

# The nimble Lancair Legacy

## ZU-FCY

By Athol Franz

**The story of the Lancair began in 1985 with the revolutionary Lancair 200, an aircraft so technically advanced that it is now part of the Experimental Aircraft Association's (EAA) museum collection. The Lancair 200 revolutionised the flying experience, offering pilots outstanding performance, more freedom, increased satisfaction and better value than any other piston-engine general aviation aircraft at that time.**

Never content to rest on their laurels, Lance Neibauer and the Lancair team continued to push the envelope of the world's finest two-place experimental kit-built plane. The result was the Lancair 320/360, an aircraft so beautiful and unprecedented in design that it hung on display in New York City's Metropolitan Museum of Art. Swift, stable, tight and responsive, the Lancair 200's evolutionary heir again shook up the general aviation industry. Some 15 years after the Lancair revolution began the history of unparalleled innovation and the heritage of record-setting performance continued with the Lancair Legacy. The successor to Lancair's legendary two-place aircraft, the Legacy represents the culmination of more than a decade of research, testing and invaluable input from Lancair builders and pilots. Redesigned from the tail forward, this plane is larger, faster and easier to build.

### WING DESIGN

When the Lancair team went to work designing a new wing plan form, high expectations were set. This wing had to perform up to the tremendous top speeds that pilots expect from Lancair aircraft. However, a higher emphasis was placed on low speed handling. To keep area to a minimum, the wing has a unique double taper to maximise the lift distribution from root to tip. This also allowed the designers to eliminate all 'washout', which can compromise efficiency. This new airfoil creates extensive laminar flow across more than 50% of the surface. The low-drag laminar 'bucket' is also wider than before, further increasing overall performance. The result is a very carefully 'tuned' wing design, which enhances overall aircraft performance. Roll control had to remain light, snappy and balanced. In addition, a relatively thick cord was employed, which aids strength whilst providing room for adequate fuel (up to 66 US gallons). This wing also had to swallow the new larger 5.00 x 5 main gear tyres without gear door modifications.

Lancair's designers are pleased that the new Legacy wing exceeds all design expectations, with lower stall speed, better roll rate, improved low speed handling and higher top speeds. Ultra-high-speed cruise with a nimble roll rate of 150 degrees/second and solid, comfortable control stick forces are the result of an intense design process. At the other end of the performance spectrum, the Legacy's low-speed roll control is remarkable and the stall behaviour is 'straight ahead.' The addition of simplified fowler flaps further increases the wing's maximum lift coefficient to enhance low speed handling. This translates into the safety of slower approaches and shorter landing distances.

### INCREASED CABIN COMFORT

Inside the cabin, creature comforts, ergonomics and luxury were foremost customer considerations. A wider and taller cabin offers more shoulder and headroom. In addition, the larger canopy affords unobstructed visibility and outstanding views in all directions, which is another safety feature. The roomier baggage area makes it possible to comfortably stow everything

required for a cross-country trip, including golf bags and fishing rods. Unlike most fast singles, pilot and passenger sit in a normal upright position with headroom to spare.

### FASTEST IN THE AIR

The Legacy's spacious new fuselage did not come at the expense of speed. The type is able to accommodate a larger engine. With a 310 hp Continental 10-550, the Legacy achieves stellar performance, by cruising at 280 mph (243 knots) at 10 000 feet. In addition the Legacy's climb rate of +2 200 fpm will outperform most aircraft types in its class.

### DESIGN

Every aspect of the Legacy has been methodically designed and engineered, from the kit assembly process to flight characteristics. Detachable wing panels are just one example. To trailer the aircraft to an airport or to the paint shop, the wings can be removed whilst the aircraft remains on its landing gear. Lancair also works closely with the engineers at Teledyne Continental Motors and Textron Lycoming, Hartzell and MT-Propellers to refine the power plant installation and to perfect the union of engine and propeller to the airframe. Several engine options from 160 hp to 310 hp can be accommodated including the Lycoming 10-360 and the Continental 10-550.

### FUEL

The fuel tanks are integrated within the wing bays. Standard fuel tanks have a 66 US gallon (250 litre) capacity. The fuel selector is designed per FAA standards, allowing for either left, right or off. As a safety feature, each wing tank incorporates a 'slosh bay' to prevent un-porting of the fuel pickup in the event of uncoordinated manoeuvres such as during slips. The fuel valve (for Continental engines) also returns 'vapour,' or return fuel, back to the fuel tank in use, which tremendously simplifies management. Custom fuel quantity monitoring systems are available as options.

