

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety Western Pacific Region

AIRFRAME AND ENGINE EXAMINATION

WPR19LA063

Accident Date: January 13, 2019 Exam Date: September 24, 2019

This document contains 50 embedded images

A. ACCIDENT

Location:Hualapai Mountain Park, Hualapai, ArizonaDate:January 13, 2019Aircraft:Piper PA22-160, N9227D, Serial # 22-6287NTSB IIC:Michael Huhn

B. EXAMINATION PARTICIPANTS:

Thomas Dickerson Airworthiness Inspector FAA Scottsdale, AZ Mark Platt ASI Lycoming Engines Williamsport, PA

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C. SUMMARY

On 01/13/2019 about 1045 Mountain standard time, a 1958 Piper PA-22-160 Tri-Pacer was substantially damaged when it struck trees and terrain in Hualapai Mountain Park, about 10 miles south-southeast of Kingman Airport (IGM), Kingman, AZ. There was no fire. The noncertificated male pilot received serious injuries and his female passenger received fatal injuries.

The accident occurred during the US Government sequestration, and no NTSB, FAA, Piper, or Lycoming personnel responded to the accident site. On-site response was handled by Hualapai Mountain Park personnel and personnel from the Mohave County (AZ) Sheriffs Office. The wreckage was recovered by Air Transport personnel to their facility in Phoenix. According to the recovery specialist and available photographs, the aircraft came to rest inverted atop manzanita bushes in a ravine bordered by ponderosa pine. The recovery specialist reported that recovery personnel removed the wings during recovery but did not make any adjustments to the aircraft's controls, and did not otherwise move any parts of the aircraft.

On September 24, 2019, the wreckage was examined in detail at Air Transport by the abovelisted FAA, Lycoming, and Piper investigators. No evidence of preimpact mechanical malfunction was observed during the examination.

AIRFRAME EXAMINATION

1.0 Fuselage

The fuselage was generally intact but displayed crushing and deformation throughout its structure. The cabin roof was crushed and deformed downward, and the window frames were buckled. Some aft crushing deformation was noted adjacent to the firewall and door frame. The forward cabin door was impact-separated; it was buckled and deformed, and the window was shattered. The windscreens and windows were fractured and separated from their frames. The baggage door remained in its frame, and was jammed closed.

The left main landing gear was broken free from the bungee and displaced upward. The wheel assembly was impact separated and was not observed during examination. The right main landing gear was impact-separated from the bungee with some impact damage noted. The nose gear remained attached but was partially displaced aft, up, and left.

The belly of the aircraft appeared clean and was free of oil.

The two forward seats remained mounted to the cabin floor; each displayed some frame deformation. The lap belts for each forward seating position remained anchored to the cabin floor and were unbuckled. Two sets (1 set per seat) of 4-point style shoulder harnesses remained attached to the cabin ceiling. Neither set was latched to its respective lap belt. There were no aft seats installed at the time of examination, however two sets of seat belts remained attached to the cabin floor.

Some deformation was noted to the instrument panel. Radios and instruments remained mounted in the panel. The cockpit throttle control was set to idle, the mixture set to full rich Both the throttle and mixture knobs were jammed and could not be moved. The primer knob was in and locked. The carburetor heat knob was set to off. The magneto switch was set to both; however, the key was absent and not located.

Both control yokes remained attached to the control tee bar, and the aileron control chains were routed normally over the sprockets. The aileron control cables could be traced through to recovery cuts in the overhead cabin structure near the wing roots. The flap handle remained in place in the cabin floor and was positioned to flaps up. The flap control cables terminated in recovery cuts in the overhead cabin structure near the wing roots.

The elevator control cables remained attached to the control bellcrank; the control cables could be traced through the fuselage to their respective attachments on the elevator. The rudder pedal bar remained mounted to the cabin floor, and the rudder cables remained connected to the pedal bar ends. Rudder cable continuity could be traced through the fuselage to the rudder control horns.

