Fixed and Fast

The Lancair line of kitbuilt singles has always been known for its sleek good looks and blistering cruise speeds. Recently, however, Lancair has come out with the first of its factory-built, FAA-certified airplanes. Now you can have the speed without the sweat. ■ You can still build a Lancair kit from the kitplane side of the company—Neico Aviation Inc.—but the emphasis these days is on the Lancair Columbia 300 and, most recently, the Lancair Columbia 400. These are the certified airplanes, built in a 140,000-square-foot facility at the Bend Municipal Airport in Bend, Oregon. Neico's kits

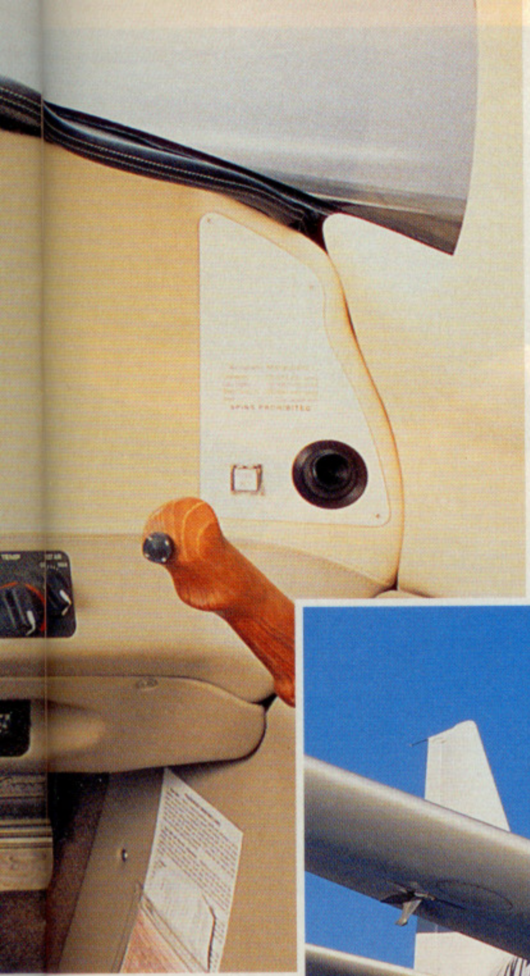
Turboprop speed and flight-level flying in a fixed-gear single

BY THOMAS A. HORNE

PHOTOGRAPH BY MIKE FIZER


N143LC


TURBOCHARGED
N143LC



come from a factory at Roberts Field in nearby Redmond, Oregon.

Due to be certified by this summer's EAA AirVenture, the 400 is a fire-breathing version of the Columbia 300. It will come with a 310-hp Teledyne Continental TSIO-550-N1B engine (a turbocharged variant of the engine powering the 300) and a Hartzell three-blade scimitar propeller. The goal is to make the 400 true out at 232 knots at 18,000 feet msl, and 245 knots at 24,000 feet msl. These turboprop-like speeds are just one aspect of the excitement surrounding the 400. Equally attention-getting will be the 400's optional instrument panel, which includes two huge (12-inch diagonal) liquid crystal displays (LCDs) providing flight and navigational information using the Highway in the Sky (HITS) concepts developed by NASA's AGATE (Advanced General Aviation Transport Experiments) program.

MIKE FIZER

The Columbia 400 looks just like the Columbia 300, and for good reason: the airframe is nearly identical. The AvroTec screens in the prototype 400 (opposite page) show Phase I display symbology. Phase II will include Highway in the Sky (HITS) symbology and do away with the trio of round, backup "steam gauges" to the right of the multifunction display.

Construction

Like the Columbia 300, the 400 is basically an all-composite airplane. The two full-span wing spars, flight control surfaces, empennage, and fuselage roll cage are of carbon fiber; the rest of the airplane uses fiberglass—with the exception of the engine mounts. Control surfaces are actuated by control rods and, together with those long, single-piece spars, convey a Mooney-like construction philosophy.

Lancair went to a lot of trouble to make the 300 and 400 airframes among the strongest in the market. The 400, like the 300, will be certified in the Utility category. To go the regulations one better, Lancair's certification tests subjected the wings to 15-G loads. The wings didn't fail at this high loading, but the test stand did. In an attempt to learn just what *would* break a Lancair wing, one of the two spars was cut in half and the test was repeated. This time a wing broke at eight Gs.