### ADVANCED LANDING GEAR

Three inches taller than the 320/360 for improved ground and propeller clearance, the Legacy's main landing gear incorporates premium air/oleo struts with the larger 5.00 x 5 main gear tyres for better landing characteristics. The nose gear is also the premium air/oleo strut with unique internal viscous shimmy dampening. Protected from the environment, the internalised dampening system provides longer service life and there are no scissor links that wear out. Steering is easily accomplished using differential braking, permitting tight-radius turns and the rudder becomes effective at taxi speeds as low as 20 mph. A tyre guide strap ensures proper retraction of the nose wheel into the gear well. The gear retraction method is Lancair's well proven, extremely reliable and simple, electro/hydraulic system.

## MATERIALS

Like every Lancair, the Legacy's major airframe is constructed of advanced composite materials. Cured at 270 degrees Fahrenheit under vacuum pressure, these NASA tested, epoxy based composites are among the lightest, strongest, stiffest materials known. The high-temperature, pre-impregnated carbon fibre and/or fibreglass systems combined with Nomex/honeycomb core materials are considered the supreme composite airframe materials of choice worldwide. This combination allows compound aerodynamic shapes, such as the Legacy's sculptured fuselage and double-taper wing whilst there are no drag-producing rivets or lap joints. Corrosion resistant, a nearly infinite fatigue life and virtually non-flammable, composite materials also extend the life of the aircraft. When correctly maintained, Lancair airframes will easily outlive any aluminium airframe, whilst composites are easier with which to work and considerably easier to repair.

## TESTING

Component parts are rigorously tested during aircraft development and throughout the manufacturing process. Lancair engineers are committed to the ideas that perfection of the whole can be accomplished only through perfection of the smallest details. For example, in addition to computer analysis, a full flutter test programme was conducted on actual aircraft components beginning with an extensive Ground Vibration Survey (GVS), which is utilised over forty accelerometers covering all points of the airframe. In environmental testing chambers, Lancair engineers simulated extreme natural conditions to which the aircraft's materials might be exposed during their long life. Samples are tested at room temperature and in extreme 'hot/wet' conditions. During this testing phase, the incredible strength and stiffness of the fibreglass and carbon fibre materials becomes most evident. Finally to confirm materials and engineering data, a complete static load-testing programme is conducted for the wing and other specific load bearing areas.

## KIT PREASSEMBLY

In order to make wing assemblies simpler and more manageable, the main spars and the ribs are 'pre-installed' into the wing skins. In addition, wing attachments' bushings that accurately establish the wing dihedral are pre-installed. Flaps and ailerons are completed and most of the control systems are also installed. The remaining installations and assemblies are simple and very straightforward. Lancair invented the fast-build kit and the Legacy kit is the result of more than ten years of fast-build kit developments.

## LANCAIR BUILDER ASSIST PROGRAMME

Nothing beats having experienced technical assistance during the early stages of a Lancair Legacy assembly. In the Lancair builder assist programme, conducted

at the factory, the builder will not only learn the basics of advanced composite construction, but also completely close both wings, including flaps and ailerons as well as complete the horizontal stabiliser and elevators in the first week. If a builder decides to stay for another week, he will finish the canopy as well as fit and finish the rudder. Lancair supplies the fixtures, tools, supplies and guidance. A builder will head home with not only much accomplished, but also the knowledge and confidence to quickly and accurately complete the airframe build process.

## FREE TECHNICAL ASSISTANCE

When a builder decides to purchase a Lancair he/she will receive unlimited, free technical assistance, five days a week, eight hours a day forever. Lancair's staff members are available to advise on all aspects of the assembly and final systems installations, from spinner to tail. Free guidance also includes optional installations such as autopilots, new avionics and system accessories. 📞

## SPECIFICATIONS

Engine: Continental IO-550-N: 310 hp at 2 700 rpm or  
Lycoming IO-540: 260 hp at 2 700 rpm  
Propeller: three-blade constant speed  
Length: 22 ft (6.71 m)  
Wingspan: 25.5 ft (7.77 m)  
Wing area: 82.5 sq ft (7.66 sq m)  
Wing loading: 23 lbs/sq ft  
Aspect ratio: 7.95:1  
G loading: +4.4, -2.2 Gs (utility) +3.8, -2.0 Gs (normal)  
Empty weight: 1 500 lbs (680 Kg)  
Gross weight: 2 200 lbs (998 Kg)  
Fuel capacity: 66 US gallons (250 litres)  
Useful load: 700 lbs (318 Kg)  
Baggage Capacity: 90 lbs (41 Kg)  
Cockpit seats two: length 63 in (1.6m)  
width 43.5in (1.1m) and height 44.5 in (1.11m)

