

# AUSTRALIAN AVIATION

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AUSTRALIA IN IRAQ



- IRAQI FREEDOM SMART WEAPONS
- RAAF HERCULES FLY INTO BAGHDAD
- GA'S NEXT GENERATION LIBERTY XL-2
- AIRBUS – THE NEW EUROPEAN GIANT

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## Liberty XL-2



The Liberty XL-2 sales demonstrator N203XL with Clive Davidson at the controls.

**I first saw the Liberty XL-2 as a 'Plug-and-Play' rolling chassis in the 'Skunk Works', at a remote location not too far from the Europa facilities in Kirkbymoorside, North Yorkshire.**

There it was: a 4130-chrome alloy steel tubular space-frame, supported by a sprung aluminium main undercarriage fitted with Cleveland wheels and tyres. The main undercarriage legs cleverly housed the brake cables, gun drilled inside the undercarriage legs, ensuring no cables were wafting in the slipstream to add drag or snag some awkward obstacle.

A slim spring steel nose wheel leg sat up front while atop this structure were two comfortable seats, a large luggage area, adjustable rudder pedals, a pair of dual control columns that pivoted from below the mid-point of the seats and an instrument panel and engine bearers. It was the prototype and model to support the numerous 'tinkerings' and revisions required to bring an improved physical reality from the design sheets.

The philosophy and intention then, as it is now, was to produce a high precision mobile frame that during its construction may be wheeled from one work area to another where the components can be, depending on your interpretation, married, mated or 'plugged in'. 'Plug-and-Play' was designer Ivan Shaw's own term for this particular modular form of construction. This promises to be an efficient and time saving break from normal GA manufacturing that removes expensive hand-built crafting – fettling, adjusting, and individual airframe modifications and their associated higher costs. This modular system will permit easier maintenance, thereby reducing the ongoing operating costs.

Mounted on the wall of the 'Skunk Works' was an aluminium, swing and folding wing, secured on its pivoting mechanism. Ivan demonstrated just how easily the wing could be unhitched vertically from the wall and swung down, rotated 90° and locked forward into the flying position. On such an aircraft, this feature should save hangar space and bills. The current Liberty XL-2 does not feature this folding wing, but I am sure this has more to do with the aircraft gaining certification to FAR-23 before such a practical oddity is incorporated. The folding wing design is present on the new pre-production spaceframe and although deactivated, it should appear later in the marque's life.

Three years later, in Melbourne, Florida, the sales demonstrator (N203XL) has the production standard aluminium flying surfaces with its high temperature pre-preg carbon fibre fuselage completing the multi-medium airframe.

Bolted on to the engine bearer is a 125hp (93kw) Continental IO-240F. The coding IO stands for injected and opposing cylinders but the last and least familiar letter designation 'F' indicates 'FADEC' – the acronym for Full Authority Digital Engine Control. Peering into the cockpit the most obvious clue is that the throttle is the only engine control – the mixture lever is not so much as missing as redundant. The system automatically leans the fuel – in cruise – to 50° on the lean side of maximum EGT. The manufacturer claims this reduces the pilot's workload.

Personally, I am not particularly convinced, as manual leaning is such a simple technique but of course we are human and to be human is, as Cicero commented, to err. With an engine this can be expensive – over-leaning, of



The Liberty XL-2 resembles the Europa Tri-gear, but in many ways is completely different. Both designs were conceived by Ivan Shaw and feature similar aerodynamics. Once again, the wing is the brainchild of Don Dykins – he was previously chief aerodynamicist with British Aerospace on the Airbus project, before assisting Ivan with the Europa. With worldwide sales of the Europa nearing 1000 and examples flying across the globe, the Europa has provided the Liberty project with considerable aerodynamic data.

course, causes damage. That said, I couldn't dispute the efficiency of a self monitoring system with "ongoing checks of engine operating parameters and immediate annunciation of faults to the pilot". Its 15% fuel savings and the wider benefits of an extended engine life and all of the savings that this implies can only be viewed in a positive light.

My first two flights in the XL-2 were an unexpected bonus. The first, a ferry flight from Melbourne to Fort Pierce – in N203XL, the sales demonstrator – served as a check ride with Ivan. On this trip I discovered her clean stall to be very gentle, with light buffet and then a brake at 52kt. With landing flap and no power she slowly rolled her left wing low at 45kt. Cruise was around 115kt at 2400rpm and 62% power.