In other tests the fuselage was subjected to loads in 175 degree Fahrenheit temperatures and 80-percent humidity (to check for consistency of stiffness under extremes), and crash-tested to the tune of five impacts at up to 27-G decelerations. Lancair said that no structural deformations resulted.

These tests and more prompt Lancair to advertise an energy-absorbing restraint system capable of protecting occupants at up to 26-G impacts (the seats absorb the impact), and to boast that the 300 and 400 "are considered to be the most thoroughly tested and evaluated piston-single, four-place aircraft ever certified."

Systems

Approach a 400's (or 300's, for that matter) cockpit, and your first impression

MIKE FIZER

It looks fast—and it is—but the leading edge cuffs at the outboard wing sections make the Lancair 300 and 400 spin-resistant, and tame these airplanes' stall characteristics.

might be one of concern: How am I going to deal with the side stick? Will I overcontrol? Roll or pitch inadvertently? Not to worry. To use a hackneyed old saw, the controls do indeed "fall easily to hand," and the transition to side-stick flying is pretty much seamless.

Engine start and pretakeoff checks are conventional in all respects, but the panel and other controls take some acclimatization. Battery and avionics master switches are over on the lower left subpanel, and just above them are the fuel, engine, and electrical gauges. Directly in front of you, again on the subpanel, are the pitot heat, lighting, door seal pump, vapor suppression (activating this switch purges vapor from the fuel lines in high and/or hot conditions should fuel flows fluctuate), and fuel boost pump switches.

The Lancair 300 and 400 use a 14-volt electrical system, and air conditioning will be offered as an option.

A standby battery system is available should the 400's standard-equipment, single alternator fail. To activate it, reach down to the circuit breaker panel on the lower left sidewall, raise the switch guard, and depress the push-button switch. Now you should have 30 minutes' worth of power from the airplane's standby six-cell lithium battery pack.

The 300/400's dual independent trim controls are also worth mentioning. Electrically driven elevator and aileron trim inputs are commanded by movements of a conically shaped "coolie hat" control on top of the side stick. There is no manual trim, so a total electrical failure leaves you without trim control, and you must manage trim pressures via raw side-stick inputs. The standby battery system only powers essential avionics and lighting, so you may have to deal with an out-of-trim condition as you make your emergency/precautionary landing.

There's a trim-indicating system that consists of a set of green lights that travel vertically and horizontally in what can be considered electronic cross hairs. Move the coolie hat forward (for nose-down trim), and you'll see an illuminated green dot travel forward. This shows what you've commanded. Same deal with the aileron trim. By the way, dual installations with coolie hats on each side stick are standard, and it's possible for one pilot to command a trim movement in one axis and the other to simultaneously command a trim change in the other. Opposite trim commands along the same axis, however, cancel each other out and no trim movement will occur.

Another unique feature of the Lancair 300 and 400 is the rudder limiter system. This operates as part of the stall warning system, and is designed to reduce the chance of inadvertent spins to the left at high power and high angles of attack—conditions that could occur during a panicked go-around or missed approach. Normally, the rudder's maximum leftward deflection is 20 degrees. But when the stall warning horn is blowing and power is above 12 inches of manifold pressure, a solenoid-activated cam limits left rudder travel to 12 degrees. According to Lancair, this tames the wildest areas of the 300/400's flight envelope. As we'll soon see, you'd have to try pretty hard to get a 300 or 400 to misbehave in the stall regime.

Takeoff

Ground steering for the 300 and 400 is by differential braking, à la the old Grumman singles. Pretakeoff checks are pretty much conventional, and after selecting the takeoff flap setting and going through all the usual precautions, it's time to take the active.

Apply takeoff power and you get an earful of those turbocharged 310 horses; maybe that's why the prototype 400

MIKE HOUSKA

flown for this report—N143LC—came with Bose X active noise-attenuating headsets. The engine's automatic wastegate prevents you from overboosting the manifold pressure during takeoff, leaving you free to steer the airplane on its initial takeoff run. After a few seconds, rudder effectiveness kicks in and you don't have to use the brakes for directional control anymore.

It's during the takeoff run that you first come to terms with the 400's character. Strapped in the four-point harness, working the side stick, glimpsing those narrow wings, and waiting for the 70-knot rotation speed, there's the feeling that you wear the airplane as well as fly it. At 70, a slight tug on the stick raises the nose and soon you're in a 105-knot, 1,000-fpm cruise climb. V_X and V_Y are slower, but at their deck angles forward visibility is compromised.

