EVOLUTION owner's newsletter

Editor, Doug Meyer | July 2015 | Layout and Graphics, Ron Hart

Information for the Evolution Owner and Builder

Redmond, OR; July 14, 2015

Possible nose gear unlock during parking update.

We have been working diligently to find the definitive cause of the 3 nose gear unlocks that have occurred during tow after parking. We are now 99% sure that we have found the underlying condition and it does have to do with pressure build-up in the actuator due to temperature. These are very rare instances (3 occurrences in at least 25,000 flight hours), but we strongly believe that it will not or cannot occur if you open your emergency dump valve after power down and leave it in the bypass mode while parked. For further assurance, you may also power up your aircraft during a tow with the bypass valve closed if you wish, but that is not a required action. The Emergency gear drop process in your POH is valid and unchanged.

Proper Procedure for Servicing of the Hydraulic Accumulator on kits #60 and above or earlier kits with the Increased Gross Weight Actuator Installed.

We have become aware of some technicians not following the proper accumulator pressurization procedure. To properly pressurize the accumulator after any landing gear system service, follow this procedure:

Revised Hydraulic Accumulator Charging Procedure

Note: may be done with aircraft on wheels

1. Elect. Power OFF
2. PULL Hyd Pump CB, Verify Gear Relay CB IN
3. Elec. Power ON
4. SLOWLY open Maintenance (dump) Valve until fluid begins to flow and wait for flow to stop
5. FULLY OPEN Maintenance Valve
6. Attach Nitrogen Source and charge to 800-850 psi
7. Disconnect Nitrogen Source
8. CLOSE Maintenance Valve
9. Push Hyd Pump CB and allow to run until flow stops.
10. Power OFF (if desired)

The point is that the accumulator needs to be pressurized with the gear DOWN after an up-cycle. Always check for leaks from the actuators. They should not leak at all and a leaky actuator should be removed from service.

EVOLUTION *owner's*
newsletter
July 2015

Nose Gear Collapse on Landing Incident.

Many of you read of the nose gear collapse on N3WB at KSQL last fall. It was the topic of a couple safety related blurbs in the aviation media and has been discussed among owners. There has been more than one question posed to us as to the cause of this incident and why we are not addressing it. The answer is that we do not know exactly what happened or why, and are waiting for the NTSB to release their report. This process is a bit different from the norm in that the NTSB were "on site" right away and took control of the damaged parts. Their labs are doing the analysis of the broken parts and will release their findings as to what failed. Bob Wolstenholme is a "party to the investigation" and will be advised of their findings. There is a supposition that what will be found is a damaged shimmy damper that allowed the gear to go into a diverging shake which overstressed the trunnion, causing it to break at the hinge pin. A part of the supposition is that the subject airplane had just come off a very long multi-stop trip with many landings where many FBO's had an opportunity to tow the aircraft. It is possible that one of those may have overturned the nose wheel, damaging or breaking the damper. As a reminder, your POH lists a limitation of 50 degrees each way from center for the nose gear. I personally inform each FBO that I visit that it is 45 degrees and to observe that limit. We are having some limit stickers made for your strut and when they are available we'll send them out to you. In the meantime, a nice strip of red tape on each side of the strut wouldn't hurt.

The speed thing.

How fast is your Evolution? There are many ways to answer that question. At what altitude? At what weight? At what power setting, and at what combination of those conditions? Then, how are you going to measure the speed accurately? Here is the generally accepted procedure for airspeed measurement.

First make a "fill in the blanks" chart that shows Pressure Altitude, OAT, IAS, GS, and TAS, the four engine parameters Tq, Np, ITT, Ng, and Fuel Flow (optional), and 4 Legs or Headings 90 deg apart (360,90,180,270)

