



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety Alaska Region

Engine Examination Summary

February 7, 2017

Alaska Aircraft Engines, Anchorage, AK

A. Accident

NTSB Number: ANC17LA006
Location: Bethel, Alaska
Date: November 11, 2016
Aircraft: Piper PA-32R-301, N9084J
Engine: Lycoming IO-540-K1G5, SN RL-26585-48E
Engine TT: 2266.8 hours
Engine TSOH: 213.4 hours
Last Inspect: 8/31/16

B. Background

On November 11, 2016, about 1650 Alaska standard time, a Piper Saratoga PA-32R-301, N9084J, sustained substantial damage during a forced landing, following a loss of engine power near Bethel, Alaska. The pilot reported that during departure the oil gage indicated zero pressure after a transient vibration was experienced. The engine seized soon thereafter as the pilot turned back to the airport. He stated that the airplane could not reach the runway, so he performed an emergency landing on the

tundra. During the forced landing, the left landing gear and nose gear collapsed. After landing, the pilot noted that the oil access panel was open, and oil was on the windscreen and top cowling. During an investigation by the Alaska Department of Public Safety, an extensive oil deposit was discovered on the flight line where the airplane engine was started. The flight was the second of the day and the airplane had been shut down for three hours with no preheating prior to start. The outside air temperature during that period was between 21°F and 25°F. A post accident examination revealed that the oil cap and dipstick were missing.

The engine was a six-cylinder, air cooled, direct drive, horizontally opposed, fuel injected reciprocating engine rated at 300hp@2700 rpm.

C. Participants in Detailed Examination (only)

NTSB Investigator-in-Charge (IIC)	Noreen Price
NTSB Investigator	Eric Swenson
AK Depart Public Safety, Aviation Safety Officer	Michael Inman
AK Depart Public Safety, Aviation Dir. Of Maintenance	Richard Falk

D. Initial Engine and Airframe Examination

On January 9, 2017, the NTSB IIC and Alaska State Trooper party representative conducted an examination of the engine and airframe at the Alaska State Trooper hangar in Bethel. The airplane was laying on tires on a trailer, which limited engine access to the upper cowling. The following observations were noted:

- The airframe sustained substantial damage to the left wing and fuselage. Refer to figure 1.
- The engine remained attached via all mounts to the airframe. Refer to figure 2.
- All engine accessories remained attached and secure at their respective mounts.
- Throttle, mixture, and propeller control continuity was established from the cockpit controls to the engine.
- All accessible fuel and oil lines remained secure to their respective fittings.
- The oil dipstick was missing. The oil access panel had outward radial scratches and shiny surface area near the center of the underside that corresponded to the size of the dipstick top. Refer to figure 3. The latching mechanism operated normally.
- The left (2/4/6 cylinder) side of the crankcase exhibited a 0.4-inch hole at the top of the no. 4 cylinder bay. Refer to figure 4.
- Two fractures about 5 inches each, emanated from the hole and across the top of the case.
- The two spine attachment bolts above cylinder 4 were both missing.
- Two of the four nuts on number 4 cylinder base were backed off. One nut was missing.
- Oil residue was observed inside the bottom of the engine cowling, around the oil cap rim, and a minimal amount on windscreen.
- The quick oil drain was opened, and no oil drained out of the sump.
- The engine firewall indicated small amount of buckling across bottom.
- The three-bladed constant speed propeller remained attached to the crankshaft flange. The spinner was attached to the propeller, and the blades were attached to the hub.

The propeller was removed from the engine, and the engine removed from the airframe and subsequently shipped to Alaska Aircraft Engines in Anchorage, for further examination. The left oil cooler was removed for shipment.



