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Liberty XL2: Give Me Liberty

Designed for speedy but economical operation

By Alton K. Marsh

British, Scottish, and American accents blend in the hallways of the frenetic Liberty Aerospace company in Melbourne, Florida, where a sporty two-seater will be assembled from British, Romanian, and American parts. While the Liberty XL2 is based on 10 years of experience with the Europa, an award-winning British kitplane with more than 1,000 copies sold in 34 countries, Liberty is a U.S.-based company that is independent of Europa Aircraft. The two aircraft appear similar in the cowling and cockpit, but are vastly different under the skin. Liberty Aerospace founder Anthony Tiarks also founded Europa but sold that company to its management to launch his new Florida venture.

The Europa was designed for the European market and features quirky landing gear with a center wheel and mid-wing outrigger wheels that fly in a trailing position but lower for landing. By contrast, the Liberty XL2 was designed for the American market with tricycle gear and was certified in February under FAR Part 23; it will be certified in Europe later.

Costs kept low

Thanks in part to its kitbuilt history, the Liberty XL2 requires little assembly time and is thus economical for the company to build. It will cost about $150,000 to purchase once avionics are added, about the same price as the two-seat Diamond Eclipse. Yet $150,000 is still a sizable chunk of cash unless you have won the lottery. Liberty's finance company has promised that average payments will be about $1,000 a month: Divide that by four owners and suddenly the monthly payments are less than, say, those of an individually owned Cessna 152 you might be considering. Unlike the 90-knot 152, the XL2 cruised at 122 knots on the day I flew it, despite its modest 125-horsepower Continental engine. Liberty officials promise even more speed in the lighter production aircraft now emerging from the assembly line.

Considerable thought has gone into keeping operating costs low. Liberty officials say that the 1,000-hour instrument-rated pilot will find insurance premiums to be less than $2,000 per year. Liberty Aerospace estimates that for the pilot who flies 100 hours a year, the total operating cost is $57 per hour for insurance, fuel, annual inspection, oil changes, an engine-replacement fund, and miscellaneous service and parts (such as tires, spark plugs, brake pads, starter replacement, batteries, and bearings and rod ends). The operating cost also includes propeller retorquing. Unlike a metal propeller, the wood-composite design requires frequent retorquing because of changes in temperature and humidity. You'll notice that hangar or tiedown fees are not included in the estimate. Hold that thought.

Speedy performance

The Liberty XL2 I flew had been used as a developmental aircraft and still had pounds of hardware aboard to support spin testing, and heavily reinforced flooring that once supported bags of lead to test fuselage load-bearing ability. It also had IFR avionics aboard. (IFR certification is expected in September.) The lighter VFR aircraft will have a 588-pound useful load and a maximum cruise of 130 knots, officials promised. Liberty has committed to meet the 588-pound useful load only for the VFR-equipped model.

Even the demonstrator was a sprightly performer, reminding me of past aerobatic aircraft I have flown, although the Liberty is not intended to be certified for aerobatics. Flight controls are nearly as responsive as those of an aerobatic aircraft, partly because of the use of pushrods instead of cables. The aircraft is particularly responsive in pitch. Thanks to the use of a stick rather than a yoke, the aircraft can be rapidly flicked into turns to support any pilot's jet-fighter fantasies.

The air-to-air photographs for this article were taken by flying the Liberty XL2 behind a new Cessna 172. The Cessna was first to take off and was airborne before the Liberty XL2 began to roll, yet before the Cessna reached the end of the runway the Liberty had caught up. Later in the flight the

Cessna followed the Liberty in order to take pictures from the rear. "Can you slow up?" the Cessna pilot pleaded. It took several minutes of reining in the Liberty and flogging the Cessna before the two formed up over the Indian River near Titusville, Florida. Part of the problem for the Cessna was that the Liberty, with its aerodynamically clean carbon-fiber fuselage, accelerates more quickly. Once the production aircraft is ready it would be fun to race it against a 172; I'm betting on Liberty to win.

Common-sense design

Speed is not the most important feature of this aircraft, however. There are a lot of common-sense tricks designed into it, like using carbon fiber only where it made sense, such as in the fuselage and vertical stabilizer. The fuselage is made by Slingsby Aviation, of England, by molding a top and bottom half that are then bonded at the midpoint of the fuselage: The average person can easily lift the completed lightweight fuselage. The wings, built by Romanian aerospace and military aircraft manufacturer IAR S.A., Brasov, are of aluminum as are the rudder and stabilator. Unlike some composite aircraft that blend the left and right wings into one bonded unit, the Liberty XL2 uses separate wings that can be mounted or removed in 15 minutes, something insurance companies like because of the reduced repair time. To mount the wing, three large rods reminiscent of those used to seal a bank-vault door are simultaneously driven into place by a small electric motor.