Ivan had obviously had enough of my flying and, having collected N204XL, the FAA conforming XL-2, from the paint shop, he decided to fly it home, leaving me to get the demonstrator back home. Fortunately, the ease of navigation along the Indian River, parallel to the east coast, took us past Vero Beach, where I had been fortunate enough to have instructed at Flight Safety and flown many a happy hour in the Stewart S-51 Mustang.

The familiarity removed any pressure so I could enjoy the trip. All the same I was conscious of being given the company's sole demonstration asset and so invited Alan Lackie, Liberty's Maintenance and Technical Support Manager to accompany me. Who better to have along should I encounter a technical hitch?

My initial impressions of the XL-2 are that this is probably more than the half brother of Ivan's kit creation, the Europa. It certainly shares much of the same gene pool and has many similar external, cosmetic and aerodynamic features as well as a clean, distinct family resemblance.

Entrance to the cockpit is best achieved by opening the gullwing doors upwards and from sitting on the leading edge near the wing route rising onto the wing and stepping in. However, the production model will have steps aft of the main wing. I left the doors open, as it was a typical hot and humid Floridian day.

The cockpit, at 123cm, wide is generously spaced, providing a very comfortable working environment. Clearly, Liberty has not skimped on the seats. I do appreciate leather – so much more appealing and pleasant than cloth. There is ample head, shoulder and leg room, the internal dimensions are both 10cm wider and taller than the Europa, so there is no shoulder rubbing. There is a four point safety harness latched centrally rather than a diagonal arrangement. The seats are static, ensuring no rails for the seats to inadvertently slide along at a critical moment.

The rudder pedals are wound backwards or forwards for adjustment, the adjustment screw being within easy reach and found unobtrusively beneath the instrument panel. The rudder action is light on the ground having no aerodynamic forces or braking mechanism to override.

I certainly have a preference for control columns, or sticks, rather than control yokes. It immediately imparts the fact that this aircraft has strong flying qualities rather than a certain imprecise, staid, suburban docility. I placed the stick in all four corners, stirring the pudding, checking for any restrictions. They seemed to have a slightly odd pivot. The base of each stick curves inward and 'hinges' in the area under the central seating section – Jodel and Rallye pilots will feel at home here. Once I was aware of this I didn't think of it again as its action is smooth and no restrictions felt.

The action was perhaps a little stiff. That was a result of a little 'stiction' in the control system rod end bearings, which has since been attended to with the newly painted FAA conforming aircraft. I would be able to compare this the following day. The controls are all rod linked, which produces a positive feel and maintains both its reaction and feel throughout its life, rather than suffering the possibility of stretch often suffered with cable linkages.

The left hand panel is well laid out with the conventional blind flying six instruments and a distinctive green screened Vision Micro Systems VM1000 displaying all the engine parameters including percentage power – very useful. There is a horizontal row of switches for the electric facilities. An upmarket central avionics package of UPS goods is mounted on the central console and circuit breakers are to the right. The central console extends downwards and separates the two seats. Here the throttle is mounted with the finger touch controls of the brakes close to the right so that the heel of the right hand holds the throttle lever, never letting go, while the fingers rest upon the brake levers. If power was needed it was at hand. The electric trim switch and indicator are positioned nearby. The fuel selector is slightly further back, by the pilots' right elbow. The rear-mounted fuel tank holds 112 litres, with all but a few litres.

The hand operated brake levers are worthy of mention. Similar to those found on the Europa Tri-Gear and the 3i Sky Arrow, the levers are eased back to engage individual brakes for turning at slow taxi speeds and both back together, latched and locked for parking. This is a sensible engineering solution replacing toe-operated, rudder mounted brakes. They are logical, if not initially familiar, in their operations. After a couple of turns and a couple of hundred feet most would feel at home with their use.

The space in the headrests is open at the sides and holds any and all of the many small items that follow you into any cockpit. Behind the seats is enough space to swallow any of the luggage needed for two people touring.

