COOKER

Pumping up the state of the art in kit aircraft

BY MARC E. COOK

Here's a recipe we can all understand. Take one airframe, sleek and stout and constructed of high-tech composites. Add power. Plenty of power. Okay, now add just a bit more. There, that's it; about 350 of those galloping quadrupeds ought to do. To make sure they have lungs, consult Chef Garrett's recipes on unnatural aspiration. Fold in a wing sharp as a Ginsu knife, but no more than 100 square feet of it. Pressure-cook the dish at 5 pounds per square inch, and leave it on the heat for about 2,500 hours. ■ What emerges from the builder's kitchen at the end of that interval will be something like the Lancair IV-P, the latest iteration of Lancair International's most anticipated kit airplane. Even as the first Lancair IV circled the states beginning in 1991, breaking speed records and turning heads, company founder Lance Neibauer began penciling the pumped-up version. Now, four years after the original IV arrived, we have the IV-P. It is without question the most sophisticated and superlative kit airplane extant. ■ In case you missed all the hoopla surrounding

PHOTOGRAPHY BY MIKE FIZER


N106L

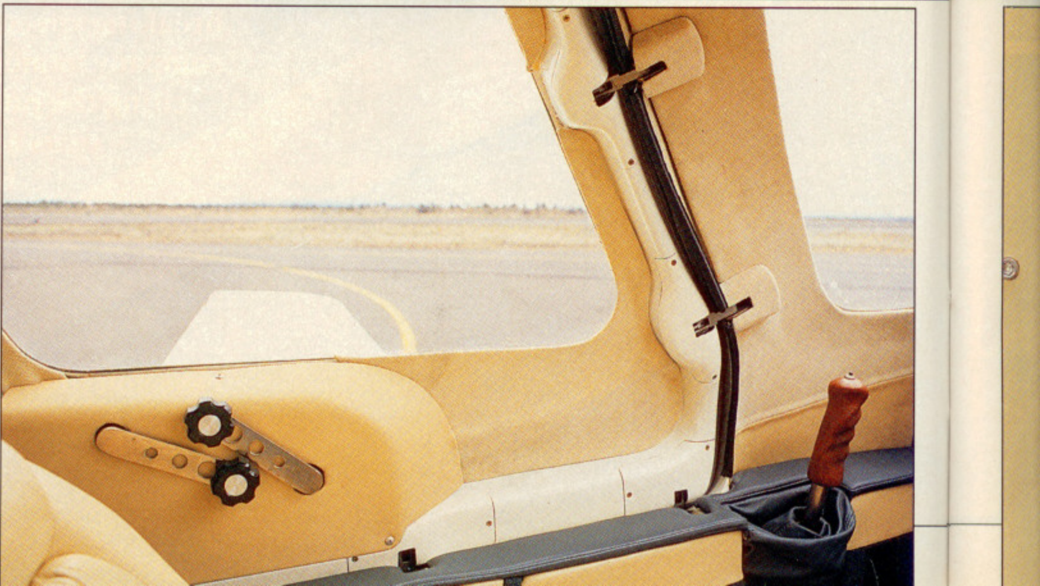
the IV's entry into the high end of the kit segment, here are its vital ingredients. A surprisingly roomy four-place cabin is perched on a laminar-flow wing of just 98 square feet. At the head of the line, find a twin turbocharged and intercooled Continental TSIO-550-B, churning out 350 horsepower through a three-blade propeller. All this rests on Cessna 210–style retractable gear and carries a maximum gross weight of just 3,200 pounds. Lancair has been selling the IV kit since 1991, alongside its two-place 320/360 series and the four-place, fixed-gear ES.

To get from the original IV to the pressurized version required more than simply rewriting the recipe. Lancair performed finite-element analysis (a computer modeling of airframe stresses) at several points in the IV-P's gestation and expended considerable engineering talent sealing up the IV's structure. Actually, a composite airframe lends itself well to pressurization

The door required a multi-latch system that's unlike the common p-airplane arrangements.

because it has a contiguous structure, without rivet gaps and with predictable stress distribution. Neibauer says, "I can't imagine pressurizing an aluminum airplane. [With the IV-P,] the thought was that this was going to be pretty simple to seal it because we've got basically a thermos bottle here."

