

TL SIRIUS

We visit TL's factory at Hradec Králové in the Czech Republic then report on the initial flight-handling evaluation at Turweston of this top-quality, all-composite, high-wing LSA tourer

Words Francis Donaldson. Photos Ed Hicks





The LAA's home airfield at Turweston sees an interesting variety of aircraft passing through, thanks in part to the LAA's presence and to regularly hosting Vintage Aircraft Club events. We also benefit from our field being a regular port of call for Peter Teichman and his personal fleet of WWII fighters and from Henry Labouchere who drops in during his perambulations around the country in a seemingly never-ending series of Moths of one sort or another. Over the years we've seen the Vickers Vimy Replica, the Goodyear blimp and every available kind of gyroplane, not to mention just about every new model of homebuilt, which come by to receive the tender ministrations of our HQ staff.

Faced with such a glorious array of types in transit, when a new model of aeroplane attracts a lot of attention from Turweston's hangar rats, it's safe to say that it is something pretty special. So it was with Czech company TL Ultralight's factory demonstrator Sirius, which spent a few days on site back in August 2011. It was here to give an opportunity for the LAA's engineers to go over it, try it out in the air and see how it would shape up as an LAA type. Over the time it was with us, the Sirius, which looks like a slender, lightweight, two-seat version of a Cessna 172, received a great deal of praise on account of its svelte appearance and the very neat detailing of its all-composite airframe and state-of-the-art cockpit.



FLIGHT TEST



After a somewhat long-winded exercise to get TL's previous design, the low-wing Sting, cleared by the LAA, Paul Sanders and Peter Ronfell (of TL Ultralight's UK agency, Midland Aviation), were keen to give the LAA an early look at the new high-wing Sirius. Once bitten and twice shy, this time they have largely resisted promoting the type until such time as LAA was prepared to issue a clearance for a UK prototype build and there was a clear path to completion of the technical issues.

Like the more familiar Sting, the Sirius is a Light Sport class aeroplane with a 600kg max gross weight, powered by the Rotax 912-ULS or the new, fuel-injected 912-IS. While it is flown as a microlight in the Czech Republic, with a 472.5kg gross weight (including a ballistic chute) it would not satisfy the UK empty weight rules for a microlight but fortunately is eligible as an SEP aeroplane with a substantially better payload.

Our initial review of the aircraft was very positive, with no showstoppers coming to light in the flight handling tests or the 'Mk 1 eyeball' design survey. Over the subsequent 18 months we received a steady trickle of documentation from TL, progressively building up the design dossier needed for UK approval. In February this year I had the opportunity to visit TL's factory at Hradec Králové in the Czech Republic, along with Paul and Peter, to see the manufacturing facility, witness how the Sirius kit is built, meet the design team and go through the design acceptance submission with them. Despite a few inches of snow covering the ground, the fog lifted briefly on the



Beautifully trimmed leather seats could be from a high-speed car



Ample luggage space with handy netting cover



Francis discusses the tailplane mounting bulkhead sub-assembly in a part-built fuselage

first day of my visit, allowing me a short ride in the demonstrator, still looking factory-fresh but now re-engined with the injected 912-iS rather than the previous ULS.

MANUFACTURING IN CZECH

TL probably has as much experience of the new iS engine as any of the European manufacturers, and its impression has been good, despite initial concerns about the complexity of the installation of this unit. Interestingly, TL had found it necessary to add a header tank to the fuel system after putting the iS in, as it found that, with the injected unit and the Sirius having twin, independently-selectable wing-tanks, if one tank was allowed to run dry then they had difficulty restarting the engine after hanging tanks, presumably because of air getting into the fuel system. With the injected engine having a recirculating fuel system, it's not clear why this should be, as any air should quickly be purged from the lines but, nevertheless, TL now uses a simple on/off fuel selector feeding the header tank from both wing-tanks simultaneously. The great benefit of the new arrangement, to my mind, is that fuel management is simplified, and by recirculating the fuel back to the header tank, there's no need for a twin port-ganged fuel selector to make sure that the spill line feeds back to the same tank as is being used.

The Sirius is built in the now common manner from mouldings of carbon and glass cloth laminated in epoxy, in many areas including a foam core typically 6mm thick to create a rigid sandwich. Using carbon fibre rather than

glass means that, other things being equal, the mouldings can have a slightly improved strength-to-weight ratio. The downside is that the carbon is a less forgiving material and that local delamination in service is more difficult to detect than in glass laminates. Also, at the manufacturing stage, with a semi-translucent glass laminate you can check at a glance that the initial wet-out of the cloth has penetrated right through the laminate, and that there are no resin-starved or resin-rich areas. This is not possible with a carbon laminate because you can't see 'through' it. Consequently, manufacturing in carbon requires more care with the quality control, and for critical parts a regime of component weight checking is often used to verify that the correct amount of epoxy has been used overall in laminating the part.

