

Bearhawk #164 “Three Sigma” Checkout Report

Date: 21-23 Mar 08

Objectives:

1. Stop fuel seep around plug in top of gascolator
2. Remove fuel selector handle and remaining floor
3. Pitot-static leak check
4. Inspection by fellow EAAers
5. Verify settings on EDM-900
6. Pitot heat checkout
7. Carbon Monoxide light leak test
8. Autopilot ground checkout
9. Dynon altitude and airspeed adjust
10. RMI μ -encoder altitude and OAT adjust
11. Grease cowl flap torque tube
12. Change ELT batteries, test ELT
13. Install stripes for door handles

1. Stop fuel seep around plug in top of gascolator

Background: Occasional whiffs of avgas smell were still occasionally noticed inside the fuselage. When the floor was removed for inspection, the top of the gascolator was moist and stained. A pipe plug was installed in the top center of the gascolator. This plugs a port provided for supplying fuel to a manual primer pump.



The internal wrenching plug's hex socket was found to be full of fuel. Inspection of the plug and thinking back placed a high probability that this plug was never properly installed with sealant or torqued.

Note in the picture above that the gascolator bracket partially covers the pipe plug. It was originally thought that there would never be a need to access this plug. Things didn't

work out that way. Since the gascolator would need to be removed to fix the fuel seep, this was a good time to address this limitation.

Procedure:

1. Mark area to grind out for access to plug
2. Fuel selector to OFF
3. Drain gascolator to empty
4. Loosen B-nuts on both sides of gascolator
5. Remove Phillips head screws holding gascolator, remove gascolator
6. Plug end of fuel lines with extra fittings
7. Grind plug access area out
8. Shop vac area clean
9. Remove fittings from fuel lines
10. Reinstall gascolator (Phillips head screws, fuel lines)
11. Remove hex plug
12. Apply Bakergel, reinstall and torque hex plug
13. Apply torque seal inspection lacquer
14. Fuel selector to BOTH to refill lines
15. Fuel selector to OFF

Results:

The repair was accomplished according to the procedure. There's something exciting yet disconcerting about grinding steel with bright little sparks going everywhere right next to a fuel line, even if the line has been drained and plugged with a fitting. Inspection the next day showed no sign of fuel leaks.



The lacing cord tied around the fuel line doesn't hold anything. It is there to detect fuel seeps. If the cord becomes stained blue, that will indicate a fuel leak.

Conclusions: The fuel seep was located and stopped.

Recommendations: Keep eyes and nose peeled for possible further indications of fuel seeps.

2. Remove fuel selector handle and remaining floor

Done. The locking button on the fuel selector handle had previously been modified with a round file to allow direct access by any hex wrench instead of requiring the shortened hex wrench (special tool) that came with the fuel selector.



3. Pitot-static leak check

Background: Advisory Circular AC 90-89A recommends applying pressure to the Pitot tube so that the airspeed indicator indicates the expected cruise speed. “The airspeed needle should remain steady for a minute if the system is sound.”

For the altimeter, low pressure is applied to the static system until the altimeter reads 2000 feet above the starting value. “The altimeter should then hold the indicated altitude for at least a minute.”

Procedure:

1. Remove Pitot-static tube from mast
2. Attach water manometer to total pressure (Pitot) line
3. Turn on two Dynons and RMI μ -encoder
4. Adjust manometer to increase pressure until airspeed indicator indicates 150 KIAS
5. Wait and observe change in airspeed
6. Adjust manometer until water level is equal on both sides
7. Detach water manometer from total pressure line
8. Attach water manometer to static pressure line
9. Set altimeter to 29.92, note pressure altitude

9. Adjust manometer to reduce pressure until altimeter indicates 2000 feet above ambient pressure altitude
10. Wait and observe change in altitude
11. Adjust manometer until water level is equal on both sides
12. Detach water manometer from static pressure line

Results:

The manometer was attached to the total pressure line and pressure increased until the airspeed indicator indicated 150 KIAS. The Dynons indicated 152 KIAS each. No change was noted in one minute.

The manometer was left in place for about 10-15 minutes to check for smaller leaks. During this time, the airspeed actually increased(!) by approximately two knots. This test was accomplished in the morning with the hangar door open, and the ambient temperature was slowly rising. A [simple analysis](#) showed that a temperature increase of 0.5° F would be sufficient to show an apparent increase in airspeed of two knots, which was quite reasonable to expect within that time frame.

The manometer was moved from the total pressure line to the static pressure line. From a pressure altitude of 2140 feet, the pressure was reduced until the altimeter indicated 3560 feet, short of the planned pressure altitude of 4140 feet. At this point, the reduced static pressure relative to the ambient pressure in the total pressure line resulted in the airspeed indicator indicating 170 KIAS, the maximum marked airspeed on the airspeed indicator face. The static pressure was not lowered any more to prevent damage to the airspeed indicator. The pressure altitude differential of 1420 feet was deemed sufficient for this test. No change in altitude was noted in one minute.

The manometer was left in place for about 10-15 minutes to check for smaller leaks. During this time, the indicated altitude decreased by approximately 40 feet. Based on the experience with the increasing airspeed, it was hypothesized that perhaps this altitude decrease was due to an increase in temperature. A [simple analysis](#) showed that a temperature increase of 0.8° F would be sufficient to show an apparent decrease in altitude of 40 feet, which was quite reasonable to expect within that time frame.

Conclusions: The total pressure system and static pressure system were determined to be sufficiently sealed for continuation of flight test.

Recommendations: After completion of the Phase I flight test, have the Pitot-static system officially tested to show compliance with 14 CFR § 91.413.

4. Inspection by fellow EAAers

Background: Fellow EAAers were invited to inspect the airplane for any discrepancies that slipped through.

Results: The following discrepancies were found, with the resolutions listed.

1. Fuel seep on left wing tank. Fuel to be drained, tank cleaned and Pro-Seal to be applied over the offending seepages.
2. Fuel seep on right wing tank. Fuel to be drained, tank cleaned and Pro-Seal to be applied over the offending seepages.
3. Wires to taxi light not secured. Wires secured.
4. Ground wires in battery compartment not secured. Wires secured.
5. Adel clamp holding coils for cylinders 3 and 4 slipping around engine mount. Adel clamp replaced with a clamp that doesn't slip.
6. Suspicion of possibility of fatigue damage to ignition coil primary wires due to lack of support. No immediate solution for securing wires was obvious. No requirements for securing the primary wires were called out in the Lightspeed Ignition Installation Instructions. A common installation for the coils is to attach them to the engine crankcase, which has far more vibration than will be expected on the engine mount. No resolution will be made at this time. This possibility will be kept in mind for inspection and for troubleshooting any ignition problems in the future.

5. Verify settings on EDM-900

Results:

The EDM-900 settings were verified to match the published engine limits and recommended operating conditions using the EZConfig II program. The configuration was stored in the file n6786e.cfg.

Paper labels were affixed to the screen of the EDM-900 to label the three unlabeled gauges—OAT (outside air temperature), CRB (carburetor air temperature), and Fuel Remain (fuel remaining).

6. Pitot heat checkout

Results:

The Pitot heat switch was switched on while holding the Pitot-static tube. Within 10 seconds the Pitot-static tube had warmed sufficiently to be felt but was not hot enough to cause burns.

Conclusion: The Pitot heat was functional. The Pitot-static tube warms up slowly enough that future tests can be made by one person switching on the Pitot heat and then immediately proceeding to the Pitot-static tube and touching it to feel for warmth.

7. Carbon Monoxide light leak test

Background: Advisory Circular AC 90-89A suggests checking for leaks in the firewall by “shine a bright flood light close to the fire-wall (sic). If light leaks into the cockpit, carbon monoxide can seep in.”

Results: While the hangar was brightly lit by sunlight with the cowl doors open, the backside of the firewall was inspected from inside the fuselage. No light leaks were found. However, with the insulation and sound deadening foam on the firewall, this test was not necessarily conclusive. However, other inspections of the firewall indicate no problems.

8. Autopilot ground checkout

Procedure: The ground checkout of the Tru-Trak Autopilot was accomplished according to the procedures listed on page 10-11 of the Installation & Users Manual For ADI Pilot I & II Series Autopilots.

Results: All tests were completed with the expected results. Both servos operated in the correct direction.

9. Dynon altitude and airspeed adjust

Results: The altimeters in both Dynons were adjusted using SETUP>ALTADJ as described in Appendix A of the EFIS-D10A Installation Guide to match the round dial altimeter corrected for instrument error.

The zero pressure values for the airspeed indicators in both Dynons were adjusted using SETUP>SPDCAL as described in Appendix A of the EFIS-D10A Installation Guide.

10. RMI μ -encoder altitude and OAT adjust

Results: The altimeter in the RMI μ -encoder was adjusted to match the round dial altimeter corrected for instrument error using the procedures outlined in Encoder Programming Manual.

The OAT in the RMI μ -encoder was adjusted to match the Dynon OAT value using the procedures outlined in Encoder Programming Manual. The calibration of the Dynon OAT had been previously verified by a calibrated thermocouple.

11. Grease cowl flap torque tube

Results: The torque tube was greased. One grease fitting was pulled out while trying to remove the grease gun. Attempts to reinstall grease fitting were unsuccessful

Recommendation: Try re-tapping the grease fitting hole. Replace grease fitting.

12. Change ELT batteries, test ELT

The previous batteries in the Ameri-King 450 ELT were installed when the ELT was purchased. The batteries were replaced with new Duracell D-cells with an expiration date of March 2014. A label on the ELT was annotated with the installation date and expiration date.

The ELT was tested between 1800 and 1805. Activation methods included the remote control panel in the instrument panel, the ON switch on the ELT, and by testing the g-switch by rapping the ELT. The ELT was connected to the external antenna. The signal was received on a handheld radio tuned to 121.5 MHz. The ELT activated properly in each case. The ELT stopped transmitting when the reset button was depressed.

13. Install stripes for door handles

Stripes were applied to the doors to align with the door handles (latches) in the fully closed position. These stripes were 1/8" wide striping tape.





These stripes allow the pilot to visually verify that each door is properly latched prior to takeoff for safety. The door is latched if the handle is aligned with the stripes.

This was also an homage to the mighty F-4 Phantom II, which I had the chance to fly on three occasions, where the checklist response for canopies closed was “CLOSE, CHECK WARNING LIGHT OUT & STRIPES ALIGNED”.