

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



WPR24LA174

INVESTIGATIVE SUPPLEMENTAL MATERIAL

ACCIDENT

Location: San Diego, California
Date: June 01, 2024
Time: 1355 Pacific daylight time
Airplane: Beechcraft

INVESTIGATIVE SUPPLEMENTAL MATERIAL

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HISTORY OF FLIGHT

On June 1, 2024, at 1355 Pacific Daylight time, a Beech 35-C33A, N1259M, sustained substantial damage when it was involved in an accident near San Diego, California. The pilot and two passengers were not injured. The airplane was operated as a Title 14 *Code of Federal Regulations* (CFR) Part 91 personal flight.

The pilot stated that the fuel tanks were full when he departed on the approximate 330 nm cross-country flight. He departed with the fuel selector positioned on the left tank and switched to the right fuel tank about 200 nm into the flight. As the airplane approached Montgomery-Gibbs Executive Airport, San Diego, an air traffic controller instructed the pilot to enter the left downwind leg of the traffic pattern for runway 28L and then to extend the leg 2 miles west of the airport. During the approach, he did not change the position of the fuel selector and noted that the fuel quantity gauges indicated that the right tank contained more fuel than the left. The auxiliary fuel pump was off as required by the checklist.

The pilot further stated that on final approach, about one mile from the runway, he fully extended the flaps. Shortly thereafter, the engine experienced a partial loss of power and was “running rough.” The pilot attempted to troubleshoot the loss of power by enriching the mixture but was unable to restore engine rpm. The pilot determined he was too low to reach the runway and prepared to make a forced landing short of the runway. At about 20 ft above ground level (agl), the pilot flared and the stall warning horn sounded. The airplane touched down hard resulting in the nose gear collapsing. During the accident sequence, the left wing sustained substantial damage.

RECORDS

The accident aircraft was a Beechcraft model 35633C, serial number CE-175, manufactured in 1967. The engine was a Continental IO-520-B, and the tachometer reading at the time of the examination was 1,463.08 hours. No records were provided at the time of the exam.

There were no engine monitors on the airplane. The pilot estimated landing with 14 gallons usable in the left tank and 24 gallons usable in the right tank.

FUEL SYSTEM

The fuel system is designed for operation with 100LL (blue) aviation gasoline. The system includes a rubber fuel cell (bladder) in each wing leading edge with a flush-type filler cap. The airplane had the optional 80-gallon capacity (74 gallons usable), which includes a visual measuring tab within the filler neck to estimate usable fuel with the wings level—27 gallons at the bottom of the tab and 32 gallons at the detent. From the wing bladders, fuel is plumbed to a fuel selector, containing the “OFF”, “LEFT” and “RIGHT” positions. Fuel then continues through a strainer, an electric auxiliary fuel pump before passing through the firewall and continuing to the engine-driven injector pump to a metering control unit and fuel manifold to the cylinder nozzles.