The major composite components for the Sirius are laid up in large moulds, using vacuum-bags to consolidate the laminate, expel unwanted trapped air and to force any surplus resin to be squeezed out into a blotting-paper like bleeder ply through small holes in a perforated release film. Interestingly with the Sirius, the female moulds for the wing skins are made not by laying-up over a hand-made plug, as many kit manufacturers do, but instead by routing out the female mould directly from massive blocks of a dense fibre-board type material, using TL's own nine-metre five-axis CNC machine – an amazingly impressive piece of kit to have in-house and one which will stand them in very good stead when it comes to their future prototyping work – more of which anon.

The spars of the Sirius's two-piece strut-braced wings are of 'I' section, using strip-like carbon caps, which are moulded first as separate components, and then placed into a further mould where the glass and foam web is laid up, using plywood pads to create hard points for the root fittings and strut attachment points. Unusually, the upper spar cap of the wing is moulded with a joggle in it where the aileron pushrod emerges, to give clearance to the pushrod, creating a bit of a stress discontinuity in the spar here.

As this is some distance outboard of the wing-strut attachment point, and therefore at a spanwise location where the bending loads will be well below their peak level in the spar, based on the wing having been satisfactorily load tested, one can only assume that the stress levels in this area are low enough for this feature to be acceptable. Nevertheless, this would certainly be a point to look at very carefully indeed if the Sirius were ever to end up on its back – luckily there's reasonable access for inspection by way of access panels and apertures in the wing's rear close-out in the shroud area for the flaps and ailerons.

The Sirius fuselage is moulded in two parts, left and right, with a centreline joint like a big Airfix kit. Unlike some composite kits, there's no overlapping flange to the centreline joint nor a thickened lip to increase the bonding area like that used on the grandfather of all these pre-moulded kitplanes, the Pulsar. Instead, the port and starboard shells are simply butt joined along the centreline and then glass tapes are laid up along the inside and outside >

"A thoroughly modern
and highly-refined LSA"



Even more than most modern kit aircraft, the Sirius could easily be mistaken for an offering from one of the certified manufacturers

of the joint. The two halves of the fuselage are mated whilst still in their moulds, which are weighty assemblies trussed with welded steel box section for rigidity, and can be hinged and pinned together so that the fuselage half-shells end up in perfect relative alignment.

I looked on while a tailplane was assembled in a similar manner, using a generous bead of foaming polyurethane adhesive to ensure full coverage on closing the job out. As with all these composite beauties, the parts count is remarkably low, the sandwich skins being stiff enough to allow the structure to work with a minimum number of ribs and frames. There's a moulded glass bulkhead sub-assembly at the rear of the fuselage, which provides the mountings for the tailplane and is the base for the fin spar, and reinforcements in the area of the wing spar and wing strut carry-throughs in the cockpit area, undercarriage and engine mounting points.

The good news is that following two days of discussions of documentation we have now reached the point where the first UK Sirius kit can get the go-ahead to build, in the expectation that by the end of the process we will have seen all the requirements for a full Permit to Fly satisfied.

SPACIOUS AND COMFORTABLE

An initial evaluation of the flight handling qualities of a factory-built example of the Sirius, registered OK QUA-95, was carried out by the LAA in August 2011. The evaluation consisted of three flights carried out from Turweston, totalling two hours. Two flights were carried out at forward/mid C of G, (one of which was a photoshoot sortie) the third with the aircraft ballasted with 50lb in the baggage bay, which resulted in a C of G position close to the aft limit. All flights were carried out solo so as to keep within the 472.5kg max gross weight

of the aircraft, which is cleared on its Czech paperwork. The intention is to deal with the aircraft in the UK with a 600kg gross weight as per the US Light Sport version, which has been designed to comply with the ASTM requirements, so the aircraft was flown at approximately 130kg below the proposed maximum gross weight.

The aircraft was almost brand new and had been built and finished to a very high standard. The cockpit is entered by way of doors on port and starboard side, which are generous in size. The doors are top-hinged and slam-to-shut like a car door, and are fitted with a secondary catch to prevent it opening in the event of partial closure. As a secondary security feature, the locking handle of the secondary catch rotates over and blocks the main door latch from being inadvertently released.

The cockpit sill is low enough to allow easy entry without the need for any intermediate



It was snowy and cold in the Czech Republic but fortunately possible to fly



Though fitted with tanks in both wings, they feed a small header tank so there is one simple On/Off fuel selector

step, sitting straight onto the seat and then bringing each leg in, in turn, facilitated by the fact that the Sirius has a pair of control yokes rather than sticks. The cockpit is spacious and comfortable and very neatly finished in a manner that would not look out of place in the brochure for a Porsche or Jaguar.

The seats are fixed but the rudder pedals are adjustable for leg length by pulling a knob on the floor between the pedals, allowing the individual pedal assembly to be slid forward or back as required and then relocked by releasing the knob, an arrangement familiar to MCR owners and many glider pilots. The layout of the remaining controls was very straightforward, with throttle and mechanical elevator trim controls being nicely to hand in a central console between the high-backed, high-quality seats. Unlike the low-wing Sting, the flaps on the Sirius are electrically operated, using a very neat pre-selector control unit on

the panel. With this type, there's no need to estimate how long you have to hold the switch down to go from 'full flap' to 'take-off' setting – you just flip the switch to the position you need and leave the electrics to get on with it.