Indeed, with judicious increases of carbon-fiber ply thicknesses out of the way, the most difficult tasks turned out to be sealing the large, left-side door and countering pressurization's effects on the control system. The door required a multi-latch system that's unlike the common p-airplane arrangements. Neibauer says, "On a big airplane, you can get a very rigid frame [around the door], and then all you need is shear pins because all you have are shear loads. Well, we have a combination of shear loads and membrane stress. Everything is flexing and moving like a balloon, so you can't have a shear pin because it has to physically lock. So the latches we have



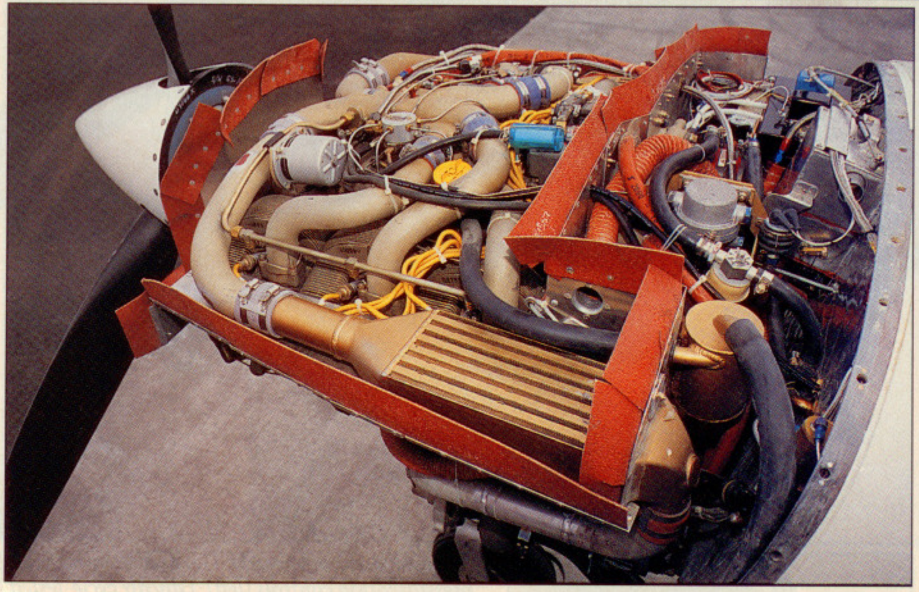
now reach around [the frame], grab, and pull in." The door is opened with a pair of handles, one controlling the latches along the front and rear edges, and the other sequencing the bottom latches of the top-hinged door. An electrically pumped up pneumatic gasket seals the door.

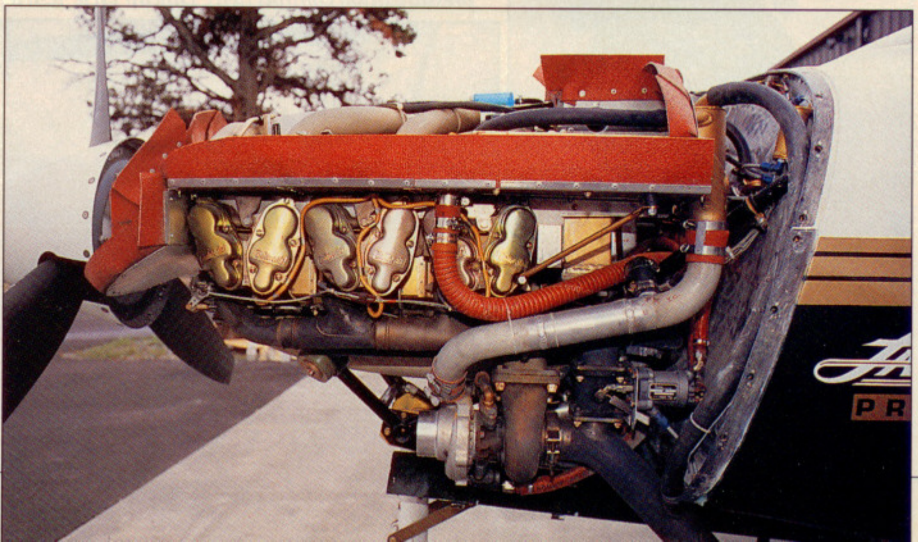
Although the standard IV has a baggage bay accessible from the cabin, the P's seat bulkhead forms part of the pressure vessel, leaving a small hat shelf inside. Baggage rides in the unpressurized tailcone. In addition to the new door, the P sports thicker windows and heftier pillars; however, the windshield side pillars are massive, taking something away from the normally panoramic view afforded by the IV.

