Lancair Legacy 2000

FLYING QUALITIES REPORT

A go-someplace machine, and it's got a big engine

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If you liked the Lancairs that preceded it, you'll like the Legacy 2000 even more. The Legacy has more cockpit room, flies faster, and behaves better than the Lancair 320/360 from which it was spawned. It's a go-someplace machine with inherited control feel and airplane response. And it's got a big engine.

A 310-hp Teledyne Continental Motors (TCM) IO-550-N powers the Legacy, driving a 72-inch Hartzell constant-speed propeller. This much power in an airplane with empty/maximum weights of 1,500/2,300 pounds makes for quick takeoffs, impressive climb rates, and fast cruise speeds. You might assume such performance when you first approach the airplane. It's fast glass, sleek, good-looking.

Step onto either wing, then into the cockpit. The forward-hinged canopy opens wide and remains completely out of your way. Your second clue that Lancair built this airplane for speed comes to you through subtle tactility as you slide into a seat reclined 25 degrees. It's La-Z-Boy comfortable, but you have to either tilt your

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The Legacy's light control stick forces, stall characteristics, and zippy performance are legacies from previous Lancair two-seaters.

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head forward or get accustomed to a forward view from a "bifocal" posture. The seat is fixed, but Lancair says the rudder pedals adjust to accommodate pilots up to 6-foot-5.

The cockpit is advertised as 43.5 inches across, and it's noticeably wider than the 320/360. Inboard shoulders don't touch, but the center console limits leg space, which you may only notice when making full lateral stick displacements. The control stick has an 8.5-inch lateral travel, and thigh contact begins around 2.5 inches left or right of neutral. If you don't wear a kneeboard, full stick is attainable with a slight leg squeeze. The good news is you're not likely to need full-stick rolling efforts very often.

Longitudinally, the stick travels 12 inches. Depending on your size, full aft stick may contact your seat belt buckle. The pedals travel approximately +/- 1.25 inches. Toe brakes are standard.

Instrument and switch layout is fairly conventional. The demonstrator is IFR-equipped and has plenty of unused instrument panel real estate. The electric landing gear switch and indicator lights are just below the glare shield. Reachable from either seat, the conventional throttle, propeller, and mixture vernier controls occupy the bottom center of the instrument panel, below the radio stack.

The center console is home to the aileron trim rocker switch, rudder and elevator trim indicators, and the fuel selector, which can select either wing tank but not both. The fuel selector is clearly labeled, but the lever points left when the right tank is selected. You actuate rudder and elevator trim through four buttons atop the control stick grip. The trim systems could be clue number three to the speed pursuit. Each trim repositions the control surface rather than deflecting a drag-producing trim tab.

Let's Get Going

Just a nudge of throttle starts the Legacy rolling on pavement in light wind conditions. Idle keeps it taxiing at a brisk pace, or tap the brakes occasionally to keep the speed appropriate for congested ramps. Steering is predictable and accurate through differential braking.

Solid material at the canopy's leading edge obscures the forward field of view (FOV) while taxiing with the canopy open. Taxiing with the canopy lowered—but not closed to allow for cooling—improves the FOV. The cowling is just about on the horizon, so S-turns or co-pilot assistance is necessary to completely clear the taxiway ahead.