When the gull wing doors are brought down and locked, the feeling of a light spacious cockpit is maintained. The large windows allow great visibility. The tailplane can be seen, certainly both wing tips, easily over the nose and up above. You could never feel claustrophobic here.

If you are going to be flying – and half the delight of flying is to enjoy the scenery, particularly if you are a passenger – then first choice is always in comfort with a window seat. You may as well see and enjoy what you are flying over and above! On a flight safety note it is a pleasure



The sales demonstrator and production conforming prototype XL-2s.

to have such a field of view, uncluttered by high wings and struts and able to see potential threats.

The starting procedure follows the normal items on a checklist but one or two items may need further comment. With the throttle set to idle, master/alternator on, power 'A' and 'B' switches on..., ah, a slight explanation. Electronic ignition and fuel injection is fitted with two individual units – A and B – and the spark for the spark plugs comes from these, each battery supplying 12 volts apiece. Should the alternator go down, a problem could arise if there was no other source of power to spark the plugs. There is a highly commendable and necessary safeguard with the batteries being capable of providing more than sufficient amperage to last for the intended leg.

Put another way, the standby battery supplying the spark to the plugs would last longer than the tank full of fuel at cruise! This should allay the fears of those more used to operating conventional magnetos.

Back to the start routine – the throttle is now opened fully and the WOT light should illuminate. This is the 'wide open throttle' that the FADEC monitor displays and should be checked on the takeoff run. It is reassuring to know your engine is doing what it is supposed to. The throttle is now set and the fuel boost pump set at 'auto'. This purges the system of any air bubbles up to 1300rpm.

The rest of the start is free of any new knowledge required of the systems. Ignition on and check the oil pressures as the engine fires. Set to 1000-1300rpm on the full sweep graphics of the VM1000 screen and continue to monitor temperatures as they rise. After the necessary ATC clearances, taxi using the middle fingers on the brake.

For the departure, 10° of flap is set and the finger brakes may be used briefly on the takeoff run – but only until the rudder has bite and positive directional steering. The lit WOT symbol confirms full power is being generated. Progressively less right rudder is needed to keep straight as the speed grows and the nose wheel is gently raised at 55kt with the initial climb at 70kt. Flaps are retracted at 75kt (86mph, 138kph) while nominated climb speeds are flown between 70 and 80kt.

This was all theory as accompanied by Alan, to hold my technical hand, it was a case of chasing Ivan in N204XL. We were heading back to Melbourne, before the forecast weather turned or night fell. We had no dispensation to operate the aircraft in anything other than VFR; so observed rates of climb were not a priority. We caught him at 2500ft, when we were 35 kilometers into our 25 minute flight. He was lighter but we had spats on. I slipped into echelon port with very little extra throttle movement left. He immediately saw us in his peripheral vision, out of those large windows, just as I could from both low and high positions.

#### LIBERTY XL-2

**Powerplant:** One 125hp (93kW) Continental IOF-240 with FADEC system. Propeller: Sensenich two-blade fixed-pitch propeller of 1.73m (5ft 8in) diameter.

**Performance** (mainly manufacturers figures): Max speed (Vne) 162kt (300km/h), max cruising speed 132kt (245km/h), economical cruising speed (55% power @ 8500ft) 120kt (222km/h), stalling speed (clean) 52kt (96km/h), stall speed (flaps down) 45kt (83km/h). Rate of climb (s/l at MTOW) 875ft/min. Range @ 55% power with reserves 500nm (927km), fuel consumption 21.8lph. Airframe limits +3.8/-1.9g.

**Weights:** Empty (VFR equipped) 476kg (1050lb), max all up 750kg (1653lb). Useful load 272kg (603lb), baggage load 45kg (100lb). Fuel capacity 106 litres.

**Dimensions:** Wing span 2.26m (7ft 4in), length 6.28m (20ft 6in), height 2.26m (7ft 4in), cabin width 1.22m (4ft 0in). Wing area 112ft<sup>2</sup> (10.41 m<sup>2</sup>), aspect ratio 7:1.