The airplane seems somewhat sensitive in pitch and heavy in roll, but the main point here is that there was absolutely no problem dealing with the side-stick controls from the get-go.

Stall behavior

An ingenious cuff at the outboard wing section gives the Lancair 300 and 400 some of the most docile slow-speed and stall characteristics of any general aviation airplane. The cuff acts like a combination stall fence and vortex generator. A tight, energized vortex of air streams aft from the inboard edge of the cuff, and this prevents the spanwise propagation of airflow that occurs as the stall nears. The cuff also energizes the air flowing aft of it, which keeps the wing tips flying—and the ailerons working—at very high angles of attack.

Sam Houston, Lancair's chief pilot, eggs me on to yank the stick full aft, and then perform some turns with full flaps and idle power. The 400 shook a little, but did as told. If the nose bobbed as we nibbled at the critical angle of attack, it was really nothing to write home about. There was never a hint of a wing drop or a spin entry. On the other hand, we only performed power-off, approach-to-landing stalls, so I didn't get a chance to see the Lancair's deck angles and stall behavior in a full-power departure stall.

The 300 and 400 wing is also notable for its use of low flap- and aileron-hinge points. These promote increased airflow over those surfaces without the complex tracks and drive mechanisms that normally attend conventionally designed Fowler flaps.

Cruise

Here's the 400's really strong suit. At a pressure altitude of 13,500 feet and an outside air temperature of minus 5 degrees Celsius, Houston and I set power at full throttle and 2,600 rpm. The twin turbos maintain the Continental's 310 horsepower all the way up to 25,000 feet, so we had this airplane floored. The result? An indicated airspeed of 171 knots, a true airspeed of 210 knots, and a 22-gph fuel burn. For my flights N143LC was fitted out with a propeller normally used on the Lancair 300. Houston said that at 17,500 feet and with the 400's intended Hartzell scimitar, he's seen the 400 fly at 232 knots true while burning 22 to 23 gph.

You'd need oxygen to take advantage of the 400's best speeds, of course, and that's an option that most of the 100-odd 400 depositors have specified. Incidentally, Lancair says that some 30 of the 400 buyers originally placed orders for the Lancair 300, then changed their minds and decided to upgrade.

Flight testing and other trials have yet to be completed, but Lancair says that the 400's target specifications include a maximum 245-knot cruise at 24,000 feet (normal cruise is expected to be 220 knots at 15,000 feet), a useful load of 1,050 pounds, and a 1,050-nm maximum range with IFR reserves.

Landings

As with any airplane this slippery, you have to think well ahead to slow down and plan your descents in the traffic pattern. The 400's speed brakes can help a lot in this regard—they let you keep the power up slightly while descending at a reduced airspeed. This prevents shock cooling of the big Continental, and slows you to the flap operating speed.

My approaches were flown with full flaps and at an 80-knot airspeed. The flaps take a while to extend, but this is probably more of a blessing: What little trim changes are needed with flap deflection can be applied at a more or less leisurely pace.

Houston suggests keeping some power on during the roundout and flare, and sort of rolling the 400 on like a light jet. At idle power, he says, the propeller disk may somewhat blanket the flow of air over the tail surfaces and diminish full elevator effectiveness in the flare.

Power on or off, however, I had no trouble making acceptable landings in the 400. OK, a couple were firmer than I'd have liked, but that wasn't the airplane's fault. (Two days' worth of transition training at Bend is included in the price of a Lancair 300 or 400.)

Lotsa glass

Another big thrill of flying this particular 400 was getting the chance to see its optional glass cockpit in action. The panel is dominated by two huge LCDs—one a primary flight display (PFD), the other an MFD (multifunction display). Lancair uses AvroTec display hardware for this optional glass cockpit, and Avidyne's navigation software, which runs using Avidyne's own operating system over Microsoft Windows NT.

The PFD, situated directly in front of the pilot, contains attitude and heading indicators. Vertical tapes depict airspeed, vertical speed, and altitude information; the heading indicator can show multiple navigation sources; groundspeed and distance information is clustered nearby; and flight director and autopilot commands can be synced up with command bars and altitude bugs.

The MFD's principal use is for plan views of moving-map IFR or VFR chart displays, although it can also be set up to superimpose lightning detection symbology and—when this capability is made operational—uplinked, ground-based weather radar imagery. The MFD can be customized by the pilot to show as little or as much data as desired. In case your PFD should fail, a reversionary feature lets you put PFD information on the MFD, giving you an essential display redundancy. This is especially vital because Lancair's intention is to eventually eliminate all electromechanical and other conventional, round "steam" gauges in the future.

Power and circuitry for all these electronics are also redundant. Two alternators, two CPUs, two air data computers, two separate wiring sets, and two batteries power this impressive display suite. There are no spinning gyros in this setup; the computers do all the attitude and rate sensing.

Lancair's most ambitious goal vis-à-vis the AvroTec displays is to provide Highway in the Sky (HITS) navigation guidance. Under this scheme the pilot need only "fly" a symbolic airplane through a series of sequential rectangular boxes in order to navigate. Fly through the boxes, which translate into windows of airspace 600 feet wide by 200 feet high, and pilots can navigate—under VFR or IFR—with the kind of precision usually reserved for high-end autopilots and flight management systems. Superimposed on navigation chart displays, HITS also promises the utmost in situational awareness.

The AvroTecs in our test airplane have yet to be certified. Hopes are that the displays and the first iteration of HITS will be certified and on the options list by the time the 400 goes to market.

Price

Base price of the Lancair 400 is currently set at $349,500. The standard avionics package will include a UPS Aviation Technologies IFR suite comprising an Apollo GX60 GPS, an SL15 stereo audio panel, an SL30 nav/com, and an SL70 transponder. A BFGoodrich Stormscope and an S-Tec System 30 autopilot are also standard.

Lancair says that most customers will opt for the premium IFR package, though a price has yet to be finalized (in the Lancair 300, a premium package adds $14,200 to the base price). This features the UPS GX50 GPS, dual SL30s, and an S-Tec 55 autopilot with altitude hold and autotrim. The BFG Stormscope is also included, as is the Honeywell Bendix/King KI 256 attitude indicator and flight director, and KCS 55A slaved HSI system.

As for the monster AvroTec display setup, its price also has yet to be set—although this option is listed at $14,500 on the Lancair 300's price list.

And don't you forget it

The Lancair 400 is likely to be one of those trend-setting airplanes that other manufacturers will try to emulate. That will be a tough job because the 400's combination of good high-speed capability and exemplary low-speed traits is tough to find anywhere else. Couple that with what will obviously be the cockpit of the future and you've got a classic in the making.

The only question is: What next? A peek inside a partially assembled Lancair 400 fuselage at the factory gives a strong hint. There's enough belly room to accommodate retractable landing gear. Fold the gear on a 400 and you'll pick up at least 15 knots, no problem. That could push the 400's max cruise speed close to that of the 290-knot, pressurized Lancair IV kitplane, and make it *the* fastest production piston single. Stay tuned as we follow the Lancair 400 through to its ultimate expression. □

Links to additional information on Lancair may be found on AOPA Online (www.aopa.org/pilot/links.shtml). E-mail the author at tom.horne@aopa.org

Lancair Columbia 400
Base price: $ 349,500

Specifications	
Powerplant	Teledyne Continental TSIO-550N1B, 310 hp
Recommended TBO	2,000 hr
Propeller	Hartzell three-blade scimitar, constant speed, 76-in dia
Length	25 ft 2 in
Height	9 ft
Wingspan	36 ft 1 in
Wing area	142 sq ft
Wing loading	24 lb/sq ft
Power loading	11 lb/hp
Seats	4
Cabin width	49 in
Cabin height	51 in
Empty weight	2,350 lb
Maximum gross weight	3,400 lb
Maximum useful load	1,050 lb
Payload w/full fuel	462 lb
Fuel capacity, std	100 gal (98 gal usable) 600 lb (588 lb usable)
Baggage capacity	120 lb

Performance	
Rate of climb, sea level to 18,000 ft	1,200 fpm
Cruise speed, target, 24,000 ft	245 kt
Cruise speed, target, 18,000 ft	232 kt
Maximum operating altitude	25,000 ft

Limiting and Recommended Airspeeds	
V_{FE} (max flap extended)	119 KIAS
V_R (rotation)	70 KIAS
V_{S1} (stall, clean)	71 KIAS
V_{SO} (stall, in landing configuration)	57 KIAS

For more information, contact Lancair Aircraft, 22550 Nelson Road, Bend, Oregon 97701-9710; telephone 541/318-1144; fax 541/318-1177; or visit the Web site (www.lancair.com/certified).

All specifications are based on preliminary and incomplete manufacturer's calculations.