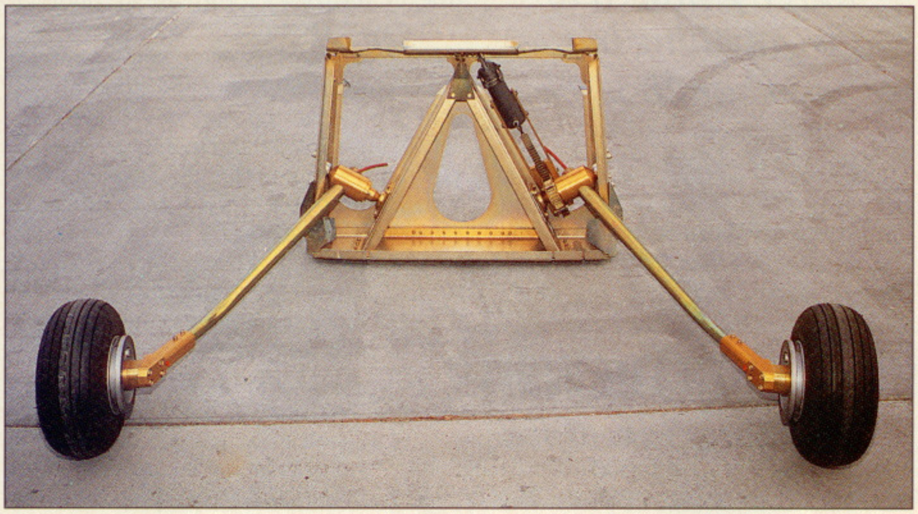
Lancair essentially left the IV's pushrod control system alone but had to make some additions in deference to pressurization. In a perfect world, anything that must penetrate the pressure vessel would have a rotational movement like a torque tube or low surface area like a typical control cable. Instead, the IV-P's ailerons and elevators are actuated by hefty push-pull rods (the rudder is cable-driven) that require boots to keep cabin pressure from leaking away. Those aileron pushrods are relatively easy to seal, with no serious functional drawbacks to booting them because their movement self-cancels with regard to cabin pressure. Not so with the elevators. Lancair had to come up with a small device that samples overall cabin differential and applies a slight nose-down movement to offset the boots' nose-up influence; the boots fill with cabin pressure and expand, moving the pushrod to which they are attached. In flight, you notice a slight stiffening of the controls, about as pronounced as a Cessna P210's or Piper Malibu's.

Much of the pressurization system would be familiar to the Malibu pilot; however, the IV-P's performance is something else. Consider these numbers: As tested, the IV-P sports a power loading of 9.1 pounds/horsepower and wing loading of 32.7 pounds/square foot. Keep those figures in mind, as they are a clue to the IV's flight characteristics.

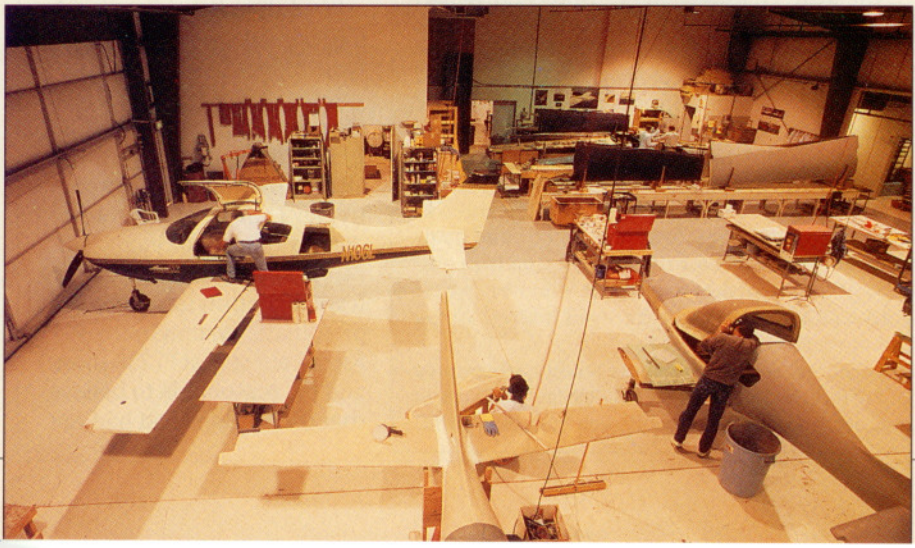
Which is not to say the IV-P is difficult to fly. Armed with some expectation of the Lancair's manners and a healthy dollop of respect for the installed power, the IV-P seemed, to me at least, a more forgiving, commu-