Figure 1. N9084J PA-32-301 at the Bethel hangar

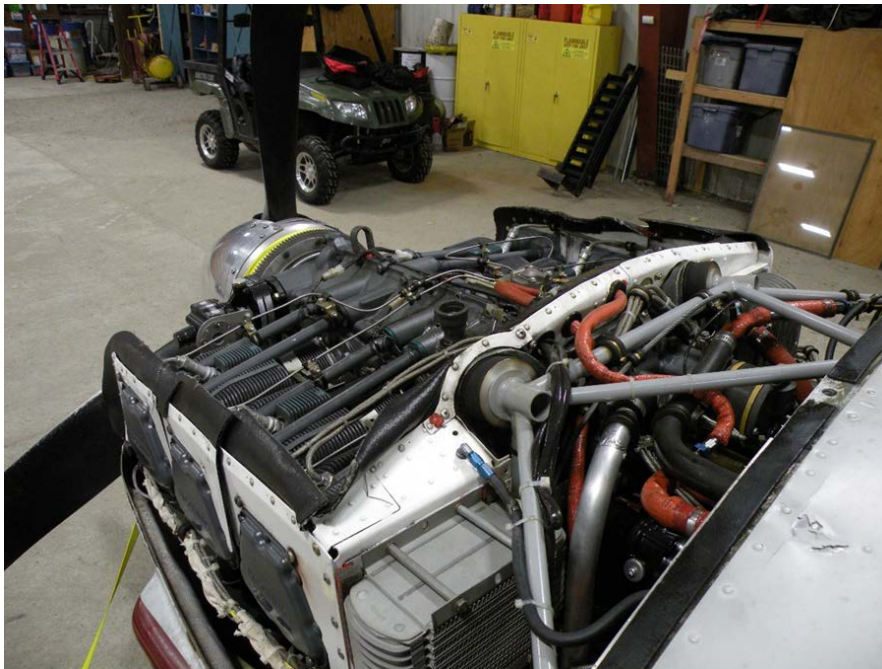


Figure 2. Top view of Lycoming IO-540-K1G5 engine



Figure 3. Oil dipstick access panel

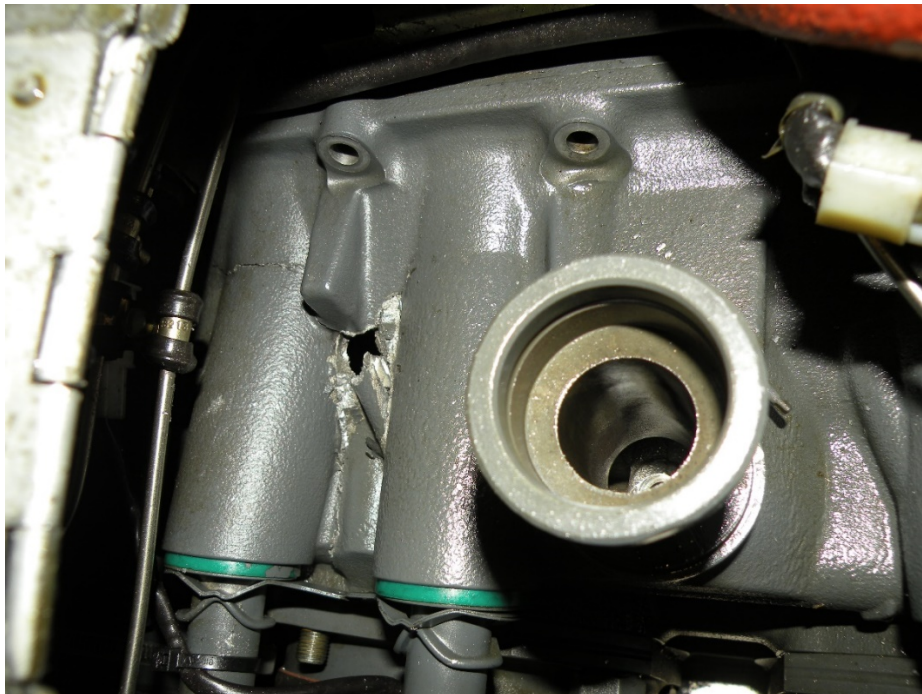


Figure 4. Hole in the crank case near the no.4 cylinder, no oil dipstick present

E. Detailed Engine Examination

On February 7, 2017, the engine was disassembled and a detailed examination was conducted at Alaska Aircraft Engines, Inc. in Anchorage. The engine arrived via airshipment strapped to a standard pallet and shrink wrapped. The left oil cooler was separate and wrapped with the engine.

The engine accessories and components were all secure. All fuel and oil lines were secure at their engine fittings except for the the oil pump output fitting for the right oil cooler which was barely finger tight. The accessory case was removed and all accessory drives remained intact and lubricated.

The magnetos were secure on the mounting pads. Each unit was removed and the impulse coupler was intact and functioned normally during rotation of the drive. Spark was produced at each lead. Electrical discharge was indicated.

The fuel pump was secure at the mounting pad. The fuel lines remained secure at their respective fittings. The fuel injection servo remained securely attached at the mounting pad. The throttle/mixture control rods were securely attached at their respective control arm of the servo. The fuel flow divider remained secure at the top of the engine. The fuel lines remained secure at each flow divider fitting and fuel injector at each cylinder.

The oil sump pan was removed and large quantities of metal debris and fractured rods were observed. Two large holes were evident on the bottom of the crank case inboard of the no. 3 and no. 5 cylinders near the spine. One 4 inch fracture was located inboard of the no. 4 cylinder. Refer to figure 5. The oil suction screen was removed and indicated pieces of non-ferrous metal particles. The thermostatic oil cooler bypass valve was removed and examined. The crimp nut and valve seat remained intact and the spring was secure. Refer to figure 6. The oil pump impeller turned with no anomalies observed.

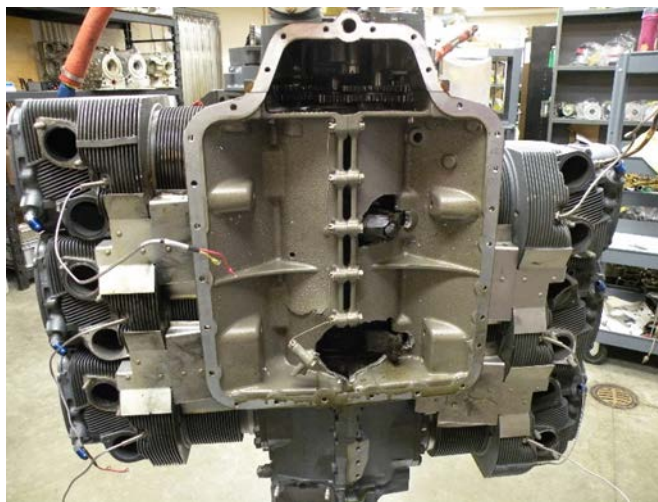


Figure 5. Bottom of fractured crank case



Figure 6. Oil cooler thermostatic bypass valve

The oil coolers were each capped off at one end and 100 psi air pressure was applied. The left oil cooler exhibited no leaks. The right oil cooler (Aero-Classics, Inc. P/N 8000074, S/N 1041902) exhibited an air leak through a 2 inch separation at a mated brazed plate that was undetected during a visual exam. Refer to figures 7 and 8. The right oil cooler was sent to the NTSB Materials laboratory for detailed examination.



Figure 7. Aero-Classic Oil Cooler, (right)



Figure 8. Aero-Classic oil cooler with fracture at seam

Spark plugs were removed and examined. All were dry and exhibited normal wear indications and coloration, except for #6 bottom which showed black soot deposits.

An examination of the no. 1 cylinder revealed no evidence of foreign object damage or mechanical malfunction. The no. 2 and 6 connecting rods were in place; however, the no. 2 rod had dark discoloration and extrudence at the rod cap and no. 6 piston skirt exhibited extensive scoring and carbon deposits in the direction of travel. The no. 3, 4 and 5 connecting rods were separated from the crankshaft by rod shank fractures with extensive thermal discoloration and deformation. Refer to figure 9. Signatures were all indicative of engine operation without sufficient oil lubrication.

