LOBO Maintenance

MAINTENANCE CLINICS

A written critique by those attending the Lancair/LOBO Fly-In at Branson, MO in October indicated that we should continue to schedule maintenance clinics around the country, in spite of the fact that we were not able to gather sufficient attendance to conduct any of the four clinics scheduled during 2011. We will continue to try based on your inputs. Please let me know at rpastusek@htii.com what you'd like to see, the location or area of the country, and if you'd be willing to host a clinic at your facility.

LANCAIR/LOBO FLY-IN - Nose Strut Maintenance Presentation

In spite of my best efforts to put on the best presentation at the Branson Fly-In, I must report that the ladies' fashion show was the top-rated event for the fly-in, and that my offering on hydraulic actuator maintenance and nose strut servicing was rated well below the fashion show. I'm not sure what this says about LOBO member interests and focus, but that could be a subject for another time… There were enough follow-up questions and emails from my talk/demonstration to indicate the need for more information on strut testing and servicing, so here's my best shot.

Chris Zavatson provided an excellent write-up for our use at Branson on overhauling the hydraulic actuators used in Lancairs that have hydraulic systems. We dis-assembled a nose gear actuator during the presentation using Chris' detailed instructions and discussed the finer points of replacing the multiple fragile seals in these units. If you didn't get a copy of Chris' instructions, write to me at the above email address and I'll send you a copy. This should be part of your reference data base if you're maintaining your own Lancair.

We also disassembled an ESCO nose strut from an IV-P to observe its multiple internal components and functions. Lancair has continued to maintain and upgrade these units for all owners, but does not sell replacement components or seals for owner-servicing. Lancair has also developed a form/fit/function replacement strut that is superior in design to the ESCO struts that are no longer being manufactured. Because there are at least a couple thousand ESCO struts still in use, I'd like to pass on some servicing/testing recommendations that can help you maintain it, and to decide whether to send your strut back to Lancair for overhaul or upgrade.

The ESCO struts used on both 2- and 4-seat Lancairs (after the 200-series) have received three major modifications over the years. The first was to add an internal "centering" cam to straighten a cocked nose wheel during gear retraction. This centering cam functions as the strut fully extends when the nose wheel lifts during takeoff. The second was to change the dimensions of the parts making up the shimmy damper to allow the bottom of the strut (and nose wheel) to pivot 60 degrees either side of center, as compared to 45 degrees of pivot with the unmodified parts. Fifteen degrees of additional pivot doesn't sound like much, but it's enough to allow you to lock one main wheel and pivot around it—something you can't do with a 45 degree pivot limit. The third change was to add an external bracket at the base of the strut. Two versions are in use. The original requires flange removal to install. The newer version is a two piece design that can be mounted externally.

The pivot limits in both original and modified struts are established by an internal plate that's attached to the strut piston with two very small (#4) hardened cap screws. This plate fits between the piston and the cylinder wall, and serves to restrict oil flow from one side to the other when the piston (with the wheel attached) pivots within the cylinder. The cap screws can be sheared by pivoting the nose wheel beyond the mechanical limit (either 45 or 60 degrees). While the screws should hold during normal taxi and maneuvering with a hand tow bar, they are easily sheared by a tractor with tow bar exceeding the wheel pivot limits. Shearing of the screws is not visible from the outside, nor will it cause an external leak, BUT THE SHIMMY DAMPENING FUNCTION OF THE STRUT IS TOTALLY LOST. Lancair can provide a pivot limit decal, or you can make your own, but this, along with a "Hand Tow Only" decal are recommended if anyone but you will move the aircraft.

I recommend the following tests to: 1) determine if you have the self-centering device installed in your ESCO strut, 2) determine whether the shimmy damper is functional, and 3) determine the pivot limits of your nose strut. The instructions below assume you have the strut installed on an aircraft.

You can test your strut "on the bench" by replicating the steps noted below with the strut in a vertical "normal operating" position. You can also accomplish the damper test without deflating the strut and removing the Schrader valve. You will need two flat metal plates (steel or aluminum thick enough not to flex) with grease between them. Place the greased plates under the nose gear and allow the aircraft weight to rest on them. Start at step 5 below, and adapt steps 6-11. For the full proceedure:

1. Jack the aircraft to fully extend the nose strut.
2. Remove the cap from the Schrader valve, about 1/3 down from the top, on the front of the strut.
3. Carefully release the nitrogen gas by depressing the Schrader valve; then remove the valve.
4. Centering Test:
	1. With the aircraft secured from falling, grasp the nose wheel and attempt to pivot it.
	2. If it pivots with some resistance WITHOUT rising up into the strut, your strut doesn't have a centering mechanism installed. If it rises up while pivoting, you likely have a centering mechanism installed.
	3. If it doesn't pivot, place a block under the nose wheel to compress the strut at least 1 ½".
	4. Again attempt to pivot the nose wheel. It should pivot with some resistance caused by the seals and dampening mechanism.
	5. Turn the nose wheel 15-20 degrees left or right and remove the block supporting it.
	6. The strut should fully extend and pivot to straight ahead if a centering mechanism is present. You may have to give it a bit of a nudge to offset the lack of pressurization, but the extension and centering should be definite.
5. Shimmy Damper & Pivot Limit Test:
	1. Again place a block under the nose wheel to fully compress the strut. This should cause just a bit of oil to be ejected from the Schrader valve opening. If no oil is visible, service with heavy duty motorcycle strut oil to the level of the Schrader valve when the strut is vertical and WHEN THE STRUT IS FULLY COMPRESSED. Do not over-service the strut with oil! [Important Note: If the strut is low on oil and you have not noticed an external leak, it's likely fluid has leaked into the hollow center of the strut tube. Confirming this requires major disassembly of the strut; the fix will definitely require disassembly and specialized tools/parts. I recommend you send the strut to Lancair if you suspect an internal fluid leak.
	2. With the strut held compressed at least 1 ½", but not fully compressed by a block, grasp the nose wheel and pivot it in either direction until it hits the internal stop.
	3. The wheel/lower strut piston should pivot with some resistance (the shimmy damper function) when twisted rapidly, and should not have a "dead band" of easier pivot when reversing directions. Any dead band movement indicates air in the damper chamber. Extend, then compress the strut fully several times to eject the air, then return to 5a and proceed again. You may need to do this 2-3 times to eliminate all the air if the strut was initially low on oilIf it pivots freely/with minimal resistance, or does not hit a stop (can be pivoted more than 60 degrees) the internal damper plate screws are likely sheared, and you have no functional shimmy dampening.
	4. If you hit stops in both directions, use a compass to determine if you have a strut with 45 or 60 degree pivot limits.
6. Remove the block under the nose wheel and reinstall the Schrader valve.
7. Measure the strut full extension distance and record for use below.
8. With the strut fully extended, re-inflate to 250-300 PSI (200 PSI for L320 & L360 nose struts) (The use of nitrogen is strongly recommended.)
9. Lower the jacks and set the aircraft back on the nose wheel.
10. Bounce it a bit to compress the strut and measure the extension. A compression of 1" to 1 ¼" from full extension is good for the 3-series, IV series and Legacy aircraft nose struts; 1" to 2" for the Legacy main struts.
11. Add or release pressure as required to achieve this extension with weight on the strut/wheel. Removing weight from the strut/wheel is recommended when adding nitrogen. See "*Method for Servicing Nose and Main Gear Struts on Lancair Legacy,ES, and IV with ESCO Struts"* by the Lancair Corporation for more detailed servicing instructions.

A lot of Lancairs are flying today with no centering and 45 degree turn limits. Upgrade to the newer capabilities is up to you. If, however, you determined that you don't have active shimmy dampening, I'd encourage you to send the strut to Lancair for repair/overhaul. Without a functioning damper, it will shimmy sooner or later. Several Lancairs have been damaged by nose wheel shimmy. It usually cracks the engine mount at a minimum, and has dumped the nose on the ground during landing rollout of at least two aircraft when a major component broke as a result of shimmy.

I'll leave you with a couple more servicing tips. Don't try to taxi your Lancair with a flat nose strut. The prop clearance is so little that you're asking for a strike. If you attempt to take off with a flat nose strut, you'll have to accelerate to a higher speed before you can raise the nose to take off attitude. A flat strut is often accompanied by oil leaking around the wheel. This indicates failed seal/seals in most cases, and dictates removal and return to Lancair for overhaul/servicing in any case. A flat strut without oil present almost always indicates failure of the Schrader valve/valve base gasket. Fix this by checking the oil level per instructions above, replacing the valve (it's a special high pressure unit; available from Aircraft Spruce), replacing the base gasket if needed, and re-inflating with nitrogen. If it goes flat again, look for a crack in the strut assembly. The only ways the nitrogen can get out of an inflated strut are 1) through the inflation valve/valve base, 2) around the seals in the lower part of the strut (always accompanied by oil), 3) around the safety-wired bolts on the front of the strut (always accompanied by oil), 4) damper key screw retainer O-rings (inside the strut), and 5) a crack in the strut piston or cylinder (4 & 5 may or may not be accompanied by oil).

As with Chris Zavatson's hydraulic cylinder overhaul instructions and the above, we'll continue to provide maintenance information and advice that we can collect, validate and post. This instruction, with accompanying pictures, will be available on the LOBO web site by the time you read this. In many cases assistance may be a referral to an experienced Lancair builder/flyer who has agreed to contribute his time/talent. Note that in all cases, this information is provided as a courtesy and on a voluntary basis. Neither LOBO nor the providing individuals take responsibility for the accuracy, completeness, or applicability to your problem. We'll continue to try to "formalize" this information as we gather and catalogue it, but it's always for you to assess and use as you think best.

Bob