A Continental TSIO-550-B nestles into Lancair IV-P's roomy cowl (left); the prototype's packaging is quite well done. Prefabricated main gear structure (above) gets bolted and bonded into the IV's belly by the builder.



nicative, and docile airplane than the non-pressurized IV. Credit a farther forward empty center of gravity, as well as the effects of adding fuel capacity to the forward wing bays, and the P's greater overall weight, say the Lancair staffers.

Company demonstration pilot Mike DeHate and I had clearly waited a day too long for the flight. Photographer Mike Fizer and I arrived the day before and spent most of the time snapping pictures, asking questions, and touring the Lancair facility. One day later, central Oregon was engulfed in low clouds and rainshowers; IFR conditions prevailed. Undeterred, DeHate planned a round-robin flight to the Portland area from Lancair's Redmond, Oregon, base. We aimed high: Flight Level 230.

In all, this proved to be an ideal test of the airplane's mettle—to say nothing of DeHate's. Give a pilot a high-flying pressurized steed, and you can bet it'll spend time in weather. Considering the investment of time and money, the IV-P becomes far more than a sunny-day fly toy.

Startup and taxi-out proved straightforward in the IV-P. Thanks to a decent amount of friction in the swiveling nosewheel, having to use differential braking to steer isn't particularly troublesome; you tap the brakes to set up a heading, and the airplane will hold it well. Ready for departure, you will find no unusual preflight items to deal with, save for the pressurization controls. Manufactured by Dukes, the system resembles others in production pressurized airplanes. Set the field altitude plus a small margin, and the airplane will pressurize automatically. During our flight, though, the system had to be manipulated manually by DeHate; N106L had just 35 hours on the Hobbs, and understandably, some of the systems had not been thoroughly shaken out.

One might reasonably expect a small, light airplane with all of the IV-P's horsepower to head resolutely left when you spur all 350 horses into action. It will, of course, but using nearly full right rudder and no brakes, the IV-P accelerated from a standstill without drama, and it was easy to keep it on the centerline. (A serious crosswind might call for some use of brakes at the beginning of the takeoff roll, however.) Naturally, at full power, the IV-P claws at the runway and air-

speed like a teenager at a fresh bag of Twinkies. The 65-knot rotation speed came and went quickly, and it took a greater tug on the side-stick controller to lift the nose than I had predicted. (Any first flight in a new airplane type calls for delicate handling of the controls.) Finally airborne after charging through 80 knots, the airplane settled into a 2,000-feet-per-minute climb at 135 knots indicated with the gear stowed and the 10 degrees of flaps used for takeoff just coming up. (Lancair deserves a pat on the back for marking the P's airspeed indicator in knots, rather than the usual kitplane practice of miles per hour.)

DeHate suggested pulling back to 75-percent power and full-rich mixture for the climb, mirroring Continental's recommendations. As such, the airplane climbed at better than 1,000 fpm at an indicated 165 knots; electronic engine gauges read 31 inches manifold pressure, 2,500 rpm, and 28 gallons per hour on the fuel flow. We were able to maintain this speed, rate of climb, and power setting all the way to FL230. A brief, air traffic control–mandated level-off at 8,000 feet let the IV-P accelerate to 205 knots indicated, for a true of 231 knots.

Those pilots coming from the Malibu would be impressed by the cooling characteristics of the Lancair.

