Bearhawk #164 “Three Sigma” Checkout Report

Date: 23-27 Apr 08

Objectives:

1. Find and address the source of the engine oil leak
2. Adjust propeller governor high RPM stop
3. Adjust carburetor idle mixture
4. Shorten landing gear shock struts
5. Split nose bowl
6. Check prop tracking

Background:

1. Previous testing found a large oil leak from the front of the engine when running at high power.

2. As tested, the maximum RPM was 2510. According to the governor manual, for a redline of 2700, the ground RPM should be 2600 to 2675.

3. As tested, the idle mixture is too lean, as shown by a lack of RPM rise while slowly pulling the mixture to idle cut-off.

4. After adding 300 pounds of fuel, the landing gear tread was measured at 72.5 inches.

5. After installing the propeller the first time, I decided that the first time the prop had to be removed the nose bowl would be split. This was primarily to avoid the need for arthroscopic surgery techniques to safety wire the prop.

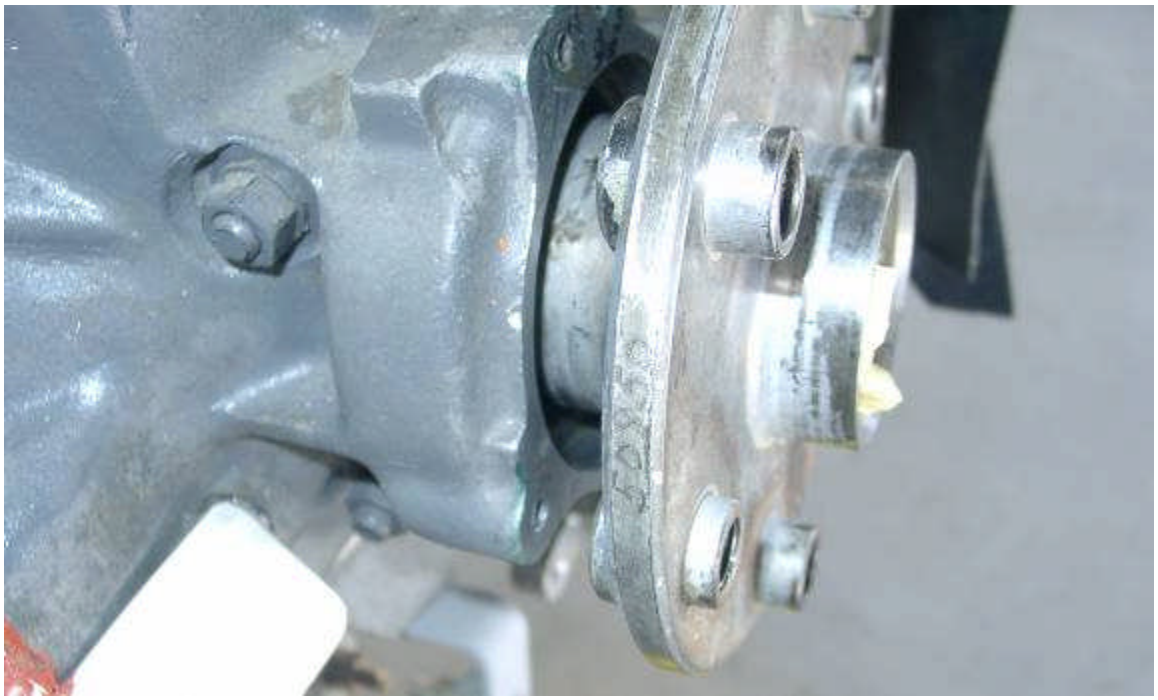
6. Prop tracking has not been checked yet.

Procedure and Results:

**Oil Leak**

The oil appeared to come from the front end of the engine. While there were several possibilities, the leading candidate was lack of a front crankshaft oil seal. I had looked at the area around where the crankshaft came out of the block and wondered about the cavity, but did nothing since I didn’t know what was supposed to be there.

