**Lancair IV Landing Gear Operation**

Gentlemen,

Without reflecting on the cause of the most recent IV-P loss, I was asked to review the operating principles of the Lancair IV landing gear system for those of you that did not build your airplane. Hopefully this knowledge will help you if you should have difficulty with the landing gear--which, by the way, has a different operating principle from the Legacy and 3-series Lancair aircraft.

The landing gear in the IV-P is hydraulically operated by an electric power pack (a pump/reservoir assembly commonly used to control boat lift/tilt out-drives). Hydraulic fluid is circulated from the pump to a gear/flap control on the center vertical instrument console in the cabin. The gear handle is actually a hydraulic valve that switches fluid flow between the “up” and “down” sides of hydraulic actuators that are attached to the two mains and the nose gear.

With the landing gear handle in the UP position and the hydraulic system pressurized, all three gear are retracted and held up by the 1000 PSI system pressure. There are no up-latches for the gear. If you lose hydraulic pressure in the system for any reason, the mains will “free-fall” to a partially-extended “trailing” position but will not fully extend because to extend enough to lock down, they must move forward (against an air load). NO AMOUNT of maneuvering, touch and gos, or flying around will fully extend the mains, and they WILL fold back into the gear bays at touchdown if partially extended. No exceptions. The only way to fully extend the main gear is to apply hydraulic pressure to them, either by restoring the electrical pump to normal operation, or by use of the emergency hand pump that's mounted between the front seats to manually pump fluid into the main gear actuators. There are several things that need to work as designed for the gear to extend and lock down, so testing of the emergency gear extension--both on jacks and in-flight-- should be one of your required condition inspection items.

The nose gear is equipped with an air spring that extends it fully if hydraulic pressure is lost—assuming the airspeed is low enough for the air spring to overcome the air load on the nose gear. The air spring should extend and lock the gear down at 120 KIAS. If the airplane must be slowed below this speed to extend the nose gear by disabling the hydraulic system (emergency extension), it's time to replace the air spring. Once extended, the nose gear can only be retracted by restoring normal hydraulic pressure, and with the gear handle in the up position. The emergency hand pump applies hydraulic fluid only to the down side of the main actuators; it does not supply fluid to the nose gear actuator in any circumstance. So to repeat, with a loss of hydraulic pressure, you’ll get an “automatic” nose gear fully extended, if you're below 120 KIAS, and “trailing” mains. You should be able to fully extend the mains using the emergency hand pump between the front seats, allowing them to lock down automatically, but if you can't do this for any reason (e.g. one or both gear down lights not illuminated), the mains WILL retract on landing. There are no known alternatives or exceptions. By the way, if you can get the mains fully extended (green down lights), the actuators have built-in locks that should hold them fully extended, even if hydraulic pressure to the actuators is subsequently lost. Even so, if one or both of the main gear indicator lights should go out after you've pumped them down, consider a final tug on the emergency pump just before landing. If it can be pumped, do so; if it doesn’t move, you should still have fully extended mains.

All of this activity can be very distracting to your primary mission of FLYING THE AIRPLANE, especially if you've not practiced it before. So if all of this is new to you, get a qualified observer or instructor and practice emergency extensions until you can comfortably fly the airplane while working to extend the gear. It's not difficult, but does take some thinking AND careful attention.

For me, any un-commanded extension of the landing gear would be time to put the airplane on the ground and sort out the electrical and/or hydraulic problem that caused it--for several reasons. As an example, a hydraulic leak can dump all the fluid overboard quickly, and allow the pump to run continuously. In time, it will destroy itself, and has been known to catch fire--it’s not designed for continuous operation.

One other thought. Flying by the tower, or even having another airplane look you over for extended main gear is probably a waste of time, and may give you a false sense of security. Unless the observer is familiar with the IV landing gear system, he/she is not likely to identify the difference between mains that are fully extended forward and those in the trail position. They will note that the nose gear looks like it's extended (and that's what they are expecting to see), so they come to the conclusion that the mains are also “extended,” and report that to you. The gear indicator lights are a MUCH more reliable indication of safely extended and locked-down mains.

Lastly, the gear handle has an electro/mechanical “lock” built into it that SHOULD prevent it being moved out of the down position when the airspeed is below about 90 KIAS (this is adjustable, so it could be more or less). If you move the handle to UP when the airplane is on the ground and the hydraulic system is pressurized, the weight of the aircraft SHOULD prevent the mains from retracting, but the nose gear will definitely retract, dumping the nose and prop on the ground. Your checklist does require you to check that the gear lever is in the down position before applying power to the aircraft, doesn’t it?

Landing gear malfunctions are serious, and can result in major damage to your airplane even in the best of circumstances. They should not, however, kill or injure you or your passengers IF you apply your training and keep your cool. Lancairs fly well in any known landing gear configuration. So task #1 is always to fly the airplane to the scene of the crash…always.

I’d be pleased to talk to any of you either on- or off-line about this. Just drop me a note.

Bob Pastusek

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