

# NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety Western Pacific Region

# **AIRFRAME EXAMINATION**

# WPR19FA115

This document contains 23 embedded photos.

# A. ACCIDENT

Location:	Fullerton, California
Date:	April 18, 2019.
Aircraft:	Beech B60, N65MY, SN P-314
NTSB IIC:	Eliott Simpson

# **B. EXAMINATION PARTICIPANTS:**

Eliott Simpson National Transportation Safety Board Mark Platt Lycoming Engines

Peter Basile Textron Aviation

### C. SUMMARY

Examination of the airplane was conducted at the accident site on April 19, 2019, with a follow up examination performed at Chino Airport, on April 20 and 21. The trim actuators were set to values appropriate for takeoff, the flaps appeared to be set to 10°, and the landing gear actuator indicated that the gear was in the extended position.

# D. DETAILS OF THE INVESTIGATION

# 1.0 Airframe Examination

Fuselage

The pressurized section of the main cabin sustained extensive thermal damage (Photo 1). The outer skins on the right side had been consumed, and the skins on the left side were extensively charred. The landing gear switch was in the down position, and its knob had melted. All windows on the right side of the cabin along with the right windshield were consumed by fire. The left windshield was partially consumed, and all windows on the left side of the cabin were melted and crazed.

The cockpit instruments and circuit breakers were all fire damaged, precluding an accurate assessment of their readings and positions, and the lower left section of the panel along with the left control yoke was detached and folded down into the foot well (Photo 2). The throttle and propeller engine controls were all in the full forward position, the right engine mixture control was in the full forward position, the left control was about 1.5 inches aft of full forward (Photo 2). At the accident site, the left fuel selector handle was in the ON position and the right handle was in the "CROSSFEED" position, however the right handle felt loose and did not appear to be connected to its control cable. Further examination of the right fuel selector handle revealed the fuel selector cable had been pulled from the handle assembly. A flight control lock (Photo 3) was found resting in the aft cabin, against the carpeted back face of the main wing spar. The lock did not appear to have sustained any damage, and its chain was found wrapped around the locking pins. Subsequent examination revealed that this was not the control lock for the accident airplane type. The needle for the pitch trim indicator was at the edge of the green scale, corresponding to about the 5 ° nose-up position.

The entire tail structure aft of the pressure bulkhead was consumed, with only ash remnants of vertical and horizontal stabilizer and flight controls remaining on the ground (Photo 4).

The pilot seat had separated from the airframe, and the seat back had detached from the base. The three seat rails remained attached to the airframe structure. The rails were intact, and the aft seat stop was in place on the center rail, and the forward seat stop was in place on the right rail (Photo 5). The seat base frame and rail assemblies were still attached, and the rollers were in place. The center slide locking mechanism was functional, and its left securing tab had bent out slightly (Photo 6).

The landing gear actuator was in a position that corresponded to the landing gear being fully extended (Photo 7). The roll servo remained attached to the lower airframe structure, its bridle

cable was still attached to both the capstan wheel and the aileron carry-through control cable, and appeared to be centered in relation to both bridle clamps. There were no tools or foreign objects present in the box area enclosing the aileron pulleys and servo.

The nose and landing gear assembly sustained extensive crush damage through to the forward pressure bulkhead. The nose gear was in the extended position. The cabin heater remained attached to the forward bulkhead, and did not exhibit any indication of fire or thermal damage.

#### Rudder

The rudder cables remained attached at the bellcrank at the base of the rudder torque tube, and were continuous through to the foot pedals in the cabin. The bellcrank was against the left rudder stop, and the base of the torque tube was crushed but remained attached to the bellcrank. The rudder cables remained attached to the yaw servo via the bridle cables.

The rudder trim cables remained attached to their chain which was found wound around the trim sprocket. The rudder trim actuator displayed 3.35 inches of extension which corresponded to neutral rudder trim. The trim cables were continuous through to the aft cabin bulkhead.

# Elevators

The aft elevator bellcrank was partially consumed, resulting in the separation of elevator control cables at their attachment fittings, and the detachment of the right and left elevator push-pull tube. The elevator cables were continuous from the bellcrank through to the cabin controls. The right elevator control arm remained connected to its torque tube and the bellcrank push-pull tube. The left elevator torque tube was intact, but its arm had completely melted. The elevator down springs remained attached at the top of the frame assembly, and had detached from the melted lower section of the airframe. The autopilot pitch servo remained connected via its bridle cables to the elevator cables.

The elevator trim cables where continuous from the aft pressure bulkhead through to the tail area adjacent to where they transitioned left to the trim actuator. The electric trim servo assembly remained attached to the trim cables. The cables had both separated in the transition area, beyond which they were attached to the trim tab actuator. The actuator exhibited 4.5 inches of extension, which was consistent with a 5 ° tab down position. The trim tab range was 30 ° down and 10 ° up.