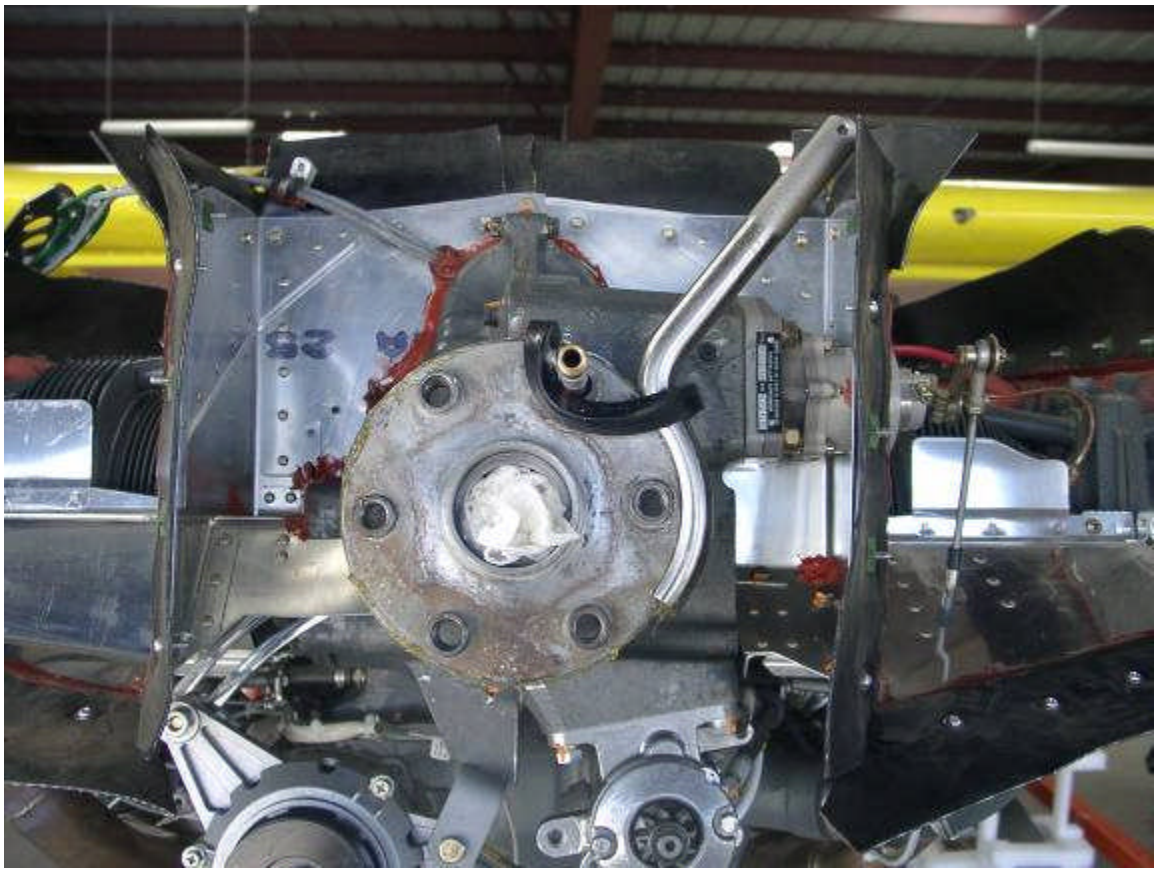
The cowling was removed. The spinner, propeller, ring gear, and Lightspeed direct crank ignition pickup board were removed. A drip pan was in place to catch the oil that came out of the propeller hub as the propeller was removed. As expected, the cavity for the front crankshaft oil seal was noticeably vacant.



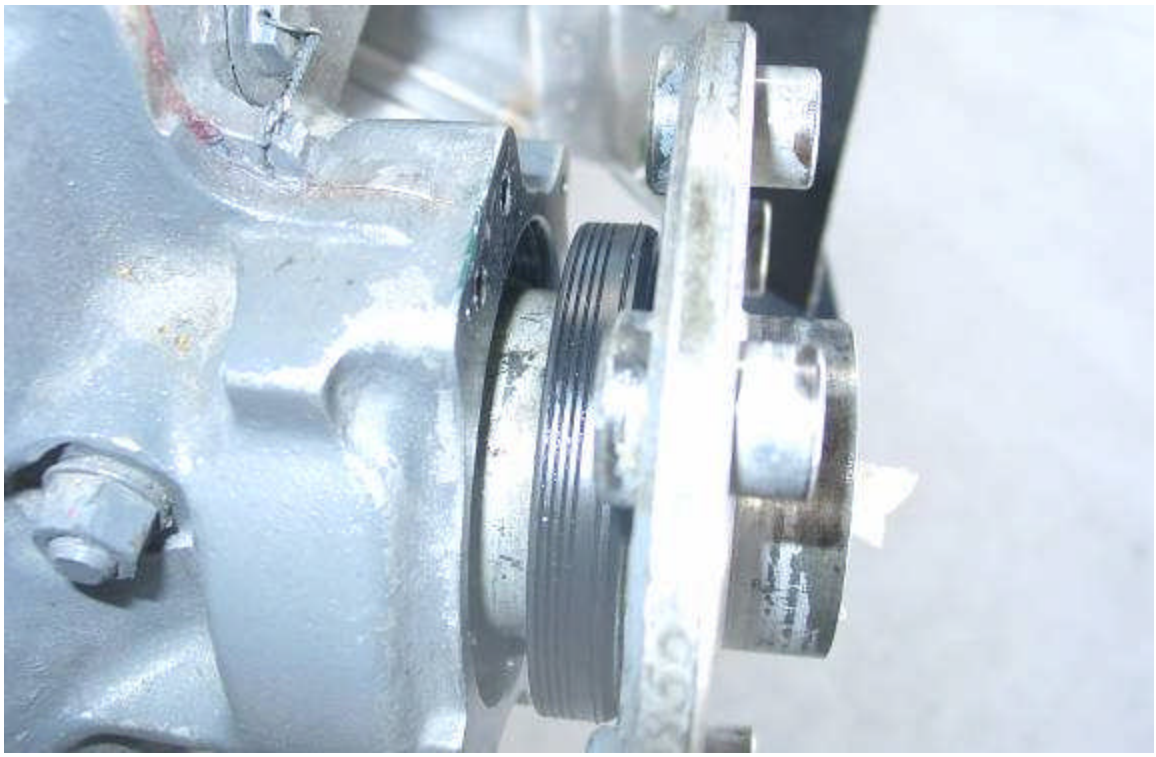
Apparently the seal was left out during the overhaul. As the overhauler was in Indiana, there was no point in taking this back to the overhauler. Two crankshaft oil seals were included in the bag o' gaskets that came with the engine. No reason is known for why the seal was left out.

An online search turned up Lycoming Service Instruction No. 1324B (30 Oct 06) that detailed the installation instructions for the seal.

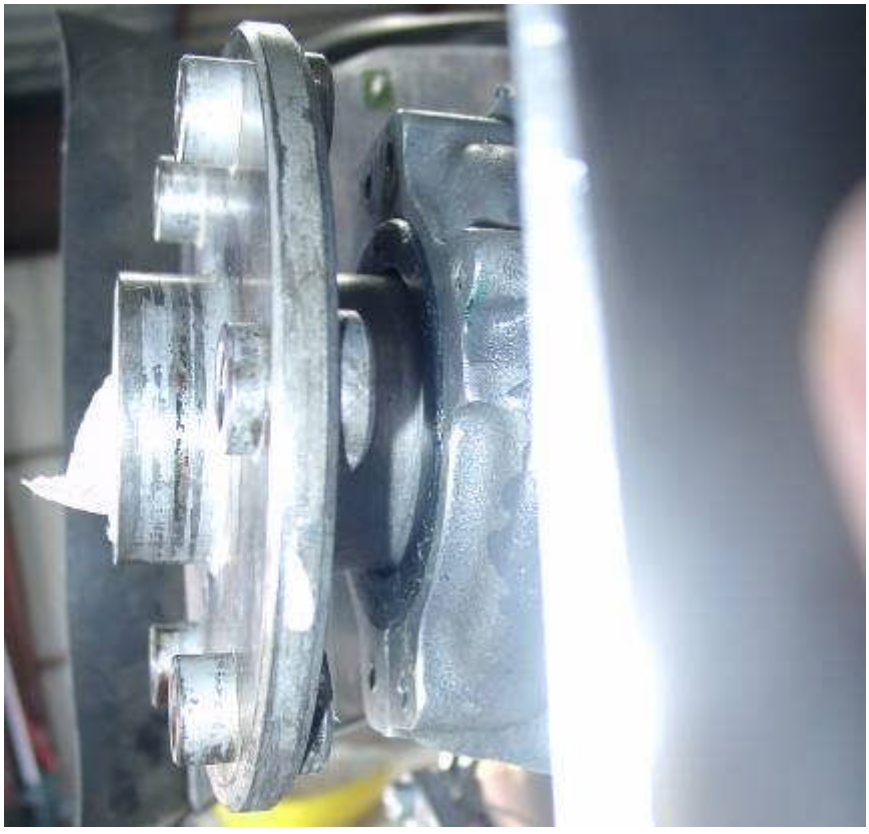
Per the instruction, the spring in the seal was removed. The seal, crankshaft, and prop flange were greased up. The seal was held in place by a brass pipe nipple through a propeller drive bushing. While not stated explicitly, I think brass was specified because it is softer than the steel threads in the propeller drive bushing, such that the threads would not be damaged. A tool (KM-5209) was inserted in the seal to stretch it around the propeller flange. I was lucky to know an A&P who happened to have this tool. The prices for it online were ridiculous (over $300). If necessary, I would think it would not be too difficult to fabricate such a tool. Bend a 4130 tube to the right curvature, cut off one side to leave a slot, then weld on a handle.



Using the tool, the seal was stretched around the prop flange by pulling the tool around. At this point, the seal sat happily around the crankshaft. The spring was wrapped around the crankshaft, hooked together, and worked back into the slot in the seal.



“Pliobond” cement (Aircraft Spruce P/N 09-28000) was applied around the circumference of the rubber seal and the seal was pressed into the cavity.



It turns out that when the Lightspeed direct crank ignition pickup board was reinstalled, the bracket overlaps part of the seal and helps to retain the seal.

The ring gear and propeller were reinstalled, taking care to ensure that the paper towels were removed before installing the propeller.

The success of this installation will not be known until the next engine run, which will be after the nosebowl modification is complete.

**Adjust Propeller Governor High RPM Stop**

The maximum propeller RPM needed to be increased a minimum of 100 RPM. According to the governor manual, one turn counterclockwise of the stop screw would increase 25 RPM. Therefore, the stop screw was turned counterclockwise 4 turns and re-safety wired.

The additional throw of the governor arm required the control cable to be adjusted as well. Merely unscrewing the rod end bearing resulted in insufficient threads in the rod end bearing. The anchor for the control cable was adjusted to move the cable up 1/4 inch. The rod end bearing was readjusted to allow full movement of the governor without bottoming out the cable on the instrument panel. A slight increase in the size of the hole in the baffle was required.

The results of this adjustment will be tested at the next engine run.

**Adjust Carburetor Idle Mixture**

The idle mixture screw on the carburetor was turned one half turn richer.

The results of this adjustment will be tested at the next engine run.

**Shorten Landing Gear Shock Struts**

Back when I changed to the beefed up rod ends, I tried just threading them in without the jam nut. My original thought was that it is impossible for the rod ends to back out because neither end of the shock strut can turn. However, I quickly found that the rod end bearing was also the seal at the end of the piston to keep the fluid in. The jam nut was needed to seal the threads. I re-installed the jam nuts and screwed in the rod end bearings as far as I could with the jam nuts. That's how they were installed before this modification.

Somewhere along the line I remembered that in the July-August-September 2005 Bear-Tracks The Bob stated "The lock nut is not needed if Lock-tite (blue) is used." I used the crane to lift up Three Sigma one side at a time and removed the shock strut on that side. The rod end bearing was removed, the jam nut removed, and the rod end bearing was

screwed back in as far as possible with blue Loctite applied. I was careful to mark the orientation of the rod end bearing so that I would return the rod end bearing to the proper orientation.

As the jam nut was about 1/4" thick, the resulting shock strut was about 1/4 inch shorter. I reinstalled the shock struts and then moved the airplane back and forth several times so that the gear would splay out with no side forces on the tires. Prior to this modification, the tread measured 72.5 inches. Measuring the tread now at essentially the same weight as before (the cowling was removed) was 69.5 inches, three inches less.

The shock strut bolts were tightened and cotter pinned. The floor was re-installed.

**Split Nose Bowl**

Since the propeller and therefore the nose bowl were removed, it was time to split the nosebowl. The propeller was significantly easier to install and safety wire without the nosebowl in place.

The attachment flange will be built up from fiberglass rather than using aluminum strips as shown in Bear-Tracks. This is a work in progress.

**Prop Tracking**

Prop tracking is good, with each blade tip passing through the same point within 1/16 inch.

Conclusions:

The front crankshaft oil seal was installed. Testing will be at the next engine run.

The propeller governor was adjusted. Testing will be at the next engine run.

The carburetor idle mixture was adjusted. Testing will be at the next engine run.

The landing gear shock struts were shortened with the desired effect.

Nose bowl splitting is in progress.

Prop tracking is good.

Recommendations:

Continue with engine testing after the nose bowl splitting is complete.