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*The Liberty XL-2 is a new two-seat touring aircraft designed to meet the needs of the private owner/pilot. It features a chromoly welded steel rolling chassis and a carbon fibre fuselage.*

Alan remarked that it was a good opportunity for him to see one of his charges in its proper element. I flew down beneath and around Ivan on the pretext of Alan getting a better look at the aircraft, from differing angles – well, that's my excuse! I was just enjoying the manoeuvrability. Ivan led the pair; got the rejoin on the radio and we beat the weather and nightfall by a conservative ten minutes. My first solo landing was done in stream with a 172 not very far behind either.

The standard approach speed is 70 knots and with the full flap limiting speed being 82kt there is a nice wide margin. Standard anticipation is required to maintain attitudes, as flap is cycled down the nose also pitches down. Aiming to be at 60kt over the numbers, the gentle touchdown was at 50kt on the two main tyres, with the nose wheel held off the runway with ease. Control was positive throughout and not overlight. I would be happy to try this on a gusty day at its maximum crosswind limit of 14kt.

That night, at a suitably noisy restaurant, with a few jugs of beer and courses of spicy buffalo wings and tender spare ribs, Ivan talked of his design ethos and reasoning behind his design. The 'Plug-and-Play' is novel in the world of light aircraft production. His design and development of the impressively successful and highly efficient Europa in all its differing marques – Classic Monowheel, XS and then the Tri-gear – was brought about by consumer demand. So far, almost 1000 have been sold into 35 different countries. The Motor Glider development with its interchangeable wings is now flying in the UK, the US

and Australia and I was fortunately involved in the pre-production and production spin trials of this particular development.

As a designer, Ivan is mindful that he is taking on the entire globe. Can this ever be a level playing field? He wanted to design an aircraft that fitted the new century – a reflection of technology with structures that represented significantly better value for money. He cited the motor industry – 80 years ago cars were hand built by craftsmen for wealthy people. Now they offer significantly better value and reliability, being built in a fraction of the time and relative cost.

Why not embrace modern manufacture with a rolling chassis and utilise precision parts, manufactured by the best firms in the world? Composites can produce complex curves from spinner to fin and with the XL-2 only two major mouldings are required. Then jig and connect – the cost/benefit ratio is very high.

"I want pilots to feel they are flying in style, club class in a wide spacious cockpit with a bird's eye view of the world and a feeling of unrestricted...wow! Look at the vista. This is why I learnt to fly," Ivan related.

Very early the following morning, well before dawn, we assembled for the briefing. Mike Fabianac, Liberty's new sales manager, was to fly the camera ship. Alan Lackie once again accompanied me, providing an extra pair of eyes as well as an engineering back up. Our aircraft was N203XL and Ivan would rendezvous with us during the sortie – in N204XL, the first FAA conforming Liberty XL-2 – on the way back from his flight test detail. N204XL is actively engaged in the flight test program and 'jollies' are not part of the game. Each flight is aimed at a specific aspect of the program. As such I couldn't just be handed the keys and told to go away and enjoy myself. I would get my chance to fly 'her' – all things of mechanical beauty are female – later in the morning when longitudinal static stability would be investigated.

It was a formation departure from Melbourne's runway 09L and as we quickly formed up and held position, the light was becoming stronger over the sea. Beyond the long strip of white sand some light, wispy stratus hung as if placed there to provide a contrasting background. I was beckoned on to our prearranged air-to-air frequency and to echelon starboard. Mike took us onto our prearranged heading while Keith could be seen lifting a camera. We were at our briefed speed of 95kt. We were on.

From straight and level the Liberty was positioned and signalled to rise, to drop back, to move in, to break right, to rejoin, to trail on the outside of a left turn, to tighten up, to move forward, to move out, then to repeat the process on the inside of the right turn. It was easy to slip back into position with the extra power at this speed. The Liberty is aerodynamically clean and like all formation flying, a little anticipation is required. I was enjoying this aspect greatly; the throttle can be cracked backwards and forwards in tiny increments – nice and responsive. The controls are well harmonised and have a fine precise feel, there is a small amount of adverse aileron yaw and rudder is needed to balance the turns, I like footwork.

Alan called out any traffic he saw and updated me on the temperatures and pressures, although all sat still – quiet and dependable. He scanned to the left and reported that he could see Ivan forming up from the left on the inside of the turn. I had a good view of him while I continued to look at the camera ship. He too was grinning. N204XL was brought into position outside of the formation and the shoot continued as we headed back towards base.