# **Right Wing**

Most of the right wing structure was consumed from the tip to the root, exposing the landing gear actuators, engine control cables, and fuel selector valve (Photos 1,4). Flap remnants were still attached to the rear spar; the flap actuator was partially consumed, which prevented an accurate assessment of its extension. The fuel tank was consumed.

The aileron cables were continuous from the outboard bellcrank assembly through to the cabin controls. The bellcrank-to-aileron pushrod had melted, but it's fitting was still attached to the remnants of the aileron control arm and an inboard section of the aileron. The outboard section of the aileron, about 4 ft in length, was located just aft of the wing.

The engine remained partially attached to the remnants of the forward spar. The fuel selector valve was charred, and still connected to its actuation cable. Melted plastic was observed within the valve when viewed through the fuel inlet port, and disassembly revealed that the valve was in the, "ON" position (Photo 8).

# Left Wing

The left wing remained attached to the fuselage, the main spar was intact along its full length, and the aft spar and trailing skins were mostly consumed by fire (Photo 1,4). The fuel cap was intact and in place at the filler neck, and remnants of the fuel tank bladder were exposed. The engine remained partially attached to the forward spar. The flap remained attached to the aft spar, and its actuator displayed 3.3 inches of extension, which corresponded with the flaps set to about 10  $^{\circ}$ .

The leading edge of the aileron remained attached to the remnants of the aft wing spar. The aileron bellcrank was twisted and fragmented into multiple pieces, and the aileron drive cable had broken away with the arm of the bellcrank. The carry through cable was attached to the aft portion of the bellcrank, and the bellcrank-to-aileron pushrod was continuous between the bellcrank and aileron remnants. The aileron cables were continuous from the outboard bellcrank assembly through to the cabin controls.

The aileron trim actuator exhibited 1.65 inches of extension (Photo 9), which corresponded to 1  $^{\circ}$  tab up. The tab range was 11.5  $^{\circ}$  up and 11.5  $^{\circ}$  down.

The fuel selector valve was charred, and still connected to its actuation cable. Disassembly revealed that the valve was in the, "ON" position (Photo 10).

# 2.0 Engine Examinations

# Left Engine

The engine appeared generally intact, and had sustained thermal damage to the accessory area. The exhaust outlet pipe was crushed, and had detached from the turbocharger housing. The alternator and intercooler, which were crushed, had separated from their attach points, and were dangling from the underside of the engine. (Photo 11)

The top and bottom spark plugs were removed. All were of the fine wire type, and did not exhibit any evidence of catastrophic failure. The plugs exhibited normal wear signatures when compared to the Champion AV-27 Check-A-Plug chart. The top and bottom plug electrode and insulator faces for cylinder No 4 were coated in light grey soot. All remaining plugs exhibited black

colored sooting to their combustion-exposed surfaces (Photo 12, 13). The top plug heat range was 36, the heat range for all remaining plugs was 32.

All fuel and oil lines were intact at their respective fittings, and all the interconnection linkages for the fuel injection and turbocharging system were intact. The oil sump contained oil, and the oil filter and sump screen was free of debris.

The propeller governor exhibited impact damage, and remained attached to the engine. The governor, throttle and mixture control cables were all still attached to their respective control arms. The entire propeller hub assembly had detached from the engine crankshaft at the bolted joint of the propeller hub extension.

The lower right bolt of the turbocharger ladder assembly had fractured, and the lower left bolt was loose. The turbo impeller and compressor wheels remained interconnected, could be rotated freely, and neither exhibited any evidence of damage. The plastic valve head of the absolute pressure release valve had melted, and was located resting against the spring of the absolute pressure relief controller within the assembly lock manifold (Photo 20), remnants of the head remained around the valve seat.

The hose connecting the absolute pressure relief valve to the intercooler inlet elbow was intact. Its forward clamp remained firmly in place, however the aft clamp appeared to be of a different type and had detached (Photo 14). The threaded portion of the clamp appeared undamaged, and the nut was not located (Photo 15). Removal of the tube revealed that its forward clamping surface was bright orange in color and pliable (Photo 15,16). The inner surface of the aft end was dark in color and frayed (Photo 16). The forward side of the intercooler elbow exhibited rubbing marks consistent with contact with the turbocharger assembly (Photo 17), the elbow had not been breached.

Removal of the induction tubes revealed the fuel injector air bleed bodies and fuel injection nozzles, all of which were intact and firmly attached to the induction housing. All induction tube O-rings were intact and pliable, and the injectors and the fuel channels within the housing were clear. The fuel diaphragm cover was removed, and its inner surfaces exhibited white corrosion-like deposits. The diaphragm was pliable and free of cracks. Droplets of fluid were observed during diaphragm disassembly, along with the odor of aviation gasoline.

The left magneto had sustained thermal damage, melting its inner components. The right magneto was intact. Removal of its cap revealed that the insulation of the points wire had melted; no sparks were observed at the ignition leads when the magneto was turned by hand.

The engine driven fuel pump and tach generator were removed and examined. The fuel pump input drive was intact, and could be rotated by hand. The inlet fuel screen was free of debris.