The fuel selector remained undisturbed in its normal location in the left lower forward cabin wall. The handle was found positioned near the detent for the left tank. The fuel selector was removed and tested for blockage using light air pressure. No blockage was noted in either the left or right tank detent. Some impedance was noted when the selector was positioned to the setting

noted during initial examination, and a visual inspection of the valve port revealed that the port was about 40% occluded by this setting. The valve handle was difficult to move. The fuel lines were found to be securely attached to the valve. No fuel was noted in the fuel selector or adjacent lines, and no evidence of any fuel leaks was observed.



Figure 1 - Aft Right View



Figure 2 - Right Side



Figure 3 - Passenger Door and Front Seats



Figure 4 - Front Right View



Figure 5 - Front View



Figure 6 - Left Side



Figure 7 - Left Side Close-Up



Figure 8 - Shoulder Harnesses



Figure 9 - Instrument Panel



Figure 10 - Engine Controls



Figure 11 - Tachometer



Figure 12 - Under-Panel Flight Control Linkages



Figure 13 - Fuel Selector Valve Handle



Figure 14 - Fuel Selector Valve (in situ)



Figure 15 - Fuel Selector Valve and Left Tank Port

2.0 Left Wing

The left wing was cut from the fuselage at the wing root during recovery. Some deformation and buckling were noted throughout the wing skins and structure. An area of aft crushing and tearing was noted about 5 ft from the wing root, extending to the tip. The lift struts remained attached to the wing and displayed recovery cuts ≈ 12 inches from the fuselage attachment clevises.

The aileron remained attached to the wing at the hinges. The aileron cables remained attached to the aileron control horn and were routed through the wing to recovery cuts at the wing root. No damage was apparent to the aileron stops.

The flap remained attached to the wing and was extended beyond its normal range and lay roughly perpendicular to the wing's chord. Some buckling and distortion were noted along its inboard end. The flap control cable remained attached to the flap control bracket and terminated in a recovery cut near the wing root.

The fuel tank remained in place in the inboard wing section. The tank displayed some buckling and denting. The fuel filler cap was absent, the filler neck showed no obvious damage, and the wing skin covering the tank showed no marks consistent with contact with a fuel cap. When a donor fuel cap was installed, it locked into place within the filler neck. No fuel was observed within the tank.



Figure 16 - Left (foreground) and Right (background) Wings



Figure 17 - Left Wing



Figure 18 - Left Wing Skin and Fuel Port

3.0 Right Wing

The right wing was cut from the fuselage at the wing root during recovery. The wing was accordion-crushed spanwise from the tip inboard, reducing it to about half of its original span. The lift struts remained attached to the wing; the forward lift strut was impact separated at the fuselage attachment clevis, and the aft displayed a recovery cut ≈ 12 inches from the fuselage attachment clevis.

The aileron remained attached to the wing at the hinges. It was accordion-crushed along its span. The aileron cables remained attached to the aileron control horn and were routed through the wing to recovery cuts at the wing root. No damage was apparent to the aileron stops.

The flap remained attached to the wing and was in the retracted position. Some buckling was noted adjacent to its inboard attach bracket. The flap control cable remained attached to the flap control bracket and terminated in a recovery cut near the wing root.

The fuel tank remained in place in inboard wing section; it was crushed and deformed. The fuel filler cap was absent and the filler neck showed no obvious damage. The wing skin covering the tank partially overrode the filler neck but showed no marks consistent with contact with a fuel cap. When a donor fuel cap was installed, it locked into place within the filler neck. No fuel was observed within the tank.



Figure 19 - Right Wing



Figure 20 - Right Wing Skin and Fuel Port Cutout



Figure 21 - Right Wing Fuel Tank



Figure 22 - Underside of Right Wing Skin with Fuel Port Cutout



Figure 23 - Right Fuel Tank Port

4.0 Empennage

The aft fuselage/tailcone section remained attached to the cabin section and displayed some wrinkling and deformation. The underside appeared clean and was free of oil. The TSO C91 ELT (121.5 MHz) had been removed from its tray and disconnected from its antenna during the recovery of the aircraft; it was found switched to OFF during this examination. When or by whom the ELT was switched OFF was not able to be determined.

The vertical stabilizer was crushed downward. The rudder remained attached to the vertical stabilizer and was deformed downward and to the left. The rudder cables remained attached to the rudder control horn, with continuity established through to the rudder pedals. The rudder control stops appeared undamaged.

The left horizontal stabilizer and left elevator were twisted and crushed forward. The right horizontal stabilizer was crushed inboard to the empennage. The right elevator was impact separated and crushed. The elevator control cables remained attached to the elevator control horn and continuity could be traced to the forward control bellcrank. The pitch trim barrel appeared undamaged; 8 threads were exposed on the top of the trim screw, correlating to neutral pitch trim.



Figure 24 - ELT



Figure 25 - Right Aft Fuselage and Empennage



Figure 26 - Left Aft Fuselage and Empennage



Figure 27 - Pitch Trim Pulley and Barrel

D. ENGINE EXAMINATION

1.0 General

Engine:	Engine Information		
	Experimental Engine 🗌 Yes 🖾 No		
Model Number:	O-320-B2A		
Serial Number:	L-1298-39		
Total Time:	unk Hours Since Field O/H		
Crankshaft S/N:	unk		

The powerplant is a four-cylinder, air cooled, direct drive, horizontally opposed, normally aspirated (carburetor), internal combustion engine rated at 160hp @ 2700rpm.

The engine remained attached to the airframe by the engine mount. The subject engine had been pushed aft which deformed the firewall where the engine mount attaches. The nose gear structure was bent aft. The engine had sustained impact damage at the forward bottom area of the engine that separated the airbox and carburetor bowl. Visual examination of the engine revealed no evidence of pre-impact catastrophic mechanical malfunction or fire.

The propeller was removed to facilitate the examination. The top spark plugs were removed, examined and photographed. The crankshaft was rotated by hand at the flange. 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. The exhaust system and mufflers were found free of obstructions.

There was no evidence of pre-impact mechanical malfunctions observed during the examination of the engine.



Figure 28 - Engine Right Side



Figure 29 - Engine Right Side (valve covers removed)



Figure 30 - Engine Front Lower Left



Figure 31 - Engine Top Left



Figure 32 - Engine Lower Left



Figure 33 - Left Cylinders (valve covers removed)



Figure 34 - Left Side Exhaust Piping



Figure 35 - Right Side Exhaust Piping

2.0 Fuel System

Fuel System 🗌 Injection 🛛 Carburetor 🗌 Electronic 🗌 Destroyed					
Manufacturer: M	larvel Schebler		Model: N	/IA-4SPA	Setting: 10-3678-12
Serial. No: 4003	3432	Floats:	🔀 Metal	Composite	Plastic N/A
Fuel Screens	Carburetor/Injector	nlet: 🛛 🖂	Clean	Contaminated	Destroyed Unknown
	Aircraft Main Fuel Stra	iner: 🛛 🖂	Clean	Contaminated [Destroyed Unknown

The carburetor bowl was fracture-separated from the carburetor base, and the portion that remained attached at the mounting pad was secure. The fracture surface signatures were consistent with overload. The throttle/mixture controls were found securely attached at their respective control arms of the carburetor. The castellated nut and cotter pin remained secure and the serrated interface at the throttle arm remained securely mated. Control continuity to the cockpit was established. All engine compartment fuel lines were found to be secure at their respective fittings.

The impact-damaged float assembly remained secure at the mounting. The float pontoons exhibited no evidence of rubbing against the wall of the bowl. 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 foam filter element remained securely attached to the airbox bracket. The filter element remained intact and exhibited no evidence of pre-impact obstruction to airflow.

The fuel system utilizes gravity fed fuel; there is no engine driven fuel pump.



Figure 36 - Displaced Carburetor Bowl and Airbox



Figure 37 - Separated Carburetor Bowl and Airbox



Figure 38 - Carburetor Fuel Inlet Screen



Figure 39 - Fuel Strainer Bowl



Figure 40 - Fuel Strainer Screen



Figure 41 - Engine Air Intake Filter

3.0 Magnetos/Ignition

Left Dual Magneto Electronic Destroyed				
Manufacturer: Bendix	Model: S	54LN-21	P/N: 10-51360-30	S/N: 568465
Impulse Coupling? Xes No	Impulse Coupling? Xes No Functioning? Yes No Unknown			known
Timing Checked? Yes No R	esults:			
Drive Secure? Xes No Un	Drive Secure? Xes No Unknown Sparks at all leads Xes No Unknown			
Damage: Secure at pad, undamaged				
Right Magneto 🗌 Electronic 🗌 D	estroyed			
Manufacturer: Bendix	Model: S	54LN-20	P/N: 10-51360-29	S/N: 564827
Impulse Coupling? 🗌 Yes 🛛 No		Functioning?	/ 🗌 Yes 🗌 No 🗌 Unk	known
Timing Checked? Yes No Results:				
Drive Secure? Xes No Un	known	Sparl	ks at all leads 🛛 Yes 🗌 I	No 🗌 Unknown
Damage: Secure at pad, undamaged				

The left and right magnetos remained securely clamped at their respective mounting pads. The ignition harness was secure at each magneto terminal and each respective spark plug. Magneto to engine timing could not be ascertained, due to the destruction of the flywheel. The magnetos were removed for examination. Each magneto produced spark at the end of the respective spark plug lead, during hand rotation of the drive. The drives of each magneto remained intact and undamaged.



Figure 42 - Magnetos



Figure 43 - Magnetos

4.0 Spark Plugs

Spark Plugs

	3~		
Manufactur	er: See Below Type: SR-85		SI 1042 Approved? Xes No
	Spark Plug Condition (per Champio	n Aviation Cl	neck-A-Plug Card AV-27)
1 Top	Undamaged Electrode/Oil Soaked	1 Bottom	Undamaged Electrode/Oil Soaked
2 Top	Undamaged Electrode/Normal	2 Bottom	Undamaged Electrode/Normal
3 Top	Undamaged Electrode/Oil Soaked	3 Bottom	Undamaged Electrode/Oil Soaked
4 Top	Undamaged Electrode/Normal	4 Bottom	Undamaged Electrode/Normal
5 Top		5 Bottom	
6 Top		6 Bottom	
7 Тор		7 Bottom	
8 Top		8 Bottom	

The Auburn brand spark plugs were secure at each position with their respective spark plug lead attached. The spark plugs were removed, examined and photographed. The spark plugs electrodes remained mechanically undamaged and according to the Champion Spark Plugs "Check-A-Plug" chart AV-27, the spark plug electrodes displayed coloration consistent with normal operation. The static oil soaking of the spark plugs (as noted) was attributed to the engine positioning at the mishap site and post recovery.



Figure 44 - Top Spark Plugs



Figure 45 - Bottom Spark Plugs

5.0 Engine Miscellaneous

Starter:	
Manufacturer: Prestolite	Destroyed Unknown N/A
Part No: MZ-4204	Serial No.: 5E000091

The starter was securely attached at the mounting pad, with the electrical connection secure at the post.

Generator:			
Manufacturer: Delco-Remy	Destroyed Unknown N/A		
Part No: 101900	Serial No.: A8705		

The generator was securely attached at the mounting pad, with the electrical connections secure at each post.

Vacuum Pump:	
Manufacturer: Pesco Products	Destroyed Unknown N/A
Part No: 3P194F	Serial No.: PF 09226F DG

The rear-mounted vacuum pump was secure at the mounting pad. The vacuum pump was not removed for examination.

Lubrication System:

Oil Suction Screen: Clean	Oil Pressure Screen: Clean
Oil Filter: N/A	

The oil suction and pressure screen were found secure and uncontaminated by any pre-impact debris.



Figure 46 - Oil Pressure Screen Housing, Oil Pressure Screen, Oil Pickup Screen (left to right)

E. PROPELLER EXAMINATION

The propeller remained mounted to the crankshaft. The spinner remained attached to the propeller backing plate and was crushed aft, with no circumferential scoring noted. The backing plate/engine mounting flange was fractured. One propeller blade was straight, with no chordwise scraping or leading edge damage noted. The other propeller blade was bent slightly aft, displayed no obvious leading edge damage, and showed a series of spanwise scrapes.



Figure 47 - Undamaged Propeller Blade



Figure 48 - Damaged Propeller Blade



Figure 49 - Propeller Flange and Starter Ring Gear



Figure 50 - Propeller, Spinner, and Mounting Components