The Continental IOF-240 engine ties the aircraft owner into the engine manufacturer's worldwide customer support program, which includes TCMLink, the online support Web site. The engine uses a FADEC system (full authority digital engine control — and the F in the IOF-240), which eliminates the mixture control, not to mention the magnetos, and makes this fun airplane simple to fly. The lack of magnetos (FADEC uses spark coils) assures that the cowling, once expected to house a Rotax engine early in the aircraft's development, is roomy enough for the Continental engine. The FADEC computers help Liberty Aerospace keep its promise that the aircraft will cruise on 5.5 gallons per hour because fuel flow is optimized for all conditions, from engine start through takeoff, climb, cruise, and descent. Computer downloads of the engine's operation, such as rpm and cylinder temperatures, help mechanics to diagnose engine problems more quickly.

Another very smart trick was to design a large removable carbon-fiber panel covering the bottom of the fuselage below the cabin area. In its simplicity, the aircraft utilizes a steel-tube chassis that contains the landing gear and serves as a mount for the fuselage and wings. This panel exposes the chassis, gear, brakes, welded-aluminum gas tank, and other key systems, reducing maintenance time. The gas tank is mounted inside the chassis and fits under that portion of the molded carbon-fiber fuselage that is shaped for pilot and passenger seats. While the 29.5-gallon tank is near the passengers — reaching half-way up the seat backs — it is protected both by the steel-tube chassis and the carbon-fiber fuselage.

Finally, the fittings are already in place for a system expected to be approved in a year or so to allow the wings to fold backward: That means you can take the airplane home on a trailer to avoid hangar costs. Airplanes bought today will be easily retrofittable with folding wings for about $4,000, Liberty officials said.

Challenges

The nosewheel is free-castering, as it is on several competing aircraft models. I found it creates little difficulty and allows the aircraft to pivot sharply when necessary, such as when facing the aircraft into the wind during an engine runup. It did take a nudge of the fingertip brakes occasionally to keep the aircraft on the taxiway centerline. Once full power is applied for takeoff, however, the rudder is fully effective for steering without the use of brakes.

I had used fingertip brakes before on the Italian-built and FAA-certified Sky Arrow, but in that model the throttle was on the left and the brakes on the right. The Liberty has both the throttle and brakes on the center console and that requires a new skill: adjusting the throttle with the right thumb and braking with the second and third fingers. Surgeons and concert piano players should have no problem. The Parker Hannifin brakes required a hefty pull for quick stops: It wouldn't hurt to have them a little stronger. It took several minutes of taxi time, with a few unwanted throttle surges nudged by my thumb, before I mastered the technique. Having said that, I got off course a few times during the first taxi, but easily maintained the taxiway centerline prior to the second test flight. Liberty officials point out that with finger-operated brakes it is unlikely that student pilots will skid the tires during landings or takeoffs because of inadvertent or excessive braking.

A few other challenges involve the way the certification is handled. Liberty officials wanted their type certificate quickly but had not done airframe fatigue testing. So the FAA totaled the flight hours on the prototype aircraft, divided by a safety factor, and restricted the airframe to a life limit of only 225 hours. However, as the fatigue-testing machines rack up hours, and hours on the prototypes continue to grow, the airframe life limit will increase rapidly: The goal is a life limit of 15,000 hours. The Cirrus SR22 faces the same scenario, and at this writing its airframe is limited to 4,350 hours, but the FAA will allow that number to grow as hours on the SR22 fleet increase. Also, at the time this was written the Liberty was restricted to day-VFR operations. Night operations approval was expected by the time you read this.

Finally, the aircraft's composite fuselage already contains lightning protection in the form of wire mesh. However, should Liberty officials desire to equip the aircraft with an electronic flight information system (EFIS), the FAA will review the design to see if lightning testing is required, according to the type certificate.

Test flight

An area of concern for me before the flight was the nose strut. I was aware that during the Parade of Planes at AOPA Expo 2002 in Palm Springs, California, it had broken on an early prototype (certification took four years), dropping the aircraft to the pavement and destroying the composite, wood-core propeller. Liberty engineers discovered that the steel used for the strut was substandard, changed suppliers, and the problem has not resurfaced. For good measure, they also redesigned the strut to strengthen it.

Entering the aircraft proved the more difficult preflight task. The wing is directly beneath the entry door. Some have suggested a step behind the trailing edge of the wing, and one prototype even has one, but the best approach is a two-scoot procedure. Scoot backward onto the leading edge by the cockpit, swing the legs in, and scoot aboard. My first attempt nearly resulted in toppling backward, but by day two I could enter without shame.