Both at altitude and down low, the IV-P proved to be anything but a handful.

There are no cowl flaps, and even at the end of our climb to FL230, the hottest cylinder head temperature settled on 409 degrees Fahrenheit. Of course, the IV-P indicated a higher airspeed in the climb than the Malibu would in cruise.

Finally set up for cruise at 75-percent power, the IV-P chugged right up to 195 knots indicated, for 278 knots true, or Mach 0.46, if you care to count it that way. This particular Continental, a longer stroke version of the Malibu engine, runs cleanly and smoothly lean of peak turbine inlet temperature; set 50 degrees lean, the fuel flow came down to 18 gph on the fuel flow computer. The highest CHT noticed in cruise was 400 degrees.

At altitude, I expected the Lancair to be a bit less forgiving than down low. I remembered the words of a very experienced Malibu pilot who said that mount was "goosey" in the flight levels, despite its long, efficient wing. In fact, the Lancair flew firmly and steadily up high, with little of the roll hunting that seems to afflict some high-flying piston singles.

We didn't, however, match the claimed speeds at altitude. Lancair lists the IV-P's cruise speeds and flows for 75- and 65-percent power at 24,000 feet as 291 knots, 17.5 gph, and 282 knots, 16.8 gph, respectively. Thanks to a winding-down attitude indicator—Lancair is considering switching from a suction to a pressure pneumatic system in the P—we cut our stay at FL230 short, and it's reasonable to believe that the airplane just had not

WHAT'S WITH THE WAIT?

These things take time.

Lancair has taken considerable heat about the length of time it has taken builders to get non-factory-built IVs flying. Right now, only three ships are flying, all in essence factory projects; the third belongs to company employee Don Goetz.

What's the deal? Neibauer explains that the delays shipping the IV fuselage kits involve the company's efforts at parts commonality. After the P model was given the go-ahead, Lancair delayed delivery of fuselages (the so-called A kit, comprising the tail and wing structures, had already been shipping). Now that the bulk of the engineering and testing has been completed, the IV and IV-P fuselages, which now share many parts, are leaving the Redmond facility at the rate of about four a week. Lancair wanted to accomplish a couple of things: to establish parts and manuals commonality, which helps the builders and the company, and to fulfill the wishes of builders who were working on wings and tails and had expressed interest in the pressurized option.

Soon, Lancair expects its Singapore facility, which now makes many of the components of the 320/360 fast-build kits, to take up some of the production slack between canings. *—MEC* accelerated to full cruise in the time allotted.

As is true with any slick, fast airplane, descending and decelerating take significant planning. Consider the limitations of pressurization here, too, because you can't reduce manifold pressure more than 4 or 5 inches without losing the cabin pressure. As such, when we headed downhill at the end of the flight, the airplane wound right up to 250 knots indicated and 2,000 fpm with a slight power reduction. At one point, the GPS called out a 381-knot groundspeed.

What will likely trip up the nascent Lancair IV-P pilot is the rate at which it will gobble up ground in the terminal area. Yes, you can always throttle back, but in attempting to keep the cabin pumped up, your options are limited. The gear's low extension speed of 145 knots means that the optional speed brakes ought to be considered standard equipment. We completed the VOR approach into Redmond without a problem, DeHate kindly and frequently making suggestions to get the airplane slowed down.

Both at altitude and down low, the IV-P proved to be anything but a handful. For the pilot unused to airplanes with low power loading, the need to frequently trim in all three axes with power changes will be a surprise, as will the prodigious sink rate that follows a large backward tug on the throttle. Overall, the IV-P is moderately stable in pitch and will hold onto trimmed airspeed reasonably well.

To ensure future Lancair IV pilots are up to the task, and so that they may get insurance, the company has set up a training course with Portland, Oregon–based Flightcraft. Alongside the usual ground school and time in either the customer's or the factory's airplane, Flightcraft will have on hand a modified Frasca simulator to help work out instrument procedures before hitting the skies. In addition, Lancair will, for a fee, dispatch a company pilot to perform first flights and airframe inspections for all Lancair builders.