## PERFORMANCE

Typical cruise 276 mph (240 knots) at 8 000 ft  
Stall speed: 65 mph (56 knots) in the landing configuration  
Service ceiling: 18 000 feet  
Take-off distance: 850 feet (260 m) gross at sea level  
Landing roll: 900 feet (274 m)  
Cross wind landing: 21 mph component  
Fuel consumption: 13.5 to 15 US g/h (51 to 56 lit) typical  
Maximum range: 1 150 statute miles (1 448 Km) with reserves at 8 000 ft  
Rate of climb: 2 700 fpm (solo IO-550) and 2 000 fpm at gross weight



# Constructing my **LANCAIR LEGACY**

By Jack Onderstall

**The aerodynamic efficiency of the Lancair design is incredible, but with a few more horses up front and a modification or two on the airframe, the type will go much faster. I had hands on experience flying in Dieter Bock's Lancair 320 hp where we tried our utmost to catch Dave Mandel's Lancair which had twenty more horsepower and winglets.**

The Lancair Legacy's legacy is the fact that the designer incorporated the best aspects of the original 320 design through its various stages of development over the years to eventually produce the ultimate, two seat, high speed cruiser in the form of the Legacy. The lines and form are similar to the original aircraft, but many changes actually took place. The most significant design changes have been:

- The engine power was raised from 160 hp to 310 hp
- The entire airframe produced from carbon fibre
- Ram air induction system in flight
- Standard electric slotted flap system
- Clean aerodynamic canopy design with lift producing engine compartment cowlings

Being a speed junkie and having some experience flying the type I decided to build a Lancair Legacy. As I have built several other aircraft types and have all the necessary tools, I set up a small assembly factory on a farm just outside Bloemfontein where the Legacy and a Sonex aircraft were built. This was stage one of the home building plan and at the time of writing the Sonex is waiting to be test flown. I spent two weeks in the Lancair factory in Redmond Oregon. Home builders receive a dust coat, safety glasses along with a lockable tool chest and innovative cupboard in which you store your kit inventory. You get to know these dedicated, hard working, enthusiastic, energetic men of all ages who do not arrive at work late, leave early or steal time on a tea break. Becoming used to this worker attitude took some getting used to. I invited two of the staff members to lunch one day and they accepted as I had made sure it was okay with their boss. The restaurant was pretty busy and it took for ever to be served. It thus seemed unlikely that my guests would make it back to the workshop floor in time when we were eventually served, so they excused themselves and went back to work. What a wonderful attitude.

## **WHAT IS IT LIKE BUILDING THE LANCAIR LEGACY?**

The Legacy goes together like a 'walk in the park'. As with most kit planes, they come with plenty of options that generate more profit for the company and although most are good to have, there are some that I would say are essential.

## **ESSENTIAL OPTIONS I WOULD SUGGEST ARE**

- Centre section bonding with fuselage: Use the factory jig, because you do not want to build your own
- Closing of the wings and building in the canopy glass: This means you get a good looking canopy. Your wings are closed in the factory jigs and tested by a team of enthusiastic and capable people

## **INNOVATIVE DESIGN FEATURES OF THE TYPE**

- The Legacy comes with removable wing sections that split just outboard of the gear. This is a great concept because it facilitates the process

of building the aircraft. Also means that moving it around the workshop, turning it over on the supplied steel rotisserie, getting it to the spray booth and eventually the airport are easily manageable because of the removable wings. Two people can de-rig the Legacy in about an hour. The most difficult operation is to get the bolts undone as the space inside the wing access is restricted - smaller hands and long arms are required

- Slotted flaps provide good runway visibility on final approach to actual touch down
- Large forward hinged bubble canopy provides for easy access and one can stand outside the aircraft whilst working on the back of the instrument panel by simply removing the glare shield
- Adjustable rudder pedals are essential offering four positions. A retrofit model available from a vendor in the USA produces a top hung set of adjustable rudder pedals that appear to offer greater leg length than the option offered by Lancair. I have found that anyone taller than six foot two inches has difficulty in fitting his knees under the panel. The seating position is extremely comfortable - laid back like a high performance sports car. The seats are even better if you use the memory foam and layer your seats in with ergonomic shaping into the seatback and bottom shape.