Takeoffs in light wind on a typical

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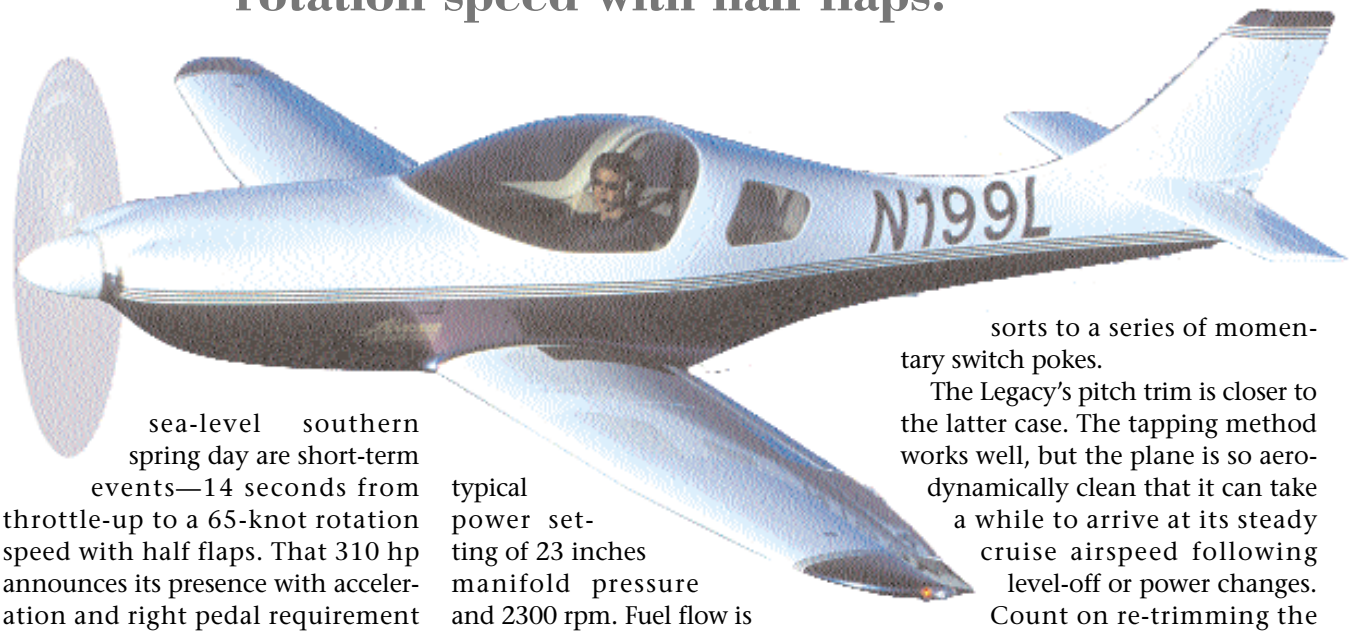

sea-level southern spring day are short-term events—14 seconds from throttle-up to a 65-knot rotation speed with half flaps. That 310 hp announces its presence with acceleration and right pedal requirement for centerline tracking, even with all three tires still on the runway. With the trims properly set, the stick pull is 5 to 7 pounds for the rotation, the highest stick force needed throughout the takeoff evolution. Figure about 20 pounds of right pedal for balanced flight during the initial climb-out.

This is a get up and go airplane. The altimeter is the most dynamic instrument in the cockpit during full-power climbs. A timed climb through an estimated 3,000-foot density altitude measures almost 2,200 feet per minute with two pilots and full fuel. Naturally, you can't see ahead with the plane's nose high enough to keep the speed at the 140-knot VY (best rate of climb speed).

Speed Anyone?

Count the impressive climb rate as clue number four in the "what's my speed" game; now you're ready to learn the real answer. The airspeed indicator shows 205 knots (218 true) in level flight at an approximate 4,000-foot density altitude with a typical power setting of 23 inches manifold pressure and 2300 rpm. Fuel flow is 13 gallons per hour. With 75-percent power the Lancair speed merchants say 240 knots true airspeed at 8,000 feet is a typical cruise situation.

In level flight the look-down over the nose is about 5 degrees. With your eyes about 3/4-chord back from the wing's leading edge, the look-down ahead of your wing is in the neighborhood of 60 degrees, and 20 degrees when looking cross-cockpit. Laterally you can see most of your side's horizontal tail and the outboard quarter of the other one. The clear canopy lets you see above and back to around 40 degrees aft of straight up. Not bad for a low-wing cruiser.

Airplanes capable of a wide airspeed range face a Goldilocks challenge when using a single-speed electric trim motor. A trim motor speed appropriate for cruising speeds can be too slow in the landing pattern, requiring patience and a dedicated finger for the duration. A trim motor speed that feels right around the pattern can be too quick at faster airspeeds, resulting in aggressive airplane responses, unless the pilot resorts to a series of momentary switch pokes.

The Legacy's pitch trim is closer to the latter case. The tapping method works well, but the plane is so aerodynamically clean that it can take a while to arrive at its steady cruise airspeed following level-off or power changes. Count on re-trimming the other two axes following an airspeed change, too.

No Carpal Tunnel Here

The Legacy's apparent sensitivity to pitch trim inputs may not be entirely due to the trim motor's speed. Small longitudinal stick inputs can also generate an immediate pitch response. It takes less than 1 pound of stick force (breakout force) to elicit a pitch response from the airplane. A light touch is warranted if your intent is to ease the nose up or down. Not difficult in smooth air, and the learning curve is fairly steep.

In light chop you feel the bumps more as heave (pure up/down) rather than pitch attitude upsets. Turbulence might cause small bank angle changes, but the airplane's neutral spiral stability means it tends to remain at a bank angle rather than continue to roll off. You may get a yaw wiggle response as well from the chop, but the neutral dihedral effect keeps it restricted to the yaw axis; it does not couple into a rolling response.

