, the last annual inspection was completed on August 31, 2022, at recording tachometer time of 1,412.7 hours. At the time of the last annual inspection, the airframe total time was 2,439.5 hours. After the annual inspection the engine oil was changed twice, on September 14, 2022, and October 14, 2022. At the final oil change, the recording tachometer indicated 1,452.1 hours.

A previous annual inspection, dated March 18, 2020, indicated that the airframe, engine, and propeller total time since new were 2,364.4 hours and the recording tachometer indicated 1,337.6 hours. The engine had accumulated 857.0 hours since the last top overhaul.

Based on the available logbook documentation, at the time of the accident, the airframe, engine, and propeller had accumulated 2,610.9 hours since new. The engine had accumulated 1,103.5 hours since the last top overhaul. The airplane had accumulated 171.4 hours since the last annual inspection completed on August 31, 2022.

The airplane had a new interior installed by Exclusive Aircraft Interiors, Las Cruces, New Mexico. The current airplane owner, who had recently purchased the airplane, took possession of the airplane in Las Cruces after the new interior was installed. FAA Inspector Farago contacted Exclusive Aircraft Interiors and asked for a copy of their maintenance logbook entry to be emailed to him. Exclusive Aircraft Interiors subsequently provided a signed logbook entry label, dated June 23, 2023, for the removal of the existing interior and the installation of new sound proofing material, interior, carpets, side panels, and headliner. Additionally, the cabin seat belts were replaced in accordance with FAA Technical Service Order (TSO) C22.

WRECKAGE EXAMINATION (JUNE 27-28, 2023)

General Wreckage Description

The airplane sustained substantial damage when it impacted lake water in a near vertical nose down pitch attitude. The airplane sank and was found inverted in 7 to 13 ft of water. The accident site was about 0.66 sm west-southwest of the runway 5 threshold at Memorial Field Airport (HOT), Hot Springs, Arkansas. On June 27, 2023, recovery crews floated the aircraft to the surface and towed it to a public boat launch where it was recovered to shore, as shown in figure 3.



Figure 3. Airplane wreckage after it was recovered to a boat launch.

Both wings remained attached to their respective fuselage attachment points. The leading edge of both wings were crushed aft. The left-wing top skin from the wing root outboard to about wing station 124.00 exhibited upward skin deflection. The cockpit windshield and the back window were separated. The left cabin door separated from the fuselage and was not observed during the examination. The engine cowling separated from the nose and was not observed during the examination.

Flight Controls

The stabilator, ailerons, rudder, trim tabs, and wing flaps were accounted for during the wreckage examination. All flight control surfaces remained attached to their respective hinge points. Flight control continuity was confirmed by either a visual check of the cable and/or pulling of the control cable at one end to move its respective control surface. Flight control cable continuity was confirmed from the cockpit controls to their respective flight control surface. Continuity of the stabilator trim control cables were confirmed from the cockpit to the flight control trim surfaces.

The stabilator trim actuator extension measured about 1.5 inches which corresponded with about 10° stabilator trim tab trailing edge down (nose up trim). However, impact-related damage to the aft fuselage during impact and wreckage recovery could have altered the position of the stabilator trim actuator position due to changes in cable tension.

The left- and right-wing flaps remained attached to their respective attachment points. The flap handle in the cockpit was found at the "¼" detent. The flap handle panel was bent forward beginning about midway down the panel. The flap actuator jackscrew was found fully extended, as shown in figure 4, consistent with the wing flaps fully extended at impact.

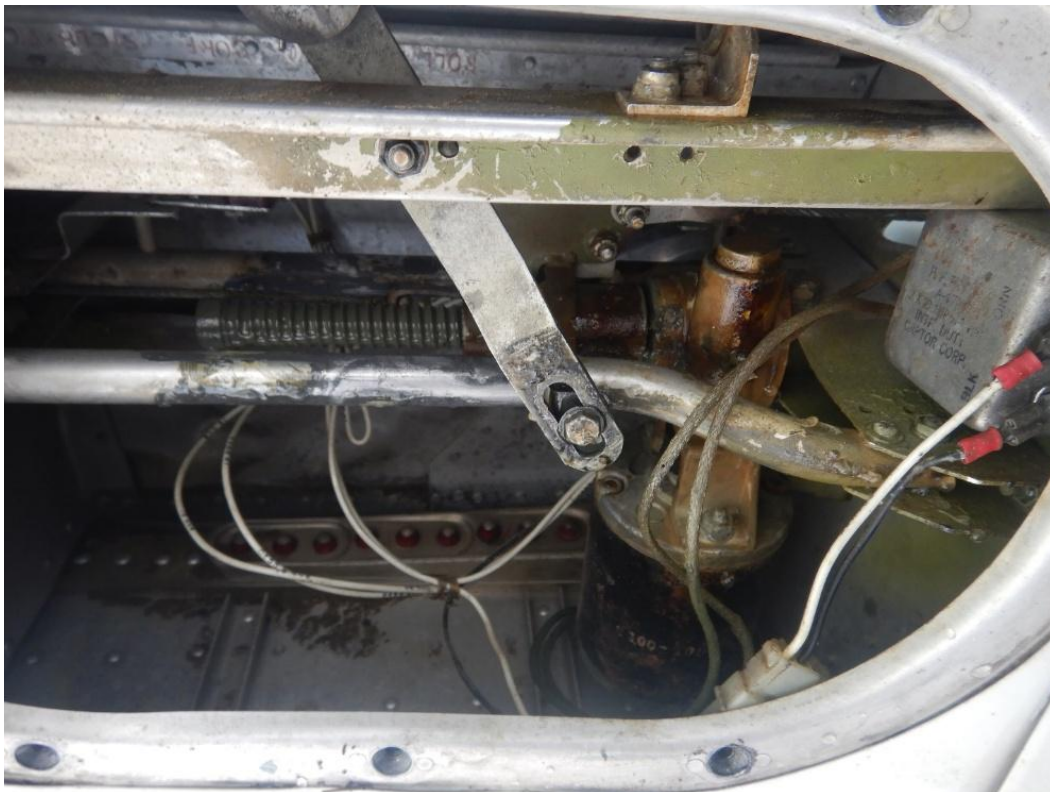


Figure 4. Flap motor/actuator.

Fuel System

The wing fuel tanks did not contain any fuel after the airplane was salvaged from the lake. Fluid samples recovered from various points in the fuel system were contaminated with lake water but also exhibited an odor consistent with 100 low lead aviation fuel. The lake water and fuel did not separate after the samples sat undisturbed for more than 3 hours.

The fuel selector valve was positioned to use fuel simultaneously from both tanks. The fuel selector valve functioned as designed, with a positive detent felt in all selector positions.

The firewall-mounted fuel shutoff valve was found in a partial open position. The fuel shutoff valve control cable remained attached to the control arm, but the control cable was bent upward due to impact-related damage.

The entire airframe fuel system was tested by blowing air through the fuel supply lines and vent lines. The fuel lines and vent lines were free of obstructions. The vented fuel caps on both wing fuel tanks exhibited no cracks and the rubber seals/flaps were in good condition. The airplane was equipped with a filler neck guard in each fuel tank filler port. The wingtip vent check valves were not obstructed and functioned as designed.

The electric auxiliary fuel pump contained water and was not tested. The cockpit switch for the electric auxiliary fuel pump was in the off position.

The fuel quantity transmitters resistance values were tested with a digital multimeter; however, notably, after the accident both wings and their respective fuel transmitters were submerged in lake water.

The left-wing fuel quantity transmitter appeared to be the original Cessna part number and design. The measured resistance at the full and empty stops were 285 ohms and 48 ohms, respectively. There were no electrical shorts in the full range of the left-wing fuel float switch.