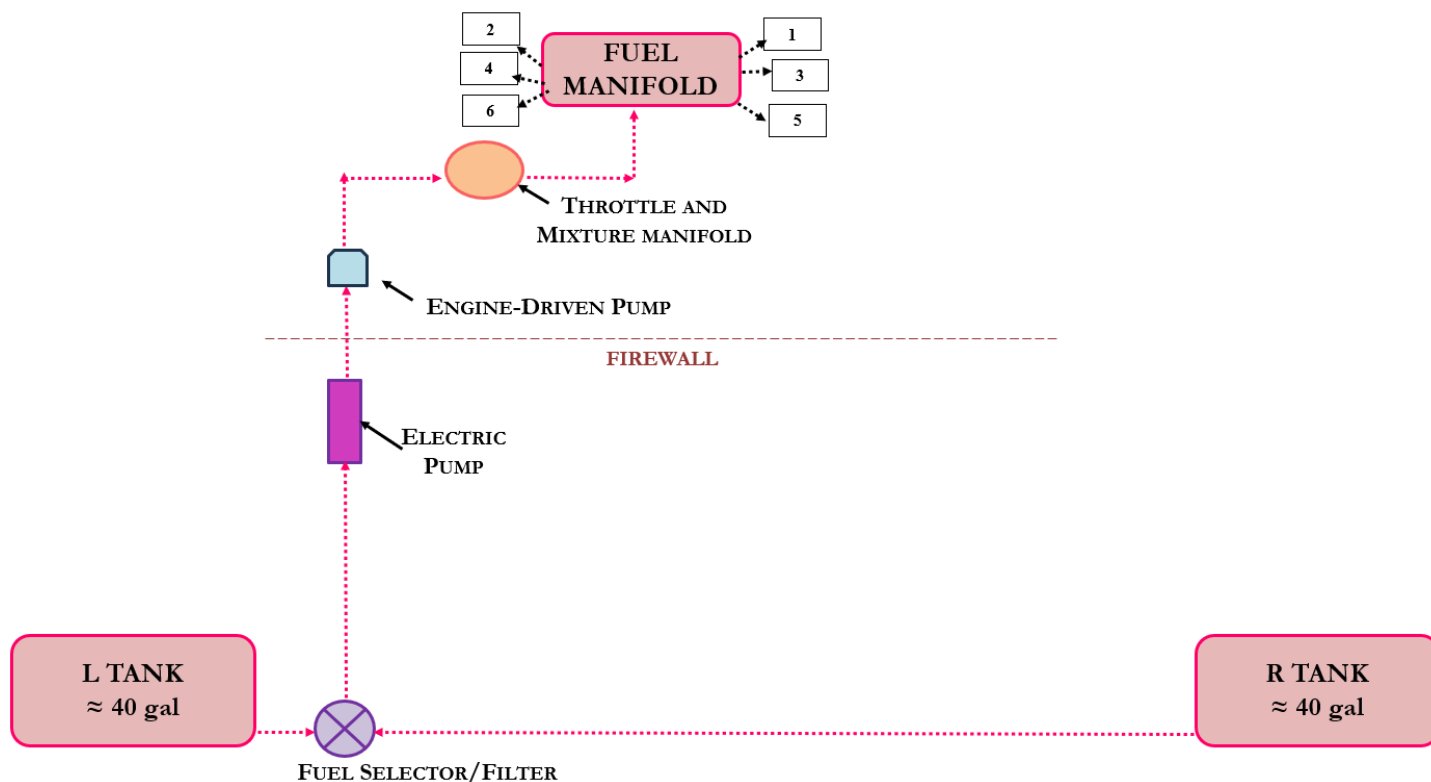


Figure 1: Fuel system diagram

The fuel manifold valve body contains a fuel inlet, a diaphragm chamber, and outlet ports for fuel lines to the individual nozzles. The spring-loaded diaphragm carries a plunger in the central bore of the manifold body. The diaphragm is enclosed by a vented cover that retains the diaphragm loading spring. When the plunger is down in the body bore, fuel passages to the nozzles are closed off. The plunger is drilled to allow fuel to pass from the diaphragm chamber to its base and to the valve within the plunger. As fuel flow increases, pressure overcomes the diaphragm spring tension, causing the plunger to move to the open position, and fuel then flows from the manifold valve outlets through the fuel lines to the fuel nozzle assemblies.

Approximately 10 gallons per hour of excess fuel returns to the selected tank. A check valve permits bypass of the engine-driven pump during starts or pump failures. A screen is installed at the tank outlet to trap large debris, and another screen is located at the inlet of the electric auxiliary pump to prevent contamination from entering downstream components. The fuel tanks are vented through lines that terminate in open ports on the bottom surface of each wing. These vents ensure continuous atmospheric pressure balance and prevent vacuum formation during fuel withdrawal.

The wings were previously removed for recovery purposes. For the purposes of testing fuel continuity, a small fuel tank was connected to the left tank inlet and return on the fuselage. The electric fuel pump was disconnected at the splice adjacent to the unit. The fuel selector was tested and functioned correctly. Fuel flowed when selected to the left tank. When the selector was moved to the "RIGHT" position, fuel flow ceased, consistent with the expected function. The fuel strainer screen was removed and found to contain areas of corrosion. The throttle and mixture manifold screen was removed and was free of contamination.

The B-nut at the engine-driven fuel pump was disconnected and then reconnected. Next, the B-nut at the throttle and mixture manifold was disconnected and then reconnected, followed by the disconnection and reconnection of the B-nut at the fuel distributor. When external power was applied to the electric fuel pump, fuel flowed through the left inlet port and continued through the system, exiting from all the respective B-nut fittings.

The fuel manifold part number R631427-2A9 (serial number C09EA071B) was disassembled. The diaphragm inside the fuel manifold, part number 631526, was found to be brittle, not pliable, and exhibited peeling on its upper surface. There were numerous flakes from the rubber found during the removal, but it could not be determined if the contaminants would have prohibited the venting of the unit. The vent hole was free of debris and no blue staining was noted at the end of the

vent line and surrounding fuselage skin. It is unknown if the wear and condition of the diaphragm resulted in the manifold malfunctioning, but the lack of fuel staining is consistent with a normally operating manifold..



Figure 2: Fuel manifold disassembled

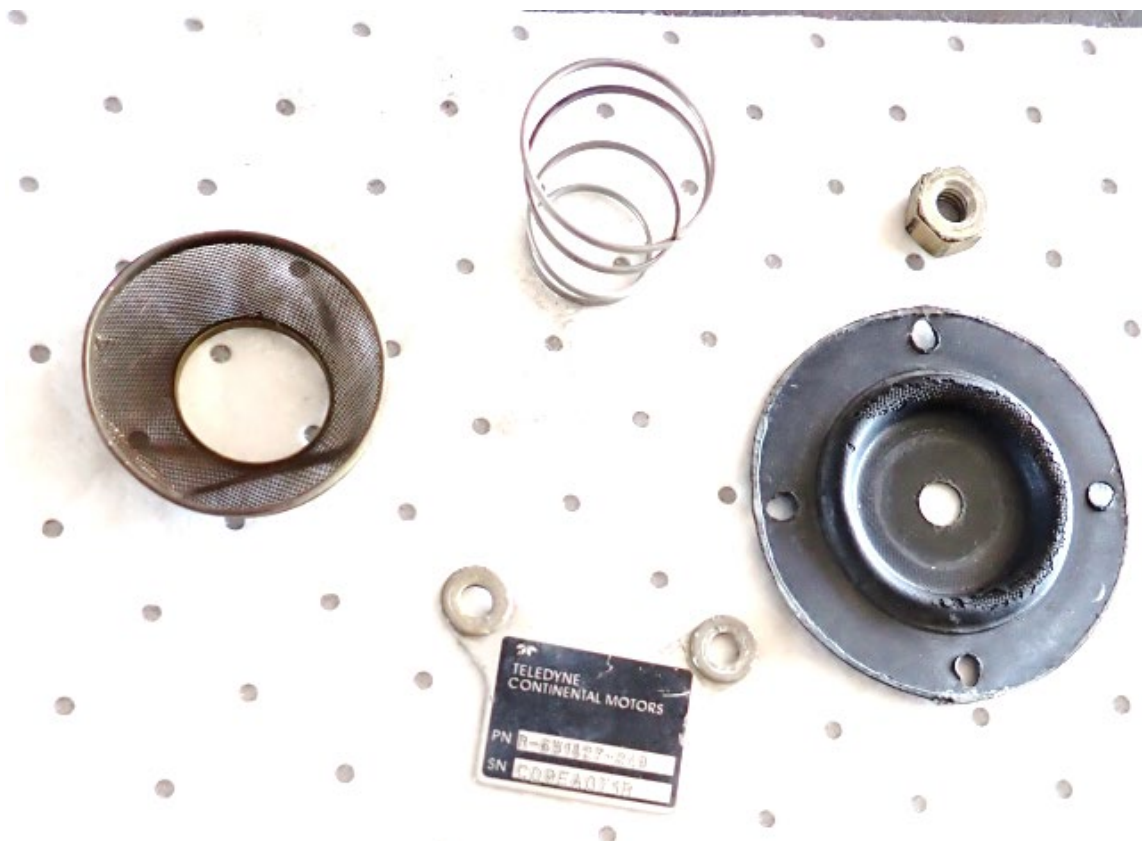


Figure 3: Manifold screen and diaphragm



Figure 4: Manifold diaphragm

The fuel manifold screen was clean of debris but rust colored. The manifold body contained trace amounts of rust, consistent with water being in the fuel.



Figure 5: Manifold body (showing corrosion)

The throttle and mixture manifold screen was also examined and found clean. The fuel strainer screen was removed and exhibited areas of corrosion.

Fuel lines to each cylinder were disconnected and jars were placed under each line. Fuel flowed from each line at similar flow rates. The fuel injectors were removed and found clear of debris.

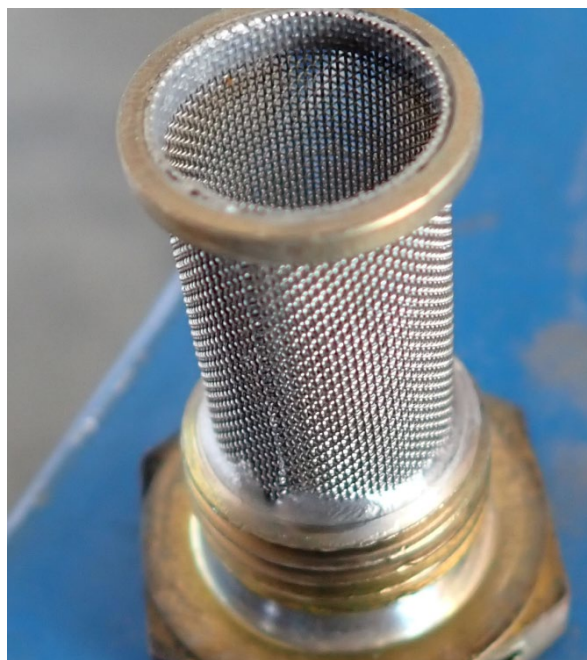


Figure 6: Fuel screen (showing corrosion)

Continuity of the vent system was verified by blowing air pressure through the system. The vent line at the outboard section of the left wing was removed and air was introduced, resulting in fluid discharge consistent with water. The right wing vent system was similarly tested; pressurized air introduced at the inlet resulted in airflow out of the vent system and trace amounts of fluid exiting the lines. A water-detecting paste turned deep magenta when exposed to liquid recovered from the system, consistent with the presence of water. There was visible corrosion on the bottom of the fuel cap and receptacle screens. Fuel cap seals were pliable, the mating surfaces contained corrosion.



Figure 7: Fuel cap receptacle (showing corrosion)

ENGINE

The airplane was powered by a Continental IO-520-B six-cylinder engine. All six top spark plugs were removed and found to be similar in appearance, displaying a gray coloration. The magneto/ignition timing could not be verified due to the absence of timing marks on the flywheel, but both magnetos appeared to be timed within a few degrees of one another.

The cylinders' combustion chambers were examined through the upper spark plug holes utilizing a lighted borescope. The combustion chambers remained mechanically undamaged, and there was no evidence of foreign object ingestion or detonation. There was no evidence of valve-to-piston face contact observed. The gas path and combustion signatures observed at the spark plugs, combustion chambers, and exhaust system components displayed coloration that the Continental representative said was consistent with normal operation. There was no oil residue observed in the exhaust system gas path.

With the fuel still plumbed directly into the left wing root, a test run was performed. The engine operated for approximately five minutes between 1,200 and 1,700 rpm. A magneto check was conducted at 1,700 and 2,000 rpm. The engine operated normally during the test-run.

PAST REPORTED DIAPHRAGM PROBLEMS

Service Difficulty Report

1. Submitter Information

(a) Unique Control #: 2004FA0000226 (b) Difficulty Date: 02/10/2004
(c) Registration #: 762AA (d) Submitter Type: D - MECHANIC
(e) Submitter Designator: (f) Submission Date: 2/24/2004 4:37:48 PM

2. Codes

(a) Operator Designator : ET9T (b) Operator Type :
(c) JASC/ATA Code : 7310
(d) Stage of Operation : NR - NOT REPORTED
(e) How Discovered : 9 - Unknown
(f) Nature of Condition :
(g) Precautionary Procedures: 0 - OTHER
(h) FAA Region : NM (i) District Office : 07

3. Major Equipment Identity

	Manufacturer	Model	Serial Number	Total Time	Total Cycles
(a) Aircraft	BEECH	M35	D6168		
(b) Engine	CONT	IO470C	718869C		
(c) Propeller					

4. Problem Description

FUEL DIAPHRAGM ON THE FUEL MANIFOLD VALVE SHOWED DETERIORATION DUE TO AGEING. FUEL LEAKED OUT OF THE AIR BLEED HOLE ON THE FUEL MANIFOLD VALVE, CAUSING ENGINE FUEL FLOW PROBLEMS. ADDITIONAL INSPECTIONS AFTER PROLONGED STORAGE.

5. Specific Part or Structure Causing Difficulty

(a) Part Name : DIAPHRAGM (b) Manufacturer's Name :
(c) Part Number : 631526 (d) Serial Number :
(e) Part Condition: CRACKED (f) Part/Defect Location: FUEL MANIFOLD
(g) Total Time : 3600 (h) Total Cycles :
(i) Time Since :

6. Component/Assembly That Includes Defective Part

(a) Component Name: FUEL MANIFOLD (b) Manufacturer's Name :
(c) Part Number : 631427A15 (d) Serial Number :
(e) Model Number : (f) Location : ENGINE
(g) Total Time : (h) Total Cycles :
(i) Time Since :

7. Structure Causing Difficulty

(a) Body or Fuselage Station - From/At: To:
(b) Water Line - From/At: To:
(c) Crack Length : (d) Number of Cracks:
(e) Stringer - From/At: To:
(f) Butt Line - From/At: To:
(g) Wing Station - From/At: To:
(h) Structural Other: (i) Corrosion Level :

----- End Of Report -----

Service Difficulty Report

1. Submitter Information

(a) Unique Control #: 2011FA0000788 (b) Difficulty Date: 12/12/2011
 (c) Registration #: (d) Submitter Type : B - REPAIR STATION PART 145
 (e) Submitter Designator: (f) Submission Date: 12/12/2011 1:37:19 PM

2. Codes

(a) Operator Designator : (b) Operator Type :
 (c) JASC/ATA Code : 2810
 (d) Stage of Operation : NR - NOT REPORTED
 (e) How Discovered : 0 - Other
 (f) Nature of Condition :
 (g) Precautionary Procedures: A - UNSCHED LANDING
 (h) FAA Region : SW (i) District Office : 99

3. Major Equipment Identity

	Manufacturer	Model	Serial Number	Total Time	Total Cycles
(a) Aircraft					
(b) Engine	CONT	IO550B	687052	690	
(c) Propeller					

4. Problem Description

ENGINE LOST POWER IN FLIGHT, MADE A PRECAUTIONARY LANDING AND COULD NOT BE RESTARTED. PROBLEM WAS AN EXTREMELY HARDENED DIAPHRAGM IN THE ENGINE'S FLOW DIVIDER. THE DIAPHRAGM WAS SO INFLEXIBLE THAT THE FLOW DIVIDER CLOSED AND COULD NOT BE OPENED NO MATTER HOW MUCH FUEL PRESSURE WAS APPLIED TO THE INLET OF THE FLOW DIVIDER. THE DATE CODE ON THE DIAPHRAGM WAS FROM 2007. UNKNOWN CAUSE FOR THE PROBLEM BUT A POSSIBLE FUEL CONTAMINATION OR ADDITIVE CAUSING A REACTION THAT CAUSED THE DIAPHRAGM TO HARDEN IS SUSPECT.

5. Specific Part or Structure Causing Difficulty

(a) Part Name : DIAPHRAGM (b) Manufacturer's Name :
 (c) Part Number : (d) Serial Number :
 (e) Part Condition: DETERIORATED (f) Part/Defect Location: FLOW DIVIDER
 (g) Total Time : 690 (h) Total Cycles :
 (i) Time Since :

6. Component/Assembly That Includes Defective Part

(a) Component Name: FLOW DIVIDER (b) Manufacturer's Name : CONT
 (c) Part Number : 64650817 (d) Serial Number : C08EA041
 (e) Model Number : (f) Location :
 (g) Total Time : (h) Total Cycles :
 (i) Time Since :

7. Structure Causing Difficulty

(a) Body or Fuselage Station - From/At: To:
 (b) Water Line - From/At: To:
 (c) Crack Length : (d) Number of Cracks:
 (e) Stringer - From/At: To:
 (f) Butt Line - From/At: To:
 (g) Wing Station - From/At: To:
 (h) Structural Other: (i) Corrosion Level :

----- End Of Report -----