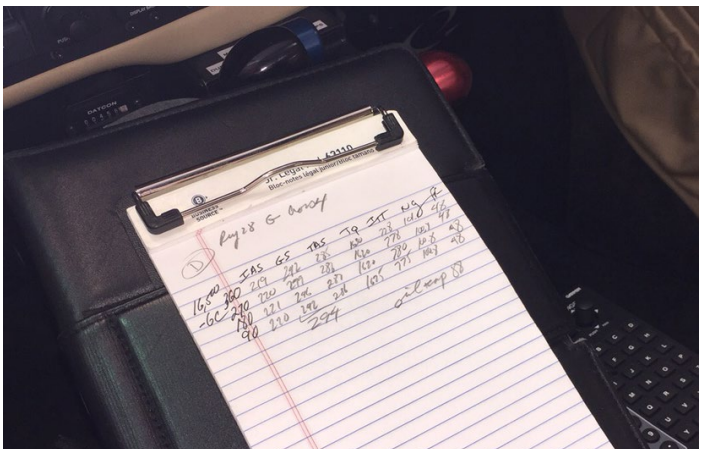
Pick a base aircraft condition for continuity, say… ½ tanks, one pilot, a close to standard day, at pressure altitudes and FL's. We can pick a standard power setting 775 deg. ITT, or max torque, or higher up to the max permitted continuous limit of any one of the leading particulars. Whatever limit you choose as long as it is consistently attainable.

Fly each heading at a given altitude until stabilized (at least two minutes) starting when wings level after the turn, and note the parameters. When you analyze the data, your actual TAS will be the average (Mean) of the four ground speeds of each box flown. You may notice a pronounced climb or descent on some legs, especially if in clouds. The vertical movement of the air mass will cause the A/P in the aircraft to nose down to maintain altitude in a rising

EVOLUTION *owner's*
newsletter
July 2015

The speed thing (*continued*)

mass and nose up in a descending mass. This can be quite pronounced and if you reverse course in the same air mass they will cancel out. The more convective movement and terrain interference there is, the greater the potential for error due to local conditions. Stable, calm days are best.



This data need not be complicated. In this actual example, note that zero wind ground speed is 294, while the average TAS is 286.

Upon completing this test session, you may find that there is a variance between the TAS shown on the G900 and your computed number. Where might this come from? Garmin tells us that the computed TAS in the G900 is the result of the computer applying the TAS correction factor as spelled out by NASA Technical Note D-822 (this is easily searched). This standard format uses only two pieces of data to compute a TAS from an IAS, those are the OAT and the pitot pressure differential as supplied by the pitot / static system of the aircraft. The variability of this data is extremely low, probably within a knot or so. So if you have a variance, it must be in the pitot static system. But, since you have an IFR cert that certifies the accuracy of this system, how can that be? Well, the artificially induced pressures put into the P/S system during the biannual certification are standard pressure altitudes and standard pitot ram pressures that would (should) be created during flight. That is, if you are at FL280 (standard ISA) the pressure altitude will be X and if you are moving the pitot through the air at, say 180 Indicated Air Speed (IAS) the pitot pressure should be Y. If you then correct that IAS to TAS using the TAS computer in the G900 you should have an accurate display of the speed across the ground at zero wind. The root of any errors in this result must then be in either the OAT or the Pitot Pressure. A common sense look at these too pieces of data would suggest that either is subject to some error. The static port must accurately show the outside barometric pressure without any influence from the airstream, and the pitot must be exactly aligned with the airflow to read the maximum available ram pressure in the pitot tube. There can only be one maximum, and misalignment can only serve to reduce the pressure (and indicated speed) never increase it. A reduction or increase in the static pressure at the static port will skew the IAS in the inverse. That is, a low pressure at the port will trick the system into correcting for a higher altitude and high pressure will correct for a lower altitude. The static port position is selected by flying the aircraft through various flight attitudes with a pressure gauge and looking for a fluctuation up or down from ambient. A spot (or spots) is chosen for a consistent, accurately neutral ambient pressure reference. That leaves the pitot alignment and resultant pressure pitot ram pressure data. Currently there is no "perfect" way to install the pitot on a given airframe. It is not a precision "jigged" mounting that is established. The builder does square it up with the airframe but we do not know how "correctly" that aligns at cruise speed. We do know that at extreme angles of attack, the airspeed error is greatest. This may account for TAS differences between airframes. This error does occur in certified aircraft. We will be looking at this further in the near future.