As originally seen, the fuel selector was unsatisfactory, being of the 'left'-'off'-'right' type where you have to pass through 'off' when you change from one tank to the other – a configuration specifically outlawed by most design codes these days because of the risk of inadvertently being switched to off and causing an engine stoppage. This has now been replaced with the single on/off valve and header tank arrangement described above.

The Sirius's instrument panel was all-glass with twin Dynon Skyviews – artificial vision, the lot. A mechanical compass was also fitted but on this Czech-registered ultralight there were no back-up mechanical altimeter or ASI, as LAA requirements would specify. The radio

was in a narrow overhead roof panel, which included the row of switches controlling all main electrical functions. The windscreen was too far away to reach to wipe clear of condensation. There was no DV window, but a small, cable-operated rotating ventilator was fitted in the windscreen, like that fitted to the Sting, which should provide a degree of de-mist capability.

The Sirius has twin 65-litre tanks giving it a massive 130-litre fuel capacity, conferring a claimed 1,400km range. It was disappointing that the only fuel gauges provided in the demonstrator were a pair of sight gauges visible in the wing-roots. With this configuration, due to the wing dihedral, the fuel gauges showed 'full' until the tanks were just under half empty, which was not ideal. TL is looking into means of improving the fuel gauging but as it points out, a fuel flow meter and totaliser provide a better actual guide

FLIGHT TEST



In the foyer of TL's impressive works, TL's design consultants, Miroslav and Petr Kabrt of Vanessa Air, Paul Sanders and Peter Ronfell of Midland Aviation, Francis Donaldson and Jan Friedrich, Francis's counterpart in the Czech LAA who generously accompanied our team to act as technical translator during the two day visit.



to fuel used than the somewhat questionable gauges fitted to many aircraft in this class. And of course, the gaugeable quantity of fuel is enough for about four hours' flying. The main thing, perhaps, is to make sure that the tanks are not filled with more fuel than intended leading to the aircraft being overweight, but a dipstick can be used to keep track of this aspect of the operation.

Taxying the aircraft, the turning circle seemed relatively large even when using the steerable nosewheel turned to its maximum extent. In practice this could be improved slightly with differential brake. The rudder pedals felt spongy when turning on the ground, which perhaps discouraged full throw being used. This was probably the result of the rudder and nosewheel steering control system being complex and rather indirect as a result of the adjustable rudder pedal feature.

HIGHLY-REFINED LSA

On opening the throttle fully at the start of the take-off, it was soon clear that the DUC propeller on the 912-ULS engine has been set coarse pitched, no more than 5,000rpm being obtained. This resulted in a relatively long take-off roll for an aircraft of this category at solo weight. However, the take-off was easily



A foaming adhesive being applied prior to fitting the second tailplane skin

controllable and unlike some Rotax-powered types, there was no shortage of right rudder authority to keep straight. Pitch authority was sufficient to offload the nosewheel at an early stage in the take-off roll and complete the remainder of the ground roll balanced on the two main wheels, saving the rather slender looking nose leg from any unnecessary pounding and giving the pilot a chance to feel out the pitch control while still safely earthbound – a good safety feature.

The climb out was unremarkable with a rate of about 850-900fpm, and well under the engine's rated 5,500 max continuous rpm available. Later, when I tested the same aeroplane with the 912iS engine and TL's own manually-controlled, constant-speed, three-blade propeller, the take-off and climb performance were transformed, which shows what would be achieved with the equally-rated carburetted ULS engine were it fitted with a finer pitch prop.

Up and away, the Sirius feels exactly what it is – a thoroughly modern and highly-refined LSA which in terms of subjective comfort and quality, relates to traditional lightplanes like the 152 or Cherokee 140 in the same way that today's mid-price saloon relates to a Ford Anglia or Morris Minor. The cockpit is quiet, comfortable, spacious and vibration free, with a really good



Smart decals and smooth lines give the Sirius a very contemporary appearance

field of view, other than the inevitable block to left and right presented by the big high wing.

Carrying out the standard set of checks, the handling qualities of the Sirius were hard to fault. I had wondered whether the marked dihedral on this high-wing aeroplane would make it tend to Dutch roll due to an excess of lateral over directional stability, but it seemed that the combination of dihedral angle and fin area had been just about perfectly matched for there was no sign of this uncomfortable drunken, lurching characteristic in the Sirius's behaviour. True, the combination of strong dihedral effect plus yoke controls rather than a stick made the aircraft not as crisp in response to aileron inputs as its low-wing counterpart, the Sting, but it was still far and away better than many other types in this category and I would class the roll responsiveness as on the good side of average.

The aileron self-centring was not very precise, especially after twisting the yoke to the right, leaving a residual tight roll input after letting go the yoke, which caused a reduction in the apparent stick-free lateral stability after aileron release in a sideslip. This may have been a result of the autopilot roll servo being mechanically connected into the system as this was of the stepper motