



NATIONAL TRANSPORTATION SAFETY BOARD

**Office of Aviation Safety
Western Pacific Region**

AIRFRAME AND ENGINE EXAMINATION

**NTSB Accident: WPR16LA093
Accident Date: April 17, 2016**

Examination Date: May 19, 2016

This document contains 48 embedded photographs
Photographs courtesy NTSB, Textron, & Lycoming

A. ACCIDENT

Location: Avalon, CA
Date: April 17, 2016
Aircraft: Cessna 172K, N7133G, Serial # 17258833
NTSB IIC: Michael Huhn

B. EXAMINATION PARTICIPANTS:

Michael Huhn
Air Safety Investigator
National Transportation Safety Board
Western Pacific Region

Michael Hicks
Air Safety Investigator
National Transportation Safety Board
AS-20 Division

Mark Platt
Air Safety Investigator
Lycoming Engines
Williamsport PA

Henry Soderlund
Air Safety Investigator
Textron Aviation
Wichita KS

C. SUMMARY

Examination of the recovered airframe and engine was conducted on May 19, 2016 at the facilities of Southwest Aircraft Recovery at Corona Airport (KAJO), Corona, California. No evidence of any preimpact mechanical deficiencies or malfunctions were noted during the examination of the recovered airframe and engine.

The wreckage remained in situ at the accident site for several days. It was then helicoptered in several pieces to a trailer, and subsequently towed to a harbor for loading onto a barge for transport to the mainland.

D. AIRFRAME INFORMATION

1.0 General

Manufacture Model Year: 1970
Initial delivery date: 11-04-69
Date purchased by current owner: 05-02-13

Most Recent Annual Inspection: 01-03-16 Hours: 4,951.6

The right wing and the engine had almost completely fracture-separated from the airplane during the impact sequence. Those components were physically cut from the airplane by recovery personnel to enable recovery and transport.

The cabin structure retained most of its original occupiable volume, with the exception of the two footwells. The primary cabin impact damage and deformation was consistent with impact loads applied from the lower forward right side. Additional damage, particularly to the aft fuselage and empennage, was consistent with the airplane tumbling and/or sliding down the steep slope at the accident site. Recovery personnel and photographic evidence indicated that the airplane impacted steeply rising terrains, travelled forward/upward for about 30-50 feet, and then slid/tumbled downhill about 100 feet

Major Components

Engine:	Manufacturer: Lycoming	Model: O-320-E2D	S/N: L-27240-27A
Propeller:	Manufacturer: McCauley	Model: 1C160CTM7553	Hub S/N: 725763

Component times were not determined during the exam



Figure 1 - Wreckage Overview



Figure 2 - Front View



Figure 3 - Aft Right (note forward crushing of fuselage)



Figure 4 - Empennage and Aft Fuselage



Figure 5 - Empennage



Figure 6 - Left Wing



Figure 7 - Right Wing



Figure 8 - Right Wing

2.0 Flight Control System Information

All portions of all aerodynamic and all flight control surfaces were accounted for at the recovery facility. According to the recovery personnel, all components were found in the immediate vicinity of the wreckage. Except for about a 1-foot outboard section of the right aileron, and a small segment of the rudder tip, all flight control surfaces remained attached to their respective aerodynamic surfaces.

Flight Control Cable Continuity (cockpit control to aero panel)

Ailerons: Established

Elevators: Established

Rudder: Established

Aileron tab: Not applicable

Elevator tab: Established

Rudder tab: Not applicable

Several flight control cables were found to be cut. According to the recovery company personnel, all the flight control cables were intact after the accident, and all cuts were made during the recovery of the airplane.

Trailing Edge Flaps

Cockpit indicator: 0°

Cockpit handle: Neutral (3 position momentary switch/handle)

Actuator extension: 4" ; equates to ~20°

Elevator Trim

Cockpit Indicator: Full nose up

Actuator: 1.3" ; equates to ~0°

3.0 Fuel System

The airplane was equipped with two metal tanks, one per wing. At the time of this examination, both tanks were devoid of fuel. The left tank was intact, with no penetrations. The cap was securely installed. The single finger screen was removed, and found to be clear and unobstructed. The aft end of the right tank was crushed forward, with the possibility of a breached tank, but that was not definitively determined. There were no other penetrations or possible penetrations of the tank. The cap was securely installed. The single finger screen was removed, and found to be clear and unobstructed.

Fuel strainer bowl: Fractured with a small segment absent, devoid of fuel, but clean, with no debris or evidence of corrosion

Fuel strainer screen: Clean

Main fuel tank gauge indications: Left: 1/2 Right: Full

The fuel selector handle had four settings: Left, Right, Both, and Off. The fuel selector handle remained connected to the fuel selector valve. Both were found set to the Left fuel tank.



Figure 9 - Left Fuel Tank Finger Screen and Float Assembly

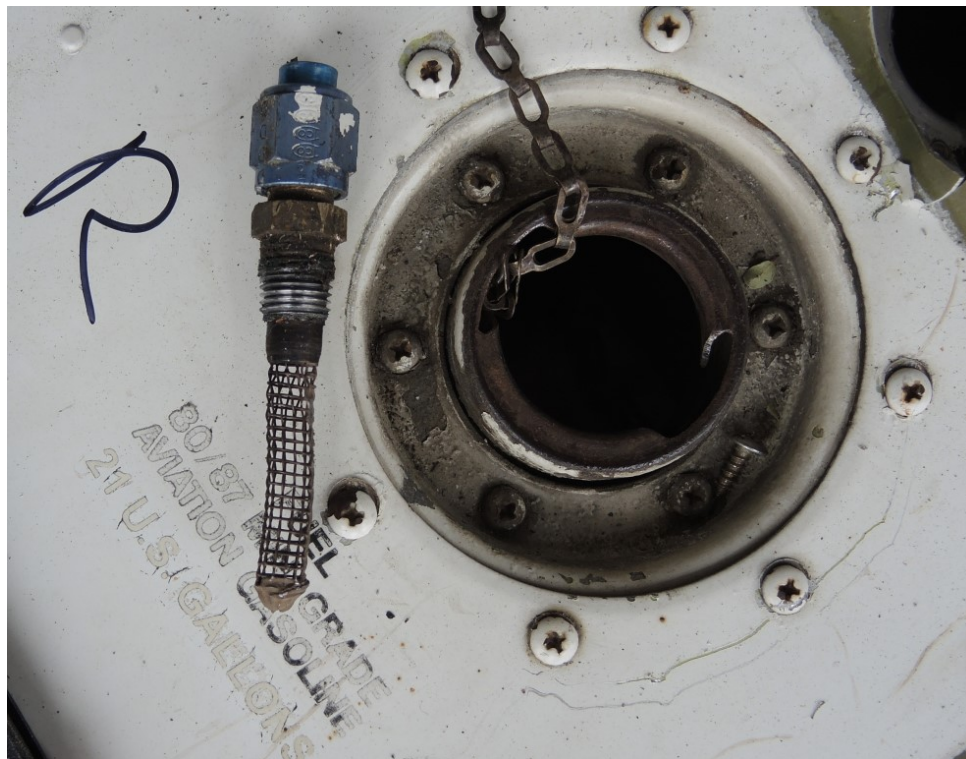


Figure 10 - Right Fuel Tank Finger Screen and Cap



Figure 11 - Fuel Strainer



Figure 12 - Fuel Strainer Bowl



Figure 13 - Cockpit Fuel Selector

4.0 Landing Gear

The airplane was a fixed-position landing gear design. The nose gear was fracture-separated from the airframe; It bore significant impact damage. Both main landing gear spring struts, wheels, and tires remained attached to the airframe.

5.0 Other Cockpit Controls and Indications

The airplane was equipped with a single (primary) set of analog flight instrumentation, mostly on the pilot's (left) instrument panel.

Magnetic compass: Undetermined

Suction gage: 0

Clock: Undetermined

Airspeed: 0 mph (outer scale). NOTE: ASI speed arcs subsequently determined to properly depict ranges/limits.

Turn coordinator: Not turning

Attitude - Tumbled

Heading indicator: 285°

Heading 'bug': Not installed

Altimeter: 8,340'

Altimeter setting: 29.86

Vertical speed indicator: 200 FPM up

Communication and Navigation Radios

The two communication and navigation radios were of the type which required electrical power to determine the frequencies they were set to. Due to the damage to the instrument panel, electrical power was not applied, and therefore the respective radio frequency settings were not determined. The same was true of the transponder.

The OBS settings on the numbers 1 and 2 VOR heads were set to 200° and 315°, respectively

Electrical Switch Positions

Master battery: On

Master alternator: On

Ignition Switch: Key found inserted, intact, set to "BOTH"

Pitot heat: Off

Lighting Switch Positions

Navigation: Off

Rotating Beacon: Off

Strobe: Off

Landing: Off

Taxi: Undetermined

Instrument: Undetermined

Environmental System Controls

Cabin heater: Off Cabin vent: Off Defrost: Not applicable

Stall Warning System

The airplane was equipped with a pneumatically-sensed/activated reed-horn stall warning system. The horn was removed from the airplane and application of low-pressure air resulted in the horn sounding properly.

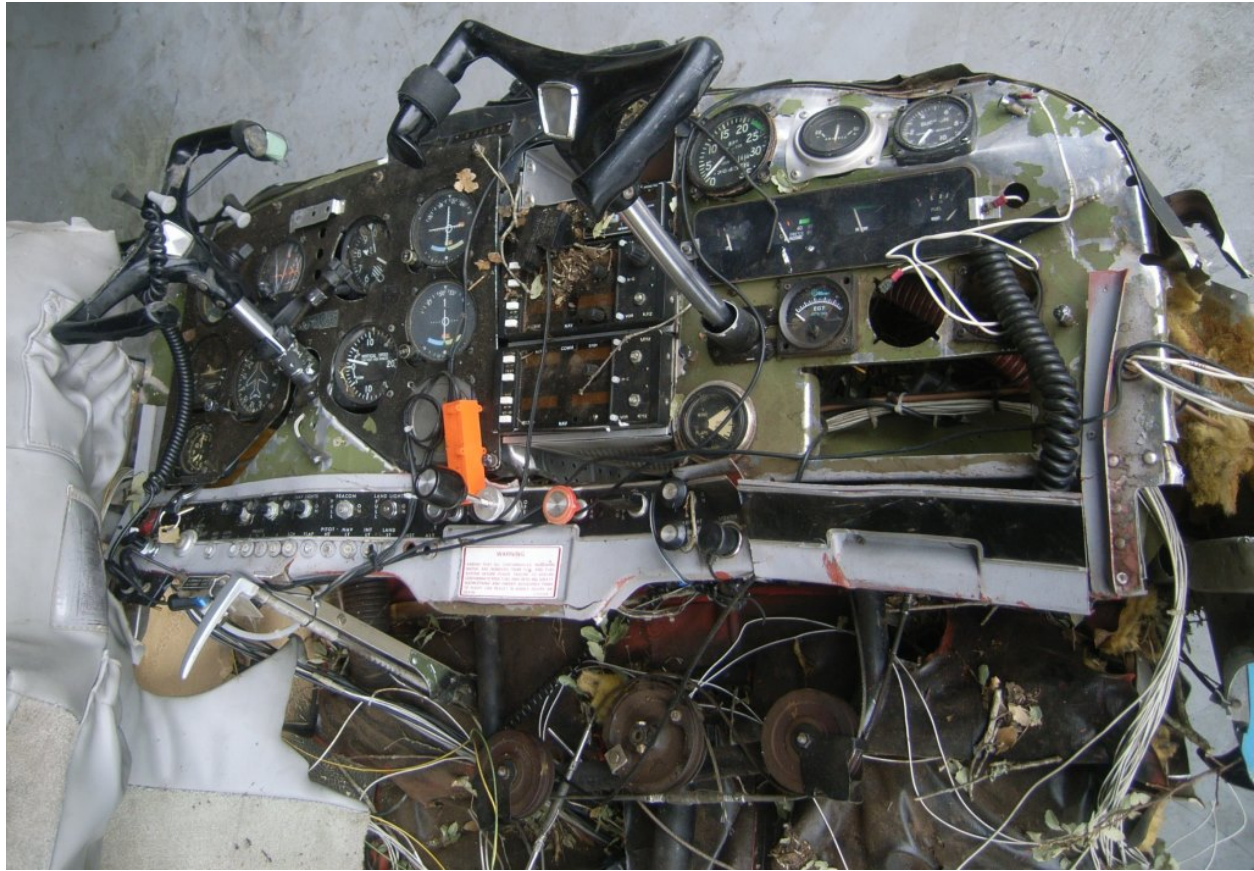


Figure 14 - Instrument Panel



Figure 15 - Airspeed Indicator



Figure 16 - Stall Warning Horn

6.0 ELT

Physically separated from wreckage by unknown person(s)/events on-scene. NOTE: The signal was detected by the SAR satellite constellation within a minute of the accident, and multiple times thereafter during subsequent satellite passes.

Manufacturer: ACK Technologies Model: E-04 Type: AF TSO C91a & 126 (406MHz)
Serial number: 11347 Battery due date: Aug 12 2019



Figure 17 - ELT

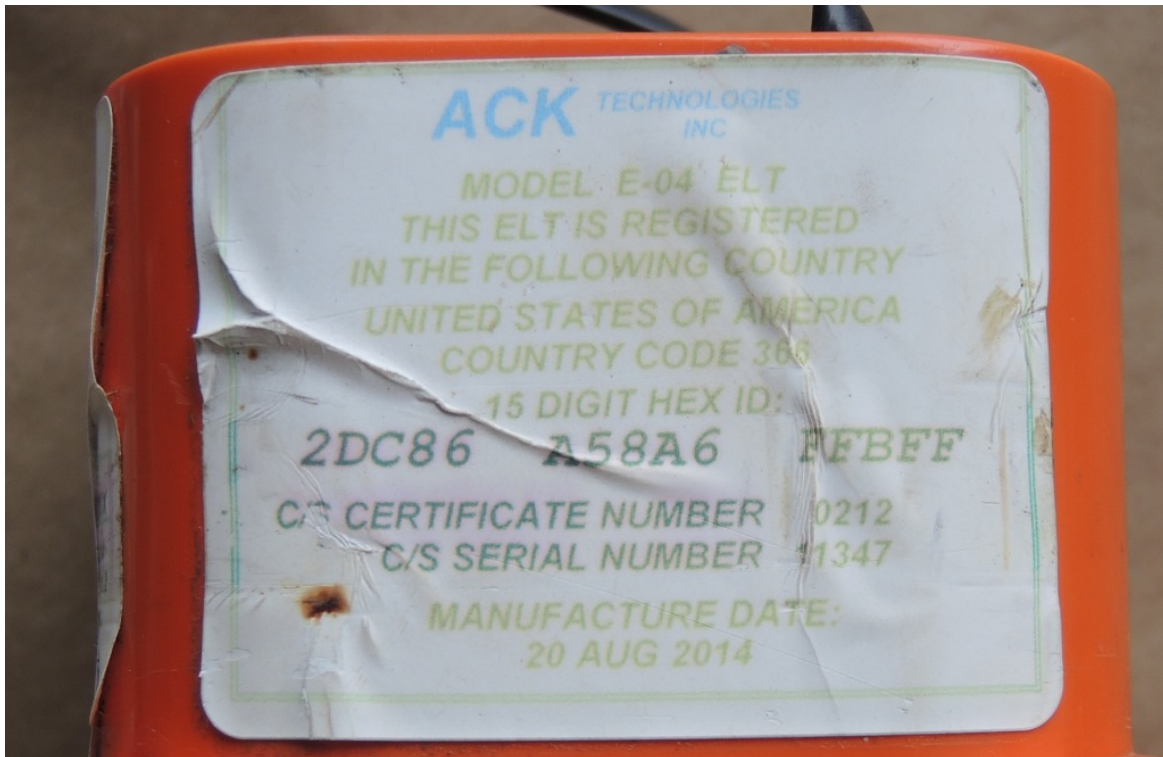


Figure 18 - ELT

7.0 Seats and Restraints

The airplane was equipped with seating and restraints for 4 persons. The two forward seats were separate units, while the rear unit was a bench seat.

According to the pilot, there were only two persons on board, both seated in the front. At the time of the examination, the right seat was found separated/removed from the cabin. The left seat remained partially installed. Examination of on-scene recovery photographs indicated the same situation.



Figure 19 - Left Front Seat Harness



Figure 20 - Right Front Seat Harness

Damage to the front seats was consistent with both seats being occupied at the time of impact. The rear seat was essentially undamaged, consistent with it being unoccupied at the time of impact.

The front left seat was equipped with the Cessna reel-type secondary seat stop mechanism, and BAS brand aftermarket single point/dual strap shoulder harnesses. The left seat harness was unbuckled but intact. The right seat harness was buckled but cut, consistent with first responder passenger extraction efforts. The front lap belts were manufactured by AmSafe.

The forward portion of each of the four front seat rails was bent upward. The forward left seat locking pin was outside the rail, and bent forward. The inboard seat back bracket was separated at the hinge point. The outboard feet of the front right seat were partially deformed.

Seat Condition Information

Seat	Feet intact	Back intact	Base intact	Rail intact
Front Left	Yes	Yes	Yes	Partially
Front Right	Partially	Yes	Yes	Partially
Aft bench	Yes	Yes	Yes	Yes



Figure 21 - Rear Seat



Figure 22 - Front Seat Rails (Forward is frame right)



Figure 23 - Front Right Seat

E. ENGINE INFORMATION

1.0 General

The powerplant was a four cylinder, air cooled, direct drive, horizontally opposed, normally aspirated (carbureted), internal combustion engine rated at 150 hp at 2700 rpm.

Photographs provided by the recovery company depict the engine partially attached to the airframe at the accident site. The engine was not connected to the airframe at the post-recovery examination. All observed external damage was consistent with impact damage, and no evidence of any internal malfunctions or failures was observed.

The propeller remained attached to the crankshaft flange, which remained attached to the crankshaft/engine.

The propeller was removed to facilitate the examination. The top spark plugs were removed, examined and photographed. The vacuum pump was removed, and the crankshaft was rotated by hand through the drive pad utilizing a drive tool. The crankshaft was free and easy to rotate in both directions. "Thumb" compression was observed in proper order on all four cylinders. The complete valve train was observed to operate in proper order, and appeared to be free of any pre-mishap mechanical malfunction. Normal "lift action" was observed at each rocker assembly.

Clean, uncontaminated oil was observed at all four rockerbox areas. Mechanical continuity was established throughout the rotating group, valve train, and accessory section during hand rotation of the crankshaft.

The bottom spark plugs were removed, examined and photographed. The combustion chamber of each cylinder was examined through the spark plug holes utilizing a lighted borescope. The combustion chambers remained mechanically undamaged, and there was no evidence of foreign object ingestion or detonation. The valves were intact and undamaged. 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 consistent with normal operation. There was no oil residue observed in the exhaust system gas path.

There was significant ductile bending of the exhaust system components. The exhaust system and muffler were found free of obstructions.



Figure 24 - Engine Data Plate



Figure 25 - Engine Left Side

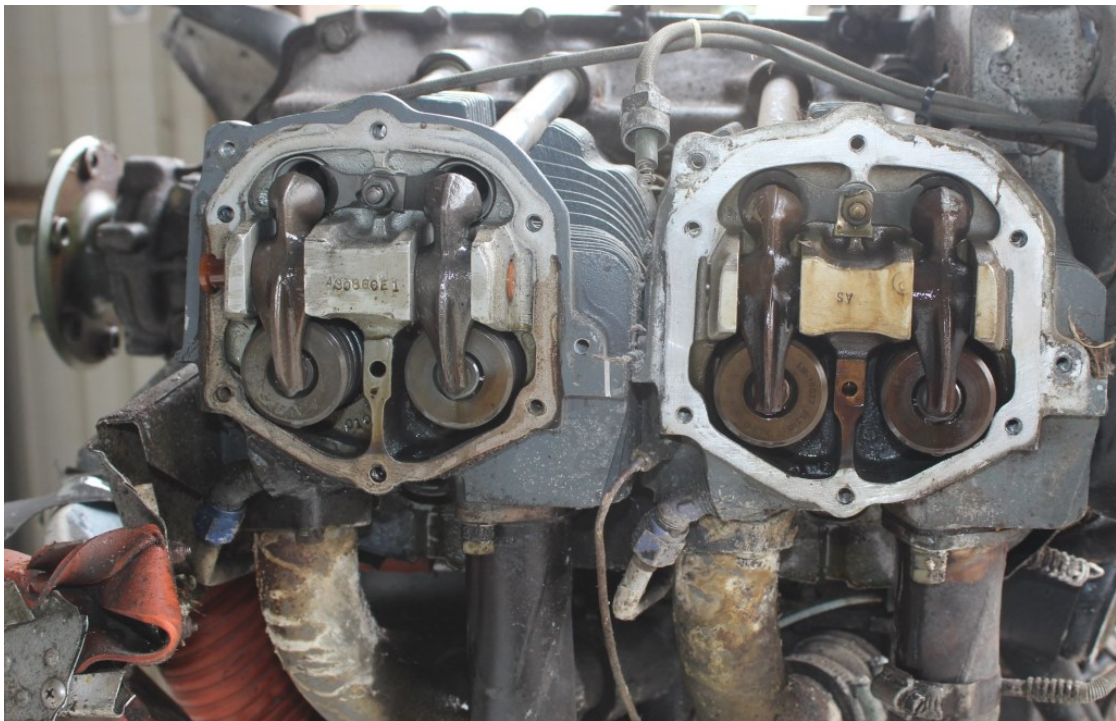


Figure 26 - Engine Left Side



Figure 27 - Engine Top/Front



Figure 28 - Engine Top



Figure 29 - Engine Right Side

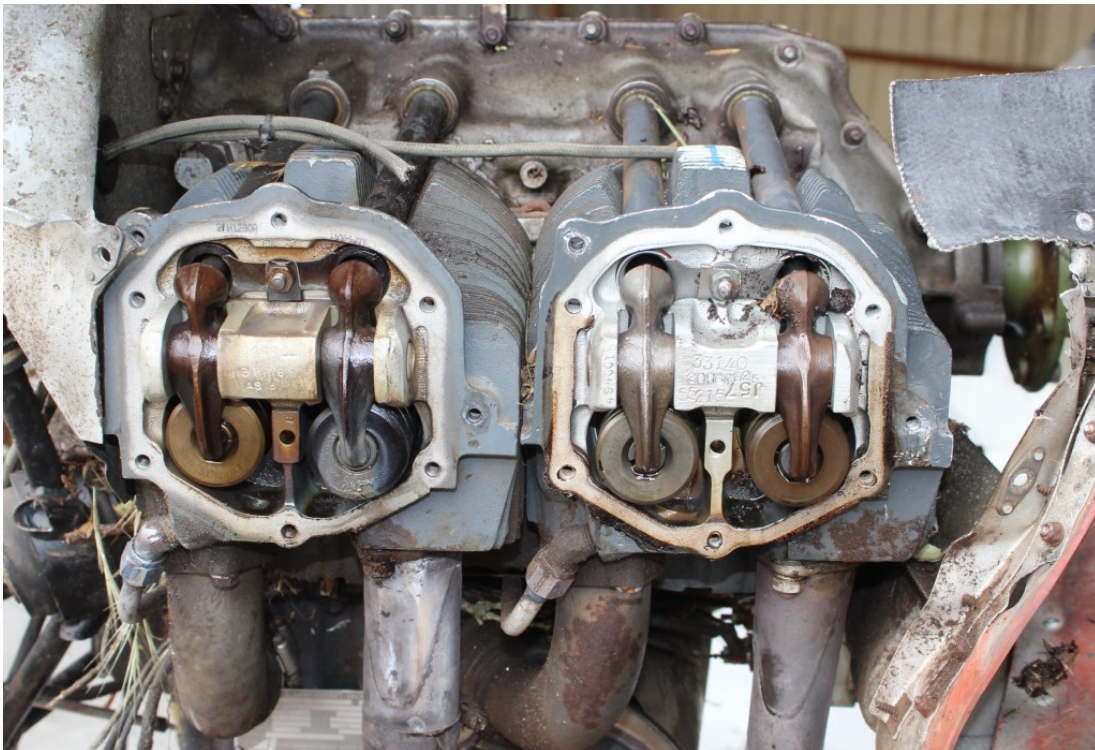


Figure 30 - Engine Right Side



Figure 31 - Engine Accessory (aft) End



Figure 32 -Exhaust Pipes and Muffler

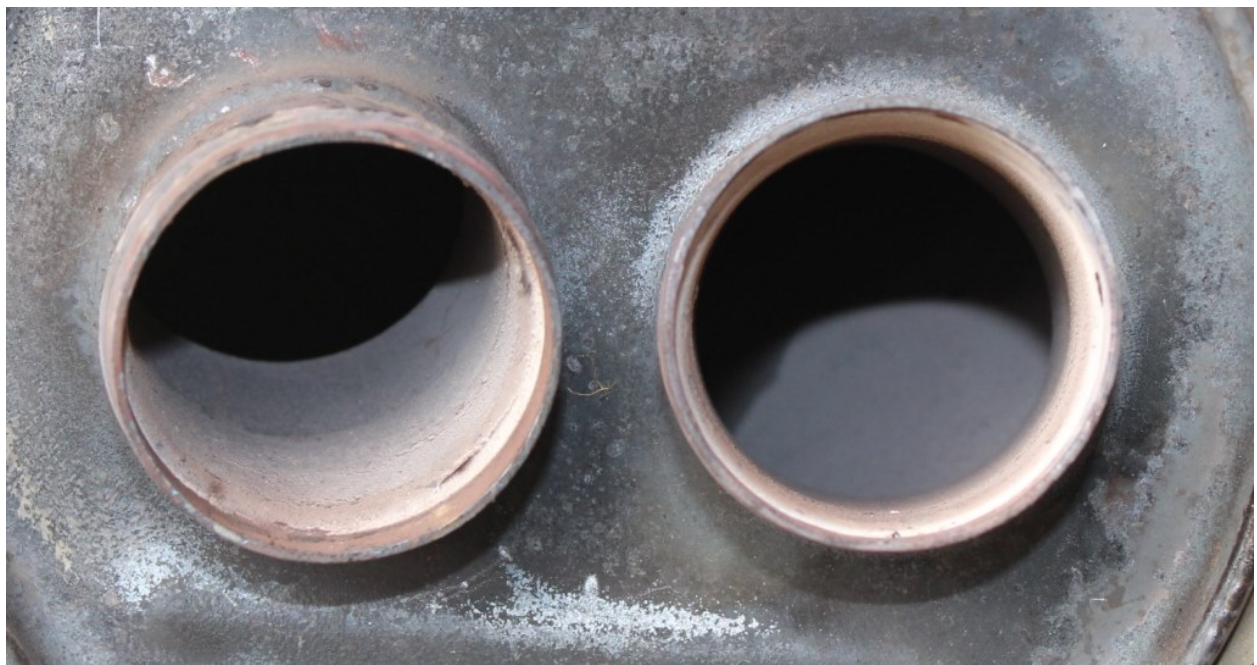


Figure 33 - Right Side Muffler Ports

2.0 Engine Instrumentation Indications

Hour meter: 4,167.6

Tach RPM: 0 Tach hours: 2,643.40

Manifold press: N/A

Oil press: 0 Oil temp: 0

EGT: 0 CHT: N/A

Fuel press: N/A Fuel flow: N/A

Ammeter: 0 Voltmeter: N/A

Engine Control Positions

ITEM	COCKPIT END	ENGINE END
Throttle:	Forward	Undetermined
Mixture:	Forward	Undetermined
Carburetor heat:	Off	Undetermined
Primer:	Locked	N/A
Propeller:	Not applicable – Fixed Pitch	
Cowl flaps:	Not installed	



Figure 34 - Hour Meter



Figure 35 - Tachometer



Figure 36 - Engine Controls

3.0 Engine Fuel System

No fuel was observed in any portion of the engine or its components.

The flexible AN hose that supplied fuel from the fuel strainer outlet to the carburetor inlet was found separated at both ends. The AN fitting at the carburetor was fractured. It was not determined

whether all separations were due to impact, or partially a result of rescue and/or recovery activities. There single primer line at the number 4 cylinder was secure at the cylinder fitting. The other end (near the lower right engine mount) was cut during airplane recovery.

The carburetor was undamaged and remained securely attached at the mounting flange. The throttle and mixture control cables were found securely attached at their respective control arms of the carburetor. The throttle, mixture and carburetor heat cables had been cut by recovery personnel, but were otherwise intact.