Company specifications show the cockpit is four feet wide and high enough that there was no concern about banging my head on the canopy while wearing a headset. The width is just one inch less than a Lancair Columbia or Cirrus SR22 cabin. As far as length is concerned, I am six feet one inch tall and my left knee still had about one inch of clearance from the instrument panel after I used a hand-crank to put the rudder pedals as far forward as possible. I was comfortable, though. Since the seats are molded into the fuselage they are not adjustable.

The items on the panel new to me were two FADEC battery switches — a switch that serves as a gateway from the aircraft's main battery to prevent accidental engine starts and another that arms a backup battery dedicated solely to FADEC — and an Aerosance Health Status Annunciator. The annunciator lets you know which cylinders are working, when you are operating with WOT (wide-open throttle), whether the fuel pump is operating, and the health of the two batteries that keep the FADEC system powered. Both battery switches, labeled FADEC PWR A and FADEC PWR B, must be on for flight. If the aircraft's main battery fails, the FADEC computer switches to battery B in a millisecond to prevent engine stoppage. A drawback of the Continental FADEC system is that the extra battery means extra weight.

Having a FADEC system means that both engine start and shutdown procedures are greatly simplified. FADEC adjusts engine operation for the engine start-up. To start the engine, turn on the two FADEC power switches, turn on the master switch (that unleashes power from the aircraft's main battery, just as the master switch does on a non-FADEC-equipped aircraft), place the fuel pump in the Auto position, and turn the key. As the key reaches the Start position the fuel pump whirs to life and the engine starts as easily as a car. Shutdown, since there is no mixture control, involves turning off the key after the electrical switches are off.

FADEC leans the engine automatically, and you can watch it do so on the Vision Microsystems engine display that also displays engine power in percentages. Want 75-percent power? Make the display read 75 percent. (The Continental software did not match up with the Liberty system properly on the day of my flight, so 83 percent equaled 75 percent, but that was to be corrected on the production aircraft.) Once in cruise flight, you'll watch the cylinder temperatures climb as the computer hunts for the lean point, and then drop as the computer enriches the mixture slightly after finding the peak temperature — just the way you'd do it. Also, the system detects from the power setting when you want maximum power and when you would rather have maximum fuel economy. It leans accordingly. It may even know if you've been bad or good.

After advancing the throttle to full power, I confirmed the WOT indication on the Health Status Annunciator and climbed at 80 KIAS from Melbourne International Airport. While the deck angle was steep, the climb rate stayed at 400 to 500 feet per minute since the aircraft was equipped with a fixed-pitch cruise propeller.

At one point during the photo shoot that followed I felt a sudden nose heaviness and discovered that my right wrist, resting on the trim control to operate the throttle, had inadvertently operated the electric trim. The trim motor runs fast, so a short punch of the switch results in a large change in trim. I mentioned that to engineers after the flight, and before my three-day visit ended they were altering the guard around the switch to prevent further occurrences. I was impressed by the responsiveness of the Liberty design crew. They plan to use a slower motor for trim changes. In the future the trim switch will be moved to the control stick, especially if a Chelton Flight Systems digital autopilot now under consideration is tested and approved.

I also mentioned to engineers that I am not a fan of electric flap control switches, such as the one Liberty has, that require the pilot to monitor a gauge until flaps are at the desired degree of deployment. However, Liberty designers were ahead of me, saying a switch that moves flaps automatically to takeoff or landing position is under consideration. The old flap system does not operate in cold temperatures, and represents the only reason why the Liberty's type certificate prohibits takeoffs at temperatures less than 14 degrees Fahrenheit — another reason why the flap motor and switch are to be replaced on the production aircraft. Are such changes possible once the aircraft is certified? Yes, FAA rules allow the company to make numerous "product improvements."

Formation flight is demanding work, yet the Liberty XL2 had the stability to make the task easy. Another big selling point for this aircraft is the panoramic view afforded by the canopy, a view that is useful for staying in formation or just spotting other traffic.

Landings and air work were left for a second flight. Slow flight provided a demonstration of the Liberty's primary stall warning device, actually a computer-generated female voice dubbed *Edith*. I flew at a speed that kept Edith talkative ("Stall! Stall! Stall!") before finally inducing a full stall and intentionally prolonging it. Generally the aircraft buffeted straight ahead but occasionally snapped a wing down. It was easily raised with opposite rudder.

During a cruise speed check I recorded 122.2 KTAS at 75-percent power with the company pilot on the controls in bouncy Florida afternoon air. Liberty engineers make no secret of their interest in trimming 20 to 30 pounds of weight out of the production aircraft to add speed.