The right-wing fuel quantity transmitter was a McFarlane replacement unit. The measured resistance at the full empty stops were 62 ohms and 1 ohm, respectively. There were no electrical shorts observed in the full range of the left-wing fuel float switch.

Engine

The engine remained attached to the airframe mounts but was displaced aft and down, as shown in figure 5. Internal engine continuity and valve train continuity were confirmed while the 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. Borescope examination of each cylinder did not reveal any anomalies with the cylinders, pistons, valves, or valve seats.



Figure 5. Engine and propeller.

The exhaust and intake tubes were removed to facilitate the engine examination. Sediment was found in one exhaust riser, but no exhaust obstructions were observed. The intake tubes exhibited excessive fuel staining and black deposits in each pipe, an example is shown in figure 6. Fuel staining was also observed on the exterior of the No. 2 cylinder tube at the mounting gasket to the cylinder.



Figure 6. Intake tube with fuel staining.

The carburetor remained attached to the bottom of the engine sump. The exhaust was pressed up against the throttle control lever. The throttle control cable remained attached to the carburetor, with the throttle plate in a mostly closed position. The mixture cable was impact separated from the mixture arm. An impacted-related witness mark on the carburetor was found from the mixture control lever in the full rich position.

The carburetor was removed for further examination. The throttle plate was mostly closed and had evidence of fuel staining on the back side (engine sump side) of the plate, as shown in figure 7. Fuel staining was only observed on the engine side of the throttle plate. The accelerator pump jettisoned water into the carburetor throat when the throttle arm was actuated. The carburetor fuel inlet screen contained organic debris; however, the fuel inlet line fitting had sheared and exhibited impact-related damage. The metal floats in the fuel bowl exhibited metal hydraulic deformation, as shown in figure 8.

The carburetor heat control knob and control cable were found pulled aft about 2 inches and bent down. The other end of the carburetor heat cable exhibited impact-related damage. The fractured end of the carburetor heat cable included the solid shaft of the carburetor heat butterfly valve. The carburetor heat ducting and valve were not recovered with the wreckage.



Figure 7. Fuel staining on throttle plate and carburetor throat.



Figure 8. Hydraulic deformation to carburetor float.

The left magneto remained attached to the accessory housing. The left magneto was removed for further testing. The left magneto produced spark at all four leads when rotated by hand. The impulse coupling functioned normally.

The right magneto was impact separated from the accessory housing at the mounting flange. The right magneto produced spark at all four leads when rotated by hand. The right-magneto was not equipped with an impulse coupling.

The bottom spark plugs were removed upon the wreckage recovery to the shore on June 27, 2023, to allow water to drain from the cylinder heads. The cylinder No. 3 top spark plug exhibited blue staining on the insulating ceramic, as shown in figure 9. The remaining spark plugs exhibited features consistent with normal engine operation.



Figure 9. Cylinder No. 3 top spark plug.

The engine-driven fuel pump functioned normally when tested by hand.

The vacuum pump remained secured to the accessory housing and appeared undamaged. The unit was removed and pumped water out when rotated by hand. The shear shaft was not damaged.

The oil suction screen remained secured to the sump and was not obstructed. The oil filter base was broken away from the accessory housing. The oil filter was slightly crushed forward into the filter base.

The airplane air filter appeared deteriorated and dirty. The filter was removed and the sealing gasket of the airbox was deteriorated and missing sections of gasket material, as shown in figures 10 and 11.



Figure 10. Engine induction filter box and gasket.



Figure 11. Engine induction filter element.

Propeller

The propeller remained attached to the crankshaft flange and spacer. The spinner displayed fore-to-aft crush damage. The propeller blades exhibited slight twist and light chordwise scratch marks, as shown in figure 12. The leading edge of both propeller blades exhibited minor scratches.



Figure 12. Propeller.