



MEMORANDUM FOR RECORD

Stephen Stein
Air Safety Investigator
National Transportation Safety Board
Office of Aviation Safety – Western Pacific Region

NTSB Accident Number: WPR17LA042
Aircraft Registration & Make/Model: N602L; Air Tractor AT-602
Accident Location: Willows, California
Accident Date: December 27, 2016

Note: The following interview was documented by the Investigator –In-Charge (IIC), Stephen Stein.

Interview #1 Summary

Brian Allen
Aviation Safety Inspector, Federal Aviation Administration

Interview Date & Time; December 29, 2016; 1142 PT

Mr. Allen reported that he conducted a cursory inspection of the airplane and discovered that the rudder and left wing spar were substantially damaged. The inspector confirmed flight control continuity for the primary flight control surfaces and the propeller, throttle and mixture control cables. An examination of the fuel from the header tank did not show any water contamination and an inspection of the airframe filter on the left hand main tank did not show any debris. The airframe fuel bowl was clear and free of contamination and each of the airplane's fuel lines were intact.



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Note: The following electronic mail records were documented by the Investigator –In-Charge (IIC), Stephen Stein.

Interview #1 Summary

Marc Gratton
Air Safety Investigator, Pratt & Whitney Engines

Interview Date & Time; October 5, 2017; 1309 PT

On the date referenced above, the engine manufacturer submitted their responses to the NTSB's questions, which have been summarized below.

- 1) If regular interval power assurance checks are required by the manufacturer
- 2) If the PT6A-34A model engine is equipped with a bleed valve seat similar to the engine on the accident airplane
- 3) The pilot's report of a "pop" sound and its relation to a compressor surge
- 4) A written description of the fuel heater test

The responses below are a summation of the engine manufacturer's answers.

According to Mr. Gratton, the engine maintenance manual recommends engine performance checks at regular intervals and after any major work. However, the manufacturer does not have a regular inspection interval for engine performance checks in the periodic inspection charts.

The manufacturer's smaller PT6 engines, such as the PT6A-34A, have a metering orifice in the P3 air inlet of the bleed valve instead of the calibrated seat found on the bleed valve of the PT6A-65AG engine.

The engine manufacturer's representative stated that the "pop" sound is indicative of an engine surge. In a later e-mail, dated October 17, 2017, the representative stated that the compressor assembly is too efficient at low speeds and draws more air than turbines can handle, which leads to compressor stalls. This is the reason the manufacturer designed the engine with a bleed valve, which opens at low speeds to bleed excess air and prevent a stall. An improper bleed valve setting may cause prevent the valve from closing correctly, which can lead to surges.

In this case, a missing valve seat will cause the engine to not accelerate as expected, feel sluggish, and the Ng temperature and fuel flow will be higher. As the valve seat was missing, the valve could not sit square on the gas generator case, which would have led to additional leaks. Further, the piston had traveled beyond its normal closing point allowing the piston ring to pop out. The bleed valve open and close points are not predictable with the air leak, which may have led to the characteristic "pop" sound following by a compressor stall.

The fuel to oil heat exchanger was tested for core matrix internal leakage by connecting air pressure to the fuel inlet port and monitoring the oil inlet and outlet ports for leaks. The unit was submerged in cold water and the air was turned on. The fuel outlet port exhibited fuel vapors, which indicated that the fuel side of the matrix was pressurized. The oil inlet and outlet ports were monitored for one minute and no leaks were observed. A second test was performed to observe the condition of the thermal element, which was installed in the test fixture and submerged in a water bath at 70° F for 5 minutes. A Vernier was used to measure the travel of the thermal element, which measured 0.00 inches. The assembly was removed from the cold water bath and placed in a 90° F warm water bath for 15 minutes. The measurement showed the travel did not meet the manufacturer's minimum requirement, 0.16 inches, indicating that the thermal element was worn.

Interview #2 Summary

Marc Gratton

Air Safety Investigator, Pratt & Whitney Engines

Interview Date & Time; November 9, 2017; 0610 PT

Mr. Gratton reported that if the bleed valve is full open the engine will not likely reach full power and if the valve is partially open the engine will be temperature limited before reached full power depending on how far open the valve is. The power influence is connected to the amount of air loss through the valve. In this case, the air loss was likely significant since the valve piston could not fully close.

In a subsequent e-mail, dated November 13, 2017, Mr. Gratton reported that the pilot was not likely to achieve only some further power demand because the piston was likely towards the closed position, but with the absence of the valve seat the piston was able to sink further into the gas generator case, which led to a further loss of P3 air. He further added that the engine would have been slower to accelerate as well.



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Interview #1 Summary

Peter Dabaghian
Director of Maintenance, Grower's Air Service

Interview Date & Time; January 13, 2017; 1102 PT

Mr. Dabaghian stated that his company employs two office employees, four pilots and three field supervisors. The company's service facility is primarily used to service their own airplane, but started performing outside maintenance because they did not have enough internally to support the staff. The maintenance shop employs three airframe and powerplant mechanics and technicians to assist in disassembly and clean. The Director of Maintenance (DOM) stated that he is the only mechanic with inspection authorization in the facility and must sign all the work off. According to the DOM, their shop services Pratt & Whitney model, PT6-34, -34AGs, -20s, -55AGs, one 60AG, and two -65AGs. They have only been servicing PT6A-65AG engines for the past two years.