Describing the Legacy's pitch sen-

Fast cruise speeds and impressive climb performance may not surprise you based on the Legacy's sleek, "fast glass" design.

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sitivity and turbulence response with words makes flying this airplane sound uncomfortable. It isn't.

Lateral breakout is also less than 1 pound. Typical cruise roll rates can be had for less than 1 inch of lateral stick displacement. This sounds like pinkie-up flying, but the stick force increase provides a reasonable feedback cue when making cruise turn lateral stick inputs. This small displacement requirement lets you perform normal airway turns without any stick-leg contact.

The Legacy pilot will be the judge of whether the stick forces are too low, but here's a final glass-half-full remark: The light breakout and low follow-on stick force requirements match the pitch case, making for a well-harmonized control stick feel. The airplane has no noticeable adverse yaw during cruise turns, and an IFR-level heading roll-out accuracy can be accomplished with your feet off the pedals.

The airplane exhibits positive static and short-term dynamic pitch stability at cruise speeds. Maintaining 185 knots with the plane trimmed for 205 takes a 2- to 3-pound stick pull. A 3-pound push holds the plane at 220 knots. Redline is a whopping 272 knots.

Maintaining level flight in 30-degree-bank turns requires finesse. The trick is to delay applying any back-stick until you establish the bank angle. Then ease in a little more than the 1-pound breakout. Reverse the procedure when rolling out of the bank.

Dynamically the Legacy's short period is deadbeat, meaning the plane does not oscillate in pitch after aggressive forward or aft stick inputs. It responds immediately and substantially, then stops pitching as soon as you stop making stick inputs—good for playing fighter pilot.

Full-stick rolls from a 30-degree bank in one direction through 30 degrees the other way takes just under one second. The average roll rate here is about 70 degrees/second (deg/sec). Full-stick takes less than 15 pounds of stick force. Rudder coordination during this kind of aggressive rolling is optional because of the essentially absent adverse yaw and neutral dihedral effect. According to Lancair, 360-degree rolls take as little as 2.5 seconds.

The character of the cruise-configuration stalls is the same as the 320/360 line. The Legacy has no traditional buffet warning, but Lancair offers optional stall strips designed to provide a warning buffet. Stall

warning without the strips is pitch attitude, propeller percussion, and stick force.

Stalls at idle power have the nose about 10 degrees above the horizon at the stall when approaching the stall slowly. You can feel the percussion slowing through 80 knots. The back-stick force increases steadily as the airspeed decays, but it never exceeds 10 pounds. You'll also need some right-stick at the slower speeds.

The stall occurs abruptly, even during a slow deceleration, just above 70 knots at a 20-degree pitch break and a wing drop of as much as 50 degrees. The wing drop direction seems to depend on the airplane's sideslip condition when the stall occurs—not unlike many other airplanes.

Recovery is immediate with back-stick relaxation. Altitude loss depends, in part, on how far the wing has dropped. The larger the wing drop, the greater the altitude lost during the recovery. Control forces remain light throughout the maneuver.

Gear & Flaps

You can lower the flaps (VFE) at 122 knots, and a 20-degree deflection results in a slight nose-right yaw that self-corrects before the configuration change is complete. (This could be the result of a slight asymmetric deflection unique to the demonstrator.)

If you drop the gear and finish lowering the flaps to 40 degrees, you'll be pleasantly surprised at the minimal trim change. Maintaining level flight throughout this configuration change is easy with the stick pull slowly increasing through 5 to 6 pounds as you decelerate through 100 knots.

Lancair recommends a 90-knot final approach speed, which the Legacy will maintain in level flight at approximately 3,500 feet density altitude with 15.5 inches manifold pressure and 2350 rpm. The FOV here is about the same as it is when cruising with the plane's nose a little higher—just below the horizon.

It still has light breakout forces in pitch and roll, but the airplane's response to stick inputs seems well suited to the applied control force. Large control displacements are not necessary for sufficient landing pattern maneuverability. The Legacy feels honest under these flight conditions.

The stick has a 3/4-inch lateral centering band, meaning the stick remains anywhere you leave it within 3/4 inch of its neutral position. Laterally displacing the stick and then allowing it to return toward neutral can leave the airplane with a 5- to 10-deg/sec residual hands-free roll rate.

The same is true in pitch, but the residual initial hands-free pitch rate is about 2 deg/sec. Generally this goes unnoticed in the visual landing pattern, and a stick tap here and there brings the rates to zero.

