SOUTHERN STAR AVIATION

April 7, 2020

Mr. Dan Baker
Senior Air Safety Investigator
Office of Aviation Safety, Central Region
National Transportation Safety Board
4760 Oakland Street, Suite 500
Denver, CO 80239
[redacted]

Dear Mr. Baker,

Attached is the summary of the inspection performed on Cessna T210N N5553C S/N: 21063791. Continental TSIO-520-R, S/N: 517570.

Visual Documentation:

Overall engine damage – The engine, engine cradle mount and nose and nose gear structure were torn from the firewall/airframe during impact. Two of the engine mounts were torn from the nose structure and were attached to the engine. The remaining two mounts were broken from the engine case and were attached to the sheared section of the nose structure.

The starter was broken from the engine case and was found in the debris field. The vacuum pump case was fractured and broken and was removed before rotating the engine. The pump shaft was intact. The pump was secure to the accessory case. The engine-driven fuel pump was securely attached and removed from the engine prior to rotation. The fuel pump coupler was intact, and the pump rotated freely.

As previously mentioned, when the aircraft impacted, it tore the nose structure, engine and associated engine control cables, fuel lines, associated wiring, etc. from main fuselage of the aircraft. Due to the impact and separation of the engine from the firewall, the throttle/propeller/mixture control quadrant and cables in the cockpit were pulled thru the instrument panel. The stretching and pulling of the cables pulled all the cockpit engine controls full forward and the cables at the engine full aft. Due to this, I was unable to determine the position of the throttle/propeller/mixture prior to impact.

Most of the engine oil was lost at the resting place of the aircraft/engine due to the separation and fracturing of the propeller hub at impact. (Only one blade and a partial section of the hub was partially attached to the engine). The engine dip stick was bent ninety degrees at impact. After straightening the dip stick and tube, only a small amount of engine oil was present on the tip of the dip stick when checked.
Removal of Items Prior to Rotating Crankshaft:

All spark plug wire ignition leads (top and bottom) were removed. All appeared in fair to good shape. Some speak plug wires showed some signs of wear. Top spark plugs for cylinders 1 – 6 all exhibited light to moderate sooting. Bottom plugs 1, 3 and 5 exhibited light to moderate sooting. Bottom plugs 2, 4 and 6 exhibit heavy un-burnt oil covering the electrodes and in the cavity of the electrodes. The fuel pump and

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vacuum pump were removed, and the starter and propeller were broken off at impact (see above paragraph). "P" lead grounding wires were broken off at impact and the magnetos were not grounded.

Internal Continuity:

All cylinders were examined with a borescope. Cylinders 4 and 5 showed signs of light detonation. I was able to smoothly rotate the engine by hand utilizing a tool attached to the crankshaft flange. All cylinders were moving normally. I conducted a differential compression test utilizing a calibrated test unit with the following results: #1= 38/80 #2=48/80 #3=20/80 #4=58/80 #5=70/80 #6=64/80. While rotating the engine, spark from the magnetos was verified at impulse.

Induction/Exhaust System:

The intake filter and induction system from the filters to the induction intake were broken off and separated from the aircraft. The intake to the fuel control servo was packed with debris from impact. Induction tubes to the cylinders were attached and secure. The exhaust system, with exception of the tail pipe from the turbo (it was attached but crushed from the impact) was attached and secure with no evidence of soot. The clamps on the turbo/exhaust/waste gate were secure. The exhaust and compressor side of the turbo charger operated freely with continuity. The impellers on both sides appeared normal with no signs of rubbing, pitting or blade damage. The waste gate was attached and appeared normal however, the linkages were broken from impact.

Ignition System/Magnetos:

Spark was verified from the ignition leads when the engine was rotated. Ignition harness was in fair condition with areas of normal wear. Cylinder #3 top lead had some outer shielding damage from impact, but the cable was intact and operating normally. See above paragraph five for spark plug condition.

Fuel Injected Engines:

Most of the fuel feed lines were broken from the aircraft at impact including the fuel feed line to the fuel flow divider. All fittings and hoses were recovered and inspected. All appeared to be in good condition. There was no fuel noted in the breached lines. The throttle body remained attached to the engine but was damaged and contained a large amount of dirt/grass, etc. from impact. The throttle plate and linkage were broken from impact. The mixture arm was broken at impact. The fuel pump was removed prior to engine rotation (See paragraph two above). The fuel flow divider, fuel injectors and fuel injection lines were intact and properly mounted and torqued. I removed the fuel injector lines. Injector lines to cylinders 2, 3, and six all contained small amounts of fuel. The smell was consistent with AVGAS. The injector lines going to cylinders 1, 4 and 5 contained trace amounts of water with no odor of AVGAS. The fuel injectors were removed and visually inspected. There were trace amounts of FOD in the form of fine sand when blowing through the injectors. None were found completely clogged.

The inlet fuel fitting to the fuel flow divider was found cracked and broke off when attempting to remove the inlet line. When the inlet line was removed, water and a chunk of thick grey paste came out of the fuel inlet (Please see the photo/video in drop box). Upon disassembly of the fuel flow divider, the diaphragm and spring was intact. There was a lot of fine sand like material located on top of the diaphragm. The steel ring in the center of the fuel screen was completely covered with rust. The top (inlet side) of the screen contained the same fine sand-like substance. Upon removal of the diaphragm/spring, there was a

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large amount of FOD consisting of chunks and a thick paste in the fuel flow divider. (Please see the photo/video in drop box). There was no odor or visual indication of AVGAS in the fuel flow divider.

Miscellaneous Accessories/Systems:

The propeller governor was damaged at impact and was found jammed in the low RPM position. As mentioned above, when the engine departed the airframe, it pulled/stretched/broke all the engine/propeller control cables/linkages. A determination could not be made as to the position of the engine controls prior to impact. The fuel selector valve was in the left tank position when we arrived at the accident site moments after the event. It was then moved to the off position to stop the flow of fuel to provide a safer environment to extricate the pilot.

The oil filter was removed and the oil in the filter was retained and examined. The oil was very dark and appeared to have a small amount of water in the oil. The filter was cut open and the element was removed and examined. There were some rust flakes in the filter as well as carbon. No ferrous metals were observed in the filter. The propeller hub and blades were separated at impact. The vacuum pump was broken on impact. Coupler was not sheered.

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Respectfully,

Kenneth M. Lantz

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A&P/IA/~~ATP~~ [redacted]
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