Carburetor

Manufacturer: Marvel Schebler

Model: MA-4SPA

Setting: 10-5009

Serial. No: BL 5 3648

Float Pontoons: Metal

The carburetor was opened for examination. The fuel bowl was free of visible contaminants. The float assembly remained secure at its mount and was free of damage. Neither the bowl nor the float pontoons exhibited any evidence of rubbing against one another. All internal locking tabs and safety devices of the carburetor were in place and properly secured. The fuel inlet screen was found properly installed and free of contamination. No external fuel staining was observed.

The carburetor and induction system were examined and observed to be free of obstruction. The airbox inlet and ducting were crushed and contaminated with vegetation & dirt debris consistent with impact. The foam filter element remained securely attached to the airbox bracket. The filter element remained intact and exhibited no evidence of pre-impact failure or obstruction to airflow.



Figure 37 - Carburetor



Figure 38 - Carburetor Data Plate



Figure 39 - Carburetor Fuel Inlet Screen

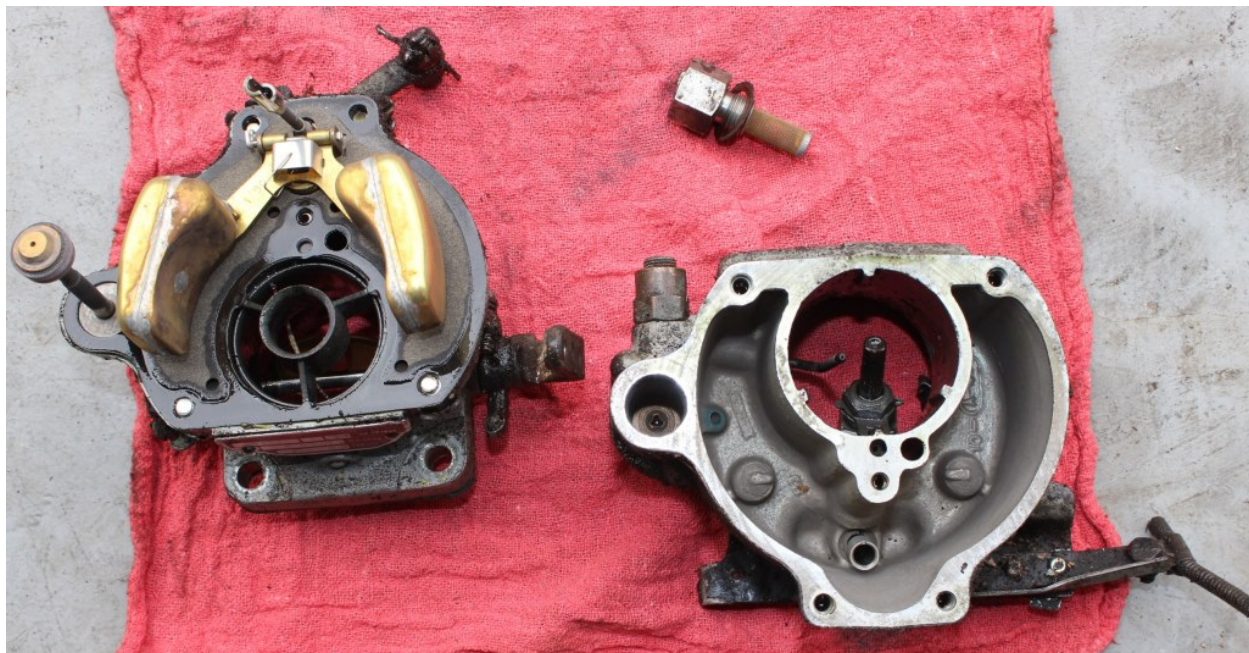


Figure 40 - Carburetor Bowl and Floats

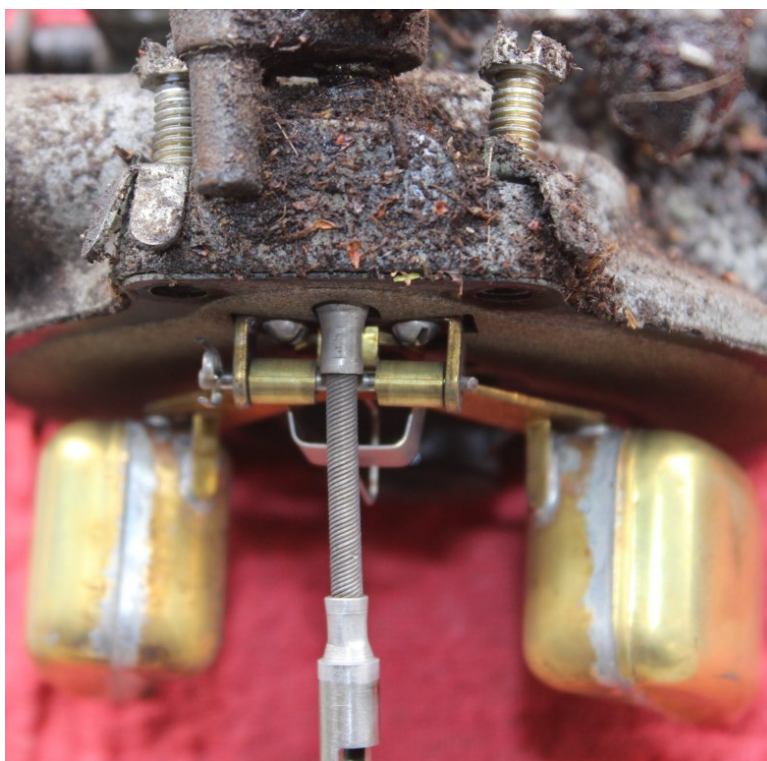


Figure 41 - Carburetor Mixture Shaft



Figure 42 - Air Intake and Filter Assembly



Figure 43 - Air Filter and Intake Assembly

4.0 Magnetos

☒ Left ☐ Dual Magneto ☐ Electronic ☐ Destroyed			
Manufacturer:: Slick	Model: 4371	P/N:	S/N: 03040012
Impulse Coupling? ☒ Yes ☐ No	Functioning? ☒ Yes ☐ No ☐ Unknown		
Timing Checked? ☒ Yes ☐ No	Results: 25° BTDC #1		
Drive Secure? ☒ Yes ☐ No ☐ Unknown	Sparks at all leads ☒ Yes ☐ No ☐ Unknown		
Damage: None			

Right Magneto ☐ Electronic ☐ Destroyed			
Manufacturer:: Slick	Model: 4370	P/N:	S/N: 03082108
Impulse Coupling? ☐ Yes ☒ No	Functioning? ☐ Yes ☐ No ☐ Unknown		
Timing Checked? ☒ Yes ☐ No	Results: 25° BTDC #1		
Drive Secure? ☒ Yes ☐ No ☐ Unknown	Sparks at all leads ☒ Yes ☐ No ☐ Unknown		
Damage: None			



Figure 44 - Magnetos

5.0 Spark Plugs & Ignition Leads

All spark plugs were secure in their respective positions, each with its respective ignition lead attached. The spark plugs were removed, examined, and photographed. The spark plug electrodes were mechanically undamaged. According to the Champion Spark Plugs “Check-A-Plug” chart AV-27, the spark plug electrodes displayed coloration consistent with normal

operation with some shaping consistent with the normal/worn condition. The static oil soaking of some of the spark plugs was attributed to the engine post-accident and post-recovery orientation.

Spark Plugs

Manufacturer: Champion		Type: REM-37E		SI 1042 Approved? ☒ Yes ☐ No	
Spark Plug Condition (per Champion Aviation Check-A-Plug Card AV-27)					
1 Top	Undamaged Electrode/Normal		1 Bottom	Undamaged Electrode/Normal	
2 Top	Undamaged Electrode/Normal		2 Bottom	Undamaged Electrode/Oil Soaked	
3 Top	Undamaged Electrode/Normal		3 Bottom	Undamaged Electrode/Normal	
4 Top	Undamaged Electrode/Normal		4 Bottom	Undamaged Electrode/Oil Soaked	

Except for one lead on the left magneto (which contained only the lead core), all ignition harness leads were attached to each magneto and respective spark plug. The ignition harness leads had sustained varying degrees of damage, consistent with impact. The harness was not tested.



Figure 45 - Top Spark Plugs



Figure 46 - Bottom Spark Plugs

6.0 Lubrication System

The oil suction screen was found secure and uncontaminated by any pre-mishap debris. The oil filter was secure at the mounting pad, and was not removed for examination. No evidence of any pre-impact lubrication system contamination or failures was observed.

Lubrication System:	
Oil Suction Screen: Clean	Oil Pressure Screen: N/A
Oil Filter: Undetermined	Oil Cooler Integrity: Destroyed By Impact
Oil Cooler Hoses: Destroyed By Impact	

F. PROPELLER INFORMATION

The two bladed fixed pitch propeller remained attached at the crankshaft flange. The spinner was attached to the propeller. The propeller blades remained attached to the propeller hub. The propeller blades displayed leading edge gouging, torsional twisting, chordwise striations across the cambered surface and trailing edge S- bending. The signatures were consistent with the propeller being driven by the engine at the time of impact.



Figure 47 - Propeller After Removal



Figure 48 - Propeller After Removal

G. OTHER DOCUMENTATION

Numerous pages of airplane documentation, and some GPS hardware, were recovered with the wreckage. These included the following item, and are addressed/documented in a separate report.

- Registration
- Appareo Stratus GPS
- Flight Logs
- Discrepancy Logs
- Fuel Slips
- Weight and Balance