The engine was then examined through the spark plug bores utilizing a borescope. There was no evidence of catastrophic internal failure, and all piston crowns and combustion surfaces were coated in grey and brown deposits.

The engine was rotated by hand at the accessory spline drive. Drivetrain continuity was confirmed throughout, "thumb" compression was present at all cylinders, and all valves and rocker arms moved by equal amounts.

### **Right Engine**

The engine sustained impact damage to the front right side, liberating the No 2 cylinder rocker assembly and pushrods, and the inlet rocker assembly of cylinder No 4. The No 4 intake valve spring had become impinged against a broken section of the cylinder casing (Photo 18). The accessory area exhibited thermal damage, and the exhaust outlet pipe was crushed, and had detached from the turbocharger housing.

All the interconnection linkages for the fuel injection and turbocharging system were intact, and all fuel and oil lines were intact at their respective fittings. The oil sump had fragmented, exposing the sump screen which was free of debris. The oil filter exhibited thermal damage, and upon removal and inspection, the paper element appeared charred, but did not display any evidence of debris.

The governor exhibited impact damage, and remained attached to the engine. The governor, throttle and mixture control cables were all still attached to their respective control arms. The entire propeller hub assembly had detached from the engine crankshaft at the bolted joint of the propeller hub extension.

The turbocharger ladder assembly had displaced upwards, and had partially pulled away from the accessory case. The turbo impeller and compressor wheels remained interconnected, and could be rotated freely. The compressor wheel was undamaged, and the impeller wheel sustained damage to its tips, opposite the direction of travel (Photo 19).

The hose connecting the absolute pressure relive valve to the intercooler inlet elbow was intact and clamped securely at its forward and aft joints. Both clamps were secured to each other with safety wire (Photo 21).

Removal of the induction tubes revealed the fuel injector air bleed bodies and fuel injection nozzles, all of which were intact and firmly attached to the induction housing. All induction tube O-rings were intact and pliable, and the injectors and the fuel channels within the housing were clear. The fuel diaphragm cover was removed, and its inner surfaces were free of corrosion and the diaphragm was pliable and free of cracks.

The engine was then examined through the spark plug bores utilizing a borescope. There was no evidence of catastrophic internal failure, and all piston crowns and combustion surfaces were coated in grey and brown deposits.

The engine driven fuel pump and tach generator were removed and examined. The fuel pump input drive was intact, and could be rotated by hand. The inlet fuel screen was free of debris.

The top and bottom spark plugs were removed. All were of the fine wire type, and did not exhibit any evidence of catastrophic failure. The electrodes and insulators for plugs No 1, 2, 4, 5 and 6 were coated in light tan deposits (Photo 22). Similar coloration was observed on the bottom plugs for No 2, 4, 5, and 6 cylinders (Photo 23). Plug No 1 was coated in oil, and plug No 3 exhibited dark sooting. All plugs had a heat range of 32, and all exhibited normal wear signatures when compared to the Champion AV-27 Check-A-Plug chart.

The engine was rotated by hand at the propeller hub. Drivetrain continuity was confirmed throughout, and "thumb" compression was present at the undamaged cylinders No 1, 3, and 5. Due to impact damage, "thumb" compression could not be attained for cylinders No 2, 4, and 6, however, the remaining pushrods could be seen to move, and the camshaft when viewed through the broken sump case appeared intact.

The left magneto had sustained thermal damage, melting its inner components. The right had displaced from the accessory case, appeared intact, and produced sparks at its output leads when rotated by hand.

#### 3.0 Examination Photos



Photo 1 – Airplane at the Accident Site



Photo 2 – Instrument Panel



Photo 3 – Control Lock



Photo 4 - Tail Section at Accident Site



Photo 5 – Pilot Seat Rails and Locks



Photo 6 – Pilot Seat Adjustment Pin



Photo 7 – Landing Gear Actuator



Photo 8 – Left Fuel Selector Valve



Photo 9 – Aileron Trim Actuator



Photo 10 - Right Fuel Selector Valve



Photo 11 – Left Engine



Photo 12 – Left Engine Bottom Spark Plugs



Photo 13 – Left Engine Top Spark Plugs



Photo 14 - Left Engine Absolute Pressure Relief Valve-to-Intercooler Elbow Hose and Clamps



Photo 15 – Aft Clamp on Left Engine Intercooler Elbow Hose



Photo 16 - Absolute Pressure Relief Valve-to-Intercooler Elbow Hose



Photo 17 – Intercooler Elbow



Photo 18 – Right Side of Right Engine



Photo 19 - Right Turbocharger Impeller Wheel



Photo 20 - Left Engine Pressure Relief Valve Head



Photo 21 - Right Engine Absolute Pressure Relief Valve-to-Intercooler Elbow Hose and Clamps



Photo 22 – Right Engine Top Spark Plugs



Photo 23 - Right Engine Bottom Spark Plugs

Submitted by: Eliott Simpson