As Liberty pilot Jason Livingston and I returned to Melbourne and started to descend, he suggested I slow the aircraft in level flight. It is so aerodynamically clean that it retains its speed during a descent even at reduced power. The use of takeoff flaps (15 degrees) does little to slow the aircraft to its approach speed of 65 to 70 KIAS. We used 70. On short final, I lowered the flaps to the landing position of 30 degrees and could feel the deceleration forces as the flaps reached their fully extended position. My landing flare tended to be a little high two times out of four, something test pilots claimed they also experienced on their early flights, and until I got used to the sight picture, I held the nose at a slight angle to the centerline. However, there was no problem on touchdown even with the nose slightly off center. Bottom line: It was easy to land.

Orders on hand

All the parts from around the world are sent to Melbourne for final assembly. Full-scale production is expected to begin soon on 50 pending orders, and all are scheduled for delivery this year. Next year company officials hope to significantly ramp up production beyond that level. Standard equipment includes the FADEC and Vision Microsystems engine instrument display, fabric interior, clock, and Cleveland wheels and brakes. Options include an extended engine warranty, nose and main wheelpants, a towbar, a ground power connection, a leather interior, a pearlescent paint scheme, and alternative exterior decal designs.

Avionics come in four options: Garmin VFR, Garmin IFR, expanded Garmin IFR, and deluxe Garmin IFR. The prices start at $6,804 for a VFR Garmin GNC 250XL GPS/com with Garmin GTX 327 transponder, intercom, cooling fan, and antennas, and reach to $26,860 for two IFR Garmin 430 GPS/com/nav units, a GTX 327 transponder, Garmin GMA 340 audio panel, two Garmin GI 106A nav indicators, cooling fan, and antennas. Other options include replacing one of the 430s with a Garmin GNS 530 and replacing the transponder with a Garmin GTX 330 unit. There are no installation charges. While the demonstrator was equipped with the Garmin AT (formerly UPSAT) MX20 and GX60 and those avionics are available to buyers, Liberty officials think most buyers will choose one of the other packages.

Overall impression

As John Glenn once said on reaching space, "That view is tremendous." You might want to buy a slap-on sun screen from a nearby auto store for your XL2 in case you are heading into the sun for an extended period of time. Most manufacturers of bubble-canopy aircraft end up painting the top as a sun screen. This aircraft uses gull-wing doors, and between them the cabin ceiling liner blocks the sun in just the area needed. The view is why most of us fly in the first place, but this aircraft adds cross-country speed and responsive controls.

Given all the thought that has gone into keeping the aircraft's operating costs low, the Liberty XL2 is a good value, but more important, it is fun to fly. If you think it is just a trainer, better take another look.

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SPEC SHEET

LIBERTY XL2
BASE PRICE: $139,500
PRICE AS TESTED: $156,172

SPECIFICATIONS

Powerplant Recommended TBO	125-hp Continental IOF-240-B/FADEC 2,000 hr
Propeller	Sensenich W69EK7-63G, 69-in dia
Length	20 ft 4 in
Height	7 ft 5 in
Wingspan	28 ft 9 in
Wing area	112 sq ft
Wing loading	14.8 lb/sq ft
Power loading	13.2 lb/hp
Seats	2
Cabin length	8 ft 5 in
Cabin width	4 ft
Cabin height	3 ft 10 in
Standard empty weight	1,065 lb
Empty weight, as tested	1,252 lb
Max gross weight	1,653 lb
Max useful load	588 lb
Max useful load, as tested	401 lb

Max payload w/full fuel	420 lb
Max payload w/full fuel, as tested	220 lb
Fuel capacity	29.5 gal (28 gal usable) 177 lb (168 lb usable)
Oil capacity	6 qt
Baggage capacity	100 lb, 20 cu ft

PERFORMANCE

Takeoff distance, ground roll	806 ft
Takeoff distance over 50-ft obstacle	1,465 ft
Max demonstrated crosswind component	15 kt
Rate of climb, sea level	696 fpm
Cruise speed/endurance w/45-min rsv, (fuel consumption), 3,000 ft @ 75% power, best economy	130 kt/4.2 hr (33 pph/5.5 gph)
Service ceiling	12,500 ft
Absolute ceiling	13,500 ft
Landing distance over 50-ft obstacle	1,510 ft
Landing distance, ground roll	835 ft

LIMITING AND RECOMMENDED AIRSPEEDS

V_R (rotation)	55 KIAS
V_X (best angle of climb)	70 KIAS
V_Y (best rate of climb)	80 KIAS
V_A (design maneuvering)	100 KIAS
V_{NO} (max structural cruising)	125 KIAS
V_{NE} (never exceed)	162 KIAS
V_{FE} (max flap extended)	80 KIAS
V_{S1} (stall, clean)	50 KIAS
V_{SO} (stall, in landing configuration)	43 KIAS

For more information, contact Liberty Aerospace, 1383 General Aviation Drive, Melbourne, Florida 32935; telephone 321/752-0332 or 800/759-5953; e-mail sales@libertyaircraft.com or visit the Web site (www.libertyaircraft.com).

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.