You can still ignore the rudder pedals if you want. The dihedral effect remains neutral, and the adverse yaw is minimal.

Static longitudinal stability is positive, but the control system friction that causes the residual pitch rate seems to create a 10-knot trim speed band. If you fly hands-free, the airplane maintains any speed within 10 knots of the airspeed it's trimmed for. At speeds faster or slower than the trim speed band, the Legacy shows shallow but positive stability. For example, it takes a 2- to 3-pound pull to fly 75 knots and a 2- to 3-pound push to fly 110 knots when trimmed for 90 knots.

In the landing configuration level turns feel about the same as cruise. Roll, and then pull just a hair harder than the breakout force. Lateral control system friction can influence the spiral stability, but the demonstrator remains at whatever bank angle you establish without having to maintain any lateral stick input (that is, neutral spiral stability).

Maximum average roll rates are in the 40 deg/sec range, which should be plenty to handle crosswinds. Stick forces are low enough for one-hand displacements, even full-stick displacements should that rogue gust be encountered.

Stall warning in the landing configuration is more subtle than the cruise warning in that the pitch attitude at the stall is only about 5 degrees nose-up. The other secondary cue is approximately 7 pounds of back-stick force just prior to the 61-

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Lancair Legacy 2000

The successor to Lancair's original 200/235, then the 320/360 (more than 250 flying), the Legacy carries on the company's trademark styling while making significant improvements in performance, utility, and ease of construction. With a 310 hp Cont. IO-550, the Legacy cruises at 276 mph at 8,000 ft.

Span (ft.)	**25.5**	**Range (sm.)**	**1200**
Area (sq. ft.)	**82.5**	**Takeoff Distance (ft.)**	**800**
Aircraft Length (ft.)	**22**	**Landing Distance (ft.)**	**900**
Gross Weight (lbs.)	**2,200**	**Max Speed (mph)**	**300**
Empty Weight (lbs.)	**1,400**	**V_{CR} (mph)**	**276**
Payload Weight (lbs.)	**404**	**Stall Speed Land (mph)**	**67**
Fuel (gals.)	**66**	**Rate of Climb (fpm)**	**2,200**
Number of Seats	**2**	**Service Ceiling (ft.)**	**18,000**
Cabin Width (in.)	**43.5**	**Kit Cost**	**$42,900**

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knot stall speed if the stall is approached slowly without re-trimming from the 90-knot final approach speed. Again, you'll have to feed in a little right-stick at the slower speeds.

Despite the higher angle of attack, the dihedral effect is still neutral, so rolling the airplane with the rudder is not an option. Conventional aileron use for roll control works fine, and all controls continue to function with plenty of authority throughout the approach to the stall.

The stall is a 10- to 15-degree pitch break, and the wing can drop a similar amount. The stall event occurs fairly suddenly, but normal recovery reaction gets the plane flying again immediately.

Idle-power approach turn stalls starting from a 20-degree bank exhibit the same pitch and roll break as wings-level stalls. The stick cue is more pronounced, however, because it is almost fully aft when the stall occurs. The stick pull force is still in the vicinity of 7 pounds. Recovery from approach turn stalls is just as quick.

Landings

Around the landing pattern establishing and maintaining the desired airspeed within a couple of knots is surprisingly easy. You can overcome the trim speed band and shallow static stability with the typical stick-nudge tweaking we all do from downwind on.

To fly a normal glideslope with full flaps and 90 knots, you'll have to carry some power. Maintaining the power-on approach until you enter the round-out results in an impressive ground effect float while waiting for the speed to bleed off. During the deceleration, keeping the airplane above the centerline without ballooning does not seem to take a particularly fine touch.

The demonstrator's need for increased right-stick as it decelerates can inspire a couple of small wing wiggles as you apply the tiny lateral stick force while your pull force increases to 7 to 10 pounds during the flare. A little practice should minimize this effect.

The touchdown is firm unless finessed. Well within safe limits, but pushing the ego limits. Once on the runway the rudder remains a powerful centerline controller all the way down to turn-off speed. The pedal forces are fairly low, so use a light touch to make the minor directional corrections feel smooth.

The Legacy 2000 is an appropriately named Lancair enthusiast's airplane. Fast, good-looking, and true to its heritage. Its light control stick forces, eager responses to any input, impressive cruise speed, and stall characteristics are legacies from previous Lancair two-seaters. Throw in the dozens of handling and comfort refinements, plop one of those 300-hp engines in it, and suffer the disappointment of getting to your destination before you're done enjoying the flight.