When I was cleared from the photographic box, Ivan was brought in for some solo shots. I sat hanging on the dead side of the formation and it struck me that being overall white and without spats, N204XL looked rather, well...young. At the time, it seems an odd observation to



The first FAA conforming Liberty XL-2 N204XL with designer Ivan Shaw at the controls.

make, as it appeared as a fledging might – new to the world. Of course, this was actually its debut in front of the camera.

Two hours later I was sitting in my customary right hand seat, but this time accompanying Ivan in N204XL. I was aware that I was the first person, outside of the company, to get my hands on her aloft. The interior was not complete but it hardly bothered me, as it was its flying qualities that interested me. Essentially these are the same as the demonstrator's but the smoothness of the controls is of a much higher order, being completely free of the stiction on N203XL.

Ivan demonstrated the completely deadbeat short cycle period when the stick is forced promptly back and released. The deliberately induced pitching cycles, or phugoids, were set up from a trimmed cruise. With the nose lowered ten degrees and with a 10kt increase the stick is released, the standard of three cycles to dampen these out was easily met. Funnily enough, I seem to remember Ivan showing this to me seven years ago, over the North York Moors, in a closely related airframe. I did find the electric trim to be rather sensitive in pitch; it only needed a slight prod for fine tuning after selecting an altitude.

The XL-2 has had 10 years, or more, of aerodynamic research and development already spent on it thanks to the Europa. Its handling traits appear to be very similar, its roll rate is slightly less than the Europa, as the wing is larger giving more aerodynamic dampening. All has been previously refined: the all flying tail and trim tab ratio, the larger rudder to fin ratio and the aileron differential tweaked.

I also learned that the maximum temporary poundage required to move the controls in pitch must not exceed 60lb

*Cockpit features traditional sticks rather than the less responsive yoke/wheel.*



and 30lb in roll. A sustained force of 10 pounds is deemed to be manageable in pitch, five pounds in roll and 20 pounds on the rudder. Imagine a runaway trim and having to hold the 10lb load and remain holding an attitude. The Liberty's control forces are well below all these figures.

The box to be ticked on our flight was to confirm that the worst situation the aircraft could be expected to encounter in longitudinal stability (pitch) would be met and countered with adequate control. This would be with a forward centre of gravity, flap fully down, power at idle, so there is no airflow over the tailplane. The elevator authority certainly responded well. Later, back in the pattern, with complete confidence in the airframe, Ivan let me prove it by getting us deliberately high on the approach to land, so that there was no doubt in either of our minds that we may undershoot, he shut down the engine and stopped the prop, allowing me to practice a dead stick landing. There was plenty of elevator feel and authority at 1.3 times  $V_{SO}$  to raise the nose for the roundout and flare. Once again, forces were easily manageable and the control reaction precise.



The XL-2 expected to obtain its FAR 23 Type Certificate (to include day/night VFR and IFR) by the end of July. The first customer aircraft is scheduled for delivery in August.

For the Liberty to be in a fit paperwork state and have all the ticks in all of the flight test evaluation program boxes to satisfy the FAA, the aircraft has to undergo many differing flights and meet all of the handling criteria. This process amounts to more work than any optimist may think. But it must be fascinating to take an aircraft along this route to a successful conclusion.

I have mentioned Ivan as the designer of the XL-2. He is now undertaking the company flight test program. Behind the Liberty hangar there is an expanding extremely able and professional team, ensuring the XL-2 will be a highly successful product – in my mind it deserves to be. We all know that the world, particularly the aviation arm, can be a very tough market to infiltrate.

Two days after our visit to Florida, N203XL was in California, proving that this model should have a 'GT' badge on her cowling.

The Liberty possesses strong handling qualities and of course, sits there stable in the cruise as well. Clearly, the XL-2 is built to travel. With a convenient and easily calculable two-miles-a-minute cruise, four hour endurance at 60%, a cavernous luggage area to carry far, far more than a bikini, toothbrush and a smile, plus that great visibility to gaze at the world below from the comfortable cockpit. I was really impressed with the XL-2 and I'm sure the market response will be as sound as its aerodynamic qualities. Fly one as soon as you get the chance! →