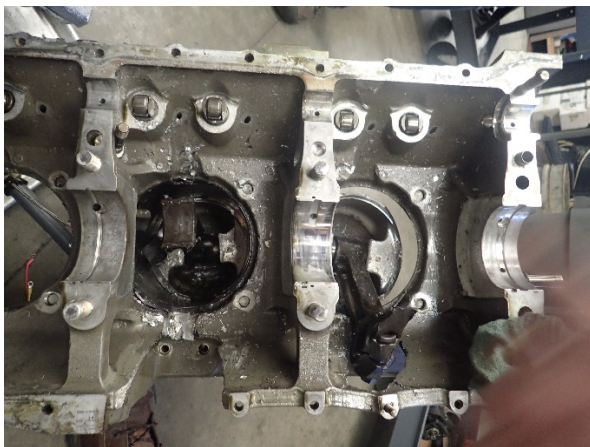


Figure 9. No. 3 and 5 connecting rod fractures and deformation (left) and no. 4 cylinder, piston and damaged connecting rod (right)

The crank shaft exhibited extensive thermal discoloration and deformation at the middle crankpin journals. Refer to figure 10.



Figure 10. Crank shaft thermal discoloration and deformation

The no. 1 main crank shaft bearing (forward) remained intact with normal wear signatures. The no. 2 main bearing was displaced with some black scoring present. The no. 3 main bearing exhibited thermal discoloration and deformation indicative of oil starvation. The no. 4 bearing (rear) exhibited minor thermal damage. Refer to figure 11.

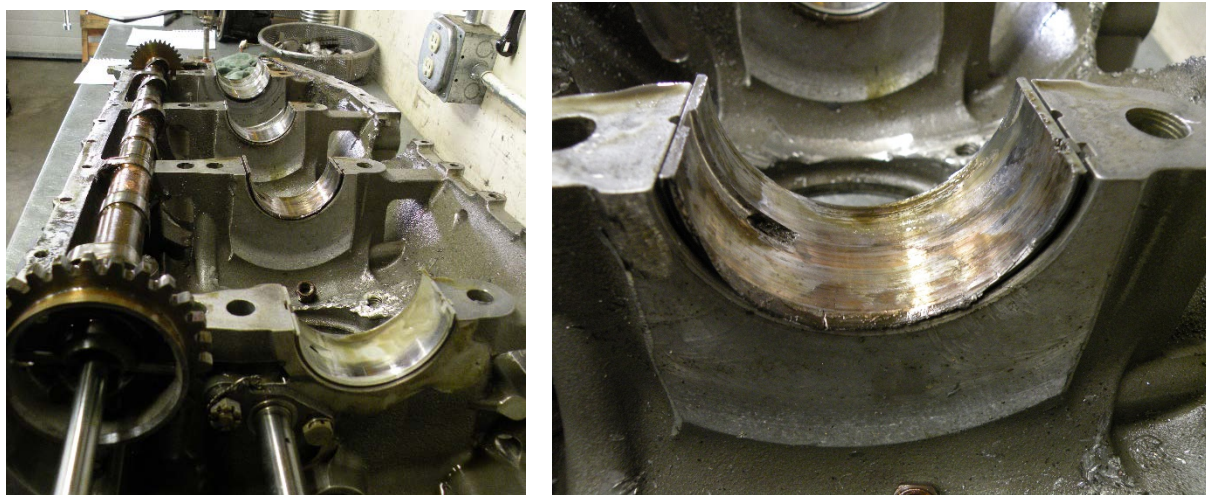


Figure 11. Cam shaft and crank shaft bearings(left), no. 3 main bearing (right)

The cam shaft remained intact with impact indentations throughout.