Quoted build time is 2,500 hours, and Lancair seems to have taken steps to simplify what is arguably the most complex kit airplane around. Main landing gear attach points are contained in an aluminum box that's prebuilt; this structure is then bonded and bolted into the airframe. A fast-build wing kit, a $7,900 option, supposedly removes about 700 hours' labor by installing the wing ribs and main and auxiliary spars. In the normal scheme of things, only the main spar comes pre-mated to one of the wing skins. Still, the builder must install control runs and wiring before closing out the wings.

As befitting its complexity, the IV-P carries a sizable price tag. Basic airframe costs run $46,900 for the unpressurized model, $66,900 for the P model, and $56,800 for a ready-for-P IV. This last option allows the builder to complete a nonpressurized airplane that needs only the additional P-model hardware; structures unique to the P are already in place, but the actual pressurization bits stay in Redmond. Lancair says that between 50 and 70 percent of the current 200-odd IV builders are constructing P models.

Add to the costs a factory-new TSIO-550-B at $45,000 or, if you want a nonturbo IV (naturally, meaning no pressurization), about half that for an IO-550-G Continental of 300 hp. With some builders specifying Bendix/King EFIS systems, it's easy to see how the costs can escalate. Figure that a professionally done panel with autopilot and current avionics will run anywhere from $25,000 for a basic setup to upwards of $50,000. Plus, paint and interior will add at least $10,000 to the total. So the bottom line will be in the neighborhood of $150,000 to $200,000, not counting the value of your time as a builder. Remember, too, that the basic building quote of 2,500 hours includes the basic airframe; custom paint jobs or shuttle-technology instrument panels will add to the time. At press time, Lancair predicted that about a dozen customer-built IVs were nearing completion.

Ultimately, though, there are some pilots who, with the serious hunger for speed and high-altitude capability, will care not at all how long it takes for this dish to jell. Having a truly lovely airplane that also can put to shame speed-wise just about everything else with a piston engine will be reward enough. It's a kind of aviating that many pilots would pay almost anything—in time and/or money—to savor. □

Lancair IV-P
Base kit price: $66,900

Specifications

Powerplant	Teledyne Continental TSIO-550-B, 350 hp @ 2,700 rpm
Recommended TBO	1,600 hr
Propeller	MT, three-blade, constant-speed, 76-in diameter
Length	25 ft
Height	8 ft
Wingspan	30 ft 2 in
Wing area	98 sq ft
Wing loading	32.7 lb/sq ft
Power loading	9.1 lb/hp
Seats	4
Cabin length	10 ft 4 in
Cabin width	3 ft 10 in
Cabin height	3 ft 11 in
Empty weight	2,140 lb
Maximum gross weight	3,200 lb
Useful load	1,060 lb
Payload w/full fuel	532 lb
Fuel capacity, std	89 gal (88 gal usable) 534 lb (528 lb usable)
Oil capacity	12 qt
Baggage capacity	175 lb

Performance

Takeoff distance, ground roll	1,200 ft
Max demonstrated crosswind component	18 kt
Rate of climb, sea level	3,000 fpm
Max level speed, sea level	297 kt
Cruise speed/endurance w/45-min rsv, std fuel (fuel consumption)	
@ 75% power, best economy 24,000 ft	291 kt/4.3 hr (17.5 gph/105 pph)
@ 65% power, best economy 24,000 ft	282 kt/4.5 hr (16.8 gph/101 pph)
Max operating altitude	29,000 ft
Landing distance, ground roll	1,400 ft

Limiting and Recommended Airspeeds

V_R (rotation)	65 KIAS
V_X (best angle of climb)	110 KIAS
V_Y (best rate of climb)	135 KIAS
V_A (design maneuvering)	170 KIAS
V_{FE} (max flap extended)	132 KIAS
V_{LE} (max gear extended)	145 KIAS
V_{LO} (max gear operating)	145 KIAS
V_{NO} (max structural cruising)	220 KIAS
V_{NE} (never exceed)	274 KIAS
V_{S1} (stall, clean)	69 KIAS
V_{SO} (stall, in landing configuration)	62 KIAS

For more information, contact Lancair International, 2244 Airport Way, Redmond, Oregon 97756; telephone 503/923-2244.

All specifications are based on manufacturer's calculations. All performance figures are based on standard day, standard atmosphere, sea level, gross weight conditions unless otherwise noted.