During a normal workday, their unskilled labor employees will remove panels and clean the airplane with the exception of the engine bay. Further, the unskilled employees will examine the airplane for corrosion. The DOM will research airworthiness directives for the airplane and review squawks. On the accident airplane, his regular mechanic, David Clarke, did most of the

engine work. The DOM removed the old bleed air valve, but did not installed the overhauled unit. At the time of the inspection they had maintenance manual version 3032842, which had been revised on March 7, 2016 and was current at the time of the inspection. During the inspection, the DOM encountered some difficulty accessing manuals on the engine manufacturer's website.

After the service was completed, an engine run was performed on December 21, 2016. The DOM stated that the engine would have been run-up to cruise power for prop balancing, but they do not have a record that show what power setting the engine was run-up to.

The DOM stated that he was not aware there was a valve seat that had to be removed and installed on the overhauled bleed valve. They sent the old bleed valve away without knowing the seat had to be removed. He added that Mr. Clarke and himself aren't familiar enough with this model engine as they normally service -34s, which do not have removable valve seats. Further, they didn't have physical hard copies of the manual in their proximity when they were working with the bleed valve. The manuals were on their computer, which is inside the front office away from the shop floor. The company does not have a written policy manual.

Additionally, they had accessibility issues with the engine manufacturer's website when they were servicing the accident airplane and trouble getting in contact with the technical representatives.

Interview #2 Summary

Grower's Air Service

Interview Date & Time; August 22, 2017; 0841 PT

Attendees: Peter Dabaghian (DOM, Grower's Air Service), Ralph Holsclaw (President, Grower's Air Service), David Clarke (Mechanic, Grower's Air Service), Brian Allen (Federal Aviation Administration), Stephen Stein (NTSB – IIC)

The NTSB IIC reported the results of the engine examination to the attendees.

Mr. Holsclaw stated that the business had been around since 1935 and that he purchased the company in 1977 and had been working on their own airplanes since the company's inception. They began to perform outside maintenance in 1999. At the time they serviced the accident airplane, they employed a DOM, a full time mechanic, a part time mechanic, and two unlicensed mechanics who worked in the shop. When they began, their shop services R1340s and R985s, but in 1997 Mr. Holsclaw purchased a collection of Air Tractors with PT6A engines. They received some information training from the dealer that assisted them in servicing these airplanes and engines in-house. Most of their airplanes are equipped with PT6A-34AG engines, but they do some work on -20 series engines in addition to the 2 customers they have with -65AG engines.

The shop began working on PT6A-65AG engines about 3 years ago when it serviced one -65AG engine that was brand new and only required routine service at the time. They started working on the engine from the accident airplane about 2 years ago. They have one other customer they provide outside maintenance for, but their airplane is not equipped with a -65AG engine.

During the inspection that preceded the accident, Mr. Clarke ran into a problem with the bleed valve piston ring, which wouldn't come out, so they fabricated a tool to remove the ring. At the time of the service, the DOM did not have the -65AG manuals on paper, so he attempted to access the manuals on the engine manufacturer's website. Normally, they pull the required manuals off the manufacturer's website, print them out and review them prior to service. They had technical problems accessing the manuals on the manufacturer's website when they were trying to remove the bleed valve. The DOM was unable to reach the technical representative, so he contacted Covington Aircraft Engines who gave him some advice to remove the valve. After the new bleed valve was bolted to the gas generator they were able to access the publications, but at that point the bleed valve was "out of sight, out of mind."



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Interview #1 Summary

Scott Carl
Prime Turbines

Interview Date & Time; January 13, 2017; 0912 PT

According to the representative, Prime Turbines will send a customer an overhauled bleed valve when service is requested and the customer will send them the core unit that was removed. In this case, the maintenance facility submitted the core bleed valve with the valve seat, which was at their facility at the time this conversation took place.

Interview #2 Summary

Scott Carl
Prime Turbines

Interview Date & Time; January 13, 2017; 1244 PT

Mr. Carl stated his records indicate the core unit was sent to them on December 12, 2016. The photograph below was taken by Mr. Carl on January 13, 2017 and shows the valve seat that was found on the core unit that was submitted by Grower's Air Service.





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Interview #1 Summary

Taylor Michaud
Accident Pilot

Interview Date & Time; January 2, 2017; 1845 PT

According to the accident pilot, he heard a “pop” noise when he adjusted the throttle during the landing phase of flight. During the landing attempt after the engine power failed to increase, the propeller continued to turn but the throttle was wide open at 95%. After the accident, the engine continued running while on the ground, but was whistling.

Interview #2 Summary

Taylor Michaud
Accident Pilot

Interview Date & Time; May 30, 2017; 1400 ET

The pilot reported that he did not perform an engine performance check or engine run-up before he departed on the accident flight because he assumed the service facility had run the engine on

the ground at various power settings. During the takeoff attempt, he perceived the engine to take a higher percent rpm to get the required torque for takeoff. At the time of the takeoff the throttle was at 97% - 98%. When he scanned the instruments the engine cruised at 95% or 96%. The interstage turbine temperature did not appear higher than normal.