EVOLUTION *owner's*
newsletter
July 2015

Air + Fuel = HP

You all know that the more air you can pass through your engine the more fuel you can burn and more fuel in the correct ratio equals torque at the prop. More torque at 1950 rpm yields more hp. and therefore, more speed. Turbine engines, pure jet, turbofan, or turboprop are "naturally aspirated". They are not turbocharged, or supercharged (which would increase the inlet air pressure above ambient). They rely on the available free airstream to feed the engine. At low airspeeds speeds (starting with zero at takeoff) the air enters the compressor section at ambient pressure. As airspeed increases the ram effect of the mass of the airflow begins to more nearly meet the engine's needs to make rated power reducing the engine's workload and by delivering "more" air to the first stage compressor. The 135A engine has a compression ratio of about 7:1, the more air you can deliver to the inlet the better. The mass airflow at max torque (sea level) is 6.5 pounds per second. The more of that air requirement that you can deliver as the altitude increases the more hp. you will produce. This is called 'Pressure Recovery" because the pressure of the mass of the amount of air moving to the compressor at a high speed is greater.

Among several evolutionary improvements to the Evolution that we have been working on is a re-designed engine inlet opening. Without speculating on the origins of the original design, the staff now concerned with these things has been working on an optimized design for the inlet. The builder community has also begun offering their ideas in this regard as we have shared our engineering data as well as the optimal design data supplied to us from Pratt and Whitney. A few designs have been flown including "ours" and all have shown speed increases of varying magnitude. Since we are only responsible for our testing, which is still ongoing, we can only speak to the efficacy of our own design.

There are really two things at work here, one is the shaping of the duct and the other is the moving of the oil cooler inlet to the bottom of the cowl separating it from the engine air. This has had a positive effect not only on engine air mass flow "in", but also on oil cooler efficiency and reducing the cooling drag it causes.

The shape of the inlet opening, the shape of the opening's leading edge, the distance from the leading edge to the prop, and the shape and finish of the internal duct all factor into this. We have seen improvements with the new shapes and there has been a lot of "buzz" on the topic. However, one thing that we have seen that is not being talked about much is rate of climb. Consider that the drag rises exponentially with the speed, and that the amount of power being produced at high cruise altitudes is much lower. For a "back of the napkin" example, let's say we recover 3% available power (I'm just makin' that up – but it's likely around there) at 10,000 feet and we went from currently 715 available hp. back up to 736, a gain of 21 hp. That is going to really show up in the rate of climb passing 10, (and it does). The engine is "pulling the airplane uphill" but the aero drag there is much lower at around 140Kts. But then we level off at FL280 and still "recover" the 3%. If currently an Evolution 135A is producing about 430 hp. at FL280 (and it is) maybe we could bring that up to 442 hp. That same 3% is now only 12 hp. and would likely yield around 4 knots (less of a numerical gain AND against an expo-

EVOLUTION *owner's*
newsletter
July 2015

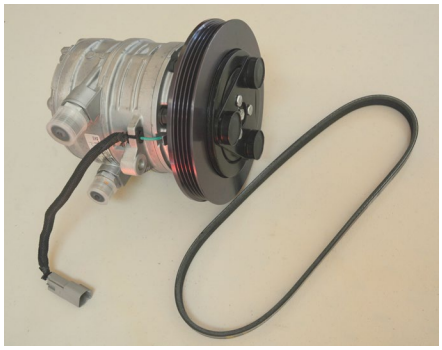
Air + Fuel = HP *(continued)*

nentially greater drag load).

Watch for a new cowl design with actual data around Oshkosh. The good news is that this is a relatively simple enhancement. We (or your builder) will simply cut the old ductwork out and graft the new shape into your existing cowl and repaint. Given the performance increase, it will be an inexpensive mod that will pay performance dividends. New aircraft will be delivered with the same new design.