## **FLYING THIS AMAZING AIRCRAFT**

Two experienced airshow rated pilots have flown my Legacy. My friends Chris Briers and Johnnie Smit. Both were extremely impressed with the handling characteristics of the Legacy and both found the control harmony comfortable and predictable. Joining overhead at full power means you have to get rid of 80 to 100 knots before lowering the gear. Losing height on final approach is all a matter of throttle position. I try to maintain steep approaches that would enable you to reach the runway in the event of a loss of power. This equates to about 100 knots on finals maintaining adequate runway visibility with about 13 to 15 inches of manifold pressure. A slower approach means less runway visibility and an attitude that takes some adjustment. I believe that high performance aircraft were not designed for low and slow approaches. Holding off at about 90 knots with touch down one third into the runway at Tempe, Bloemfontein comfortably allows the Legacy to run to the end of the runway without excessive braking. Gear deployment is super fast and emergency extension of the gear relies on three gas struts to lock the gear into over centre position. The standard Legacy kit comes with main gear inner doors. The gear system is well designed and operates like a dream. The cockpit is fairly noisy with the gear out, but once you are in the cruise phase and trim the aircraft with the provided rudder aileron and elevator tabs, she sits comfortably with an incredibly light touch in the palm of your hand.

The Legacy remains on the step and has a slight nose down attitude in flight. This should take most pilots into a world unknown to many, as they gaze out and appreciate panoramic visibility through the incredible low

slung canopy of the Legacy. The standard Continental IO 550 can operate fuel efficiently at lower power settings. I have seen the figures recorded in the US as low as 43 litres per hour whilst achieving 190 knots indicated.

The Legacy has incredibly good looks and with the correct decals or striping she becomes a real eye catcher. Dieter Bock and I flew this Legacy to the SAAF Test Flight and Development Centre, Overberg in just two hours and seven minutes in cruise mode from Bloemfontein.

If you fit the optional adjustable sun shades on to the canopy you will have an incredibly comfortable, economical high performance sporty aircraft that will give you the ride of your life every time you take her out of the hangar. The Legacy is well designed and built from the best, air and navy standard aircraft grade materials available today. If you treat her with respect and a fair amount of discipline there is no reason to think that this aircraft will bite you.

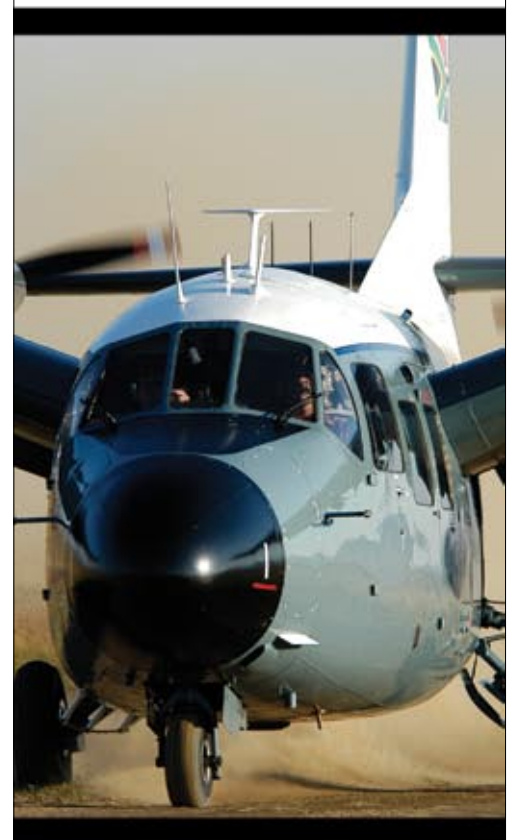
The test flight on ZU FCY was undertaken by Gideon Langeveld and there was no question about whether I was going to go with him on the test flight. Gideon spent quality time, meticulously checking through the airframe, noticing build quality and attention to detail. He remained calm throughout the inspection process, showing no tendency to rush at all. He asked questions about certain choices I had made in assembling the plane and offered advice on possible negative issues around these choices. Finally it was his decision to climb on board and start the engine, based on his careful evaluation of the build quality of the aircraft. I was in the right seat for this incredible moment, where I experienced the acceleration down the runway as the engine was opened up for the first time. Getting to know and appreciate Gideon under these circumstances was an enormous pleasure. 📷



*Arrival of Legacy and tools*



*Chris Briers and Jack Onderstal*



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