Air Conditioning Efficiency Improvement

When the Evolution kit was first spec'ed out, an air conditioning compressor was chosen that "fit" and was more or less properly sized to do the job. During one of the projects that we have undertaken over the last couple years to improve the system, we found that the A/C compressor, although optimal in nearly every way, was operating at the very high end of its' rpm efficiency "map". That is, it was spinning too fast to compress the A/C fluid to a "best" pressure. It needed to be slowed down to perform better and last longer. Unfortunately, there was not a larger pulley available for that compressor, and the drive pulley on the engine pad could not be made any smaller to decrease the rpm of the compressor. The solution was to machine the stock pulley down to a "hub" and make a larger pulley "ring" that could be installed onto the hub. We did that, and have been running a so equipped compressor on N424SM for about 300 hrs. with excellent results. The A/C works very well and there have been no issues with the set-up. We have installed a similar set up on another demo aircraft to prove the modification and installation process. It will be available to you by sending your compressor to us so we can install the larger pulley ring. Other than the R&R of the compressor, this is not a do it yourself or locally available process due to the special pulley and machining process. It will be returned modified and accompanied by a longer belt. New compressors are not all that expensive, so you might consider having the mod done to a new one and keeping your current compressor for a spare since the mod will cost the same whether we do a new one or yours. Using a new one would give you a spare on the shelf. Pricing is still being formulated. Call Kim for an update in a couple of weeks.



Evolution main gear shock strut Improvements

Along with the gross weight increase Lancair has been working on an improvement for the main gear shocks, and these are now available to all owners. We have tested a new seal and sleeve set-up which allows the shock to handle more nitrogen pressure. Current standard pressure in the old shock (PN:432-0007) is 250psi nitrogen. The new shocks (PN:432-0036) will be pre-set at 275psi with a max of 300psi. The new shocks are now available on all new kits (post June 1) and current Evolution customers may have their shocks up-dated at this time. There is an exchange program for the up-dated shocks, if you would like your shock updated and overhauled remanufactured, or you may purchase new one. The remanufactured, up-dated shock will have a manufacturer's 1 year warranty. Those customers up-dating to the new shock will have to amend their POH, (VII-10). Please contact KCI for availability and timelines. New shock PN:432-0036, $1495.00 EA.

Remanufactured shock with 1 year warranty $395.00 EA. (exchange).

EVOLUTION *owner's*
newsletter
July 2015

Garmin G900x v14 Software "anomaly"

Version 14 of the Garmin G900x software contains a previously removed function that shows your TAS as a Mach number at .4 Mach and above. Although fun to look at, it's not very useful to the Evolution pilot. This "feature" was previously removed but has found its way back into v14. It is not user selectable, so we have asked that this oversight be corrected. But if you have installed v14 you get the Mach number until v15 comes out.

Cleaning Products Update

A couple years ago we found and recommended the MetalWax Stainless Cleaner process for your PT6 exhausts. The producers of that product found themselves unable to ship it in individual sets due to Hazardous Material shipping regulations and we no longer carried it. The same product is now being distributed by RealClean Products. They buy it in large "ship-able" quantities and re-package it as the NewStax Exhaust Polishing System. It is the same product. It works perfectly if you follow the directions (EXACTLY) and comes in a boxed kit with instructions, towels and applicators for $199.95 from KCI. Still available from us is the Metalwax aluminium spray polish for oxidation removal on your polished spinner. You have seen us use these products on the show planes and they are simple to use and extremely effective. Another great product that we are carrying from RealClean is their Turbine Soot Master soot remover. It is every bit as good as the Thor we used to recommend (again off the market due to small quantity "Haz Mat" shipping problems) and this is also stocked by KCI at $28.95. KCI is also carrying RealClean Approved De-ice Boot Prep (removes old sealant and cleans the rubber, $24.95) and Boot Sealant (New seal and shine $42.95). If you have moved to the BE Aerospace Boots for your ice protection, these products will help you properly maintain them.

We still recommend and use all the Mother's products for wax and "show shining" your finish, and their leather products to maintain your interior. I became a "Mother's believer" when attending the Barrett Jackson auctions and saw owners polishing cars worth (literally) tens of millions of dollars with Mother's products. (They probably got it free….) Buy it at your local auto parts store.

Back Issues of these newsletters

If this is your first Evolution Newsletter or if you would just like to review the past issues, you can download them at: Click here

Comments and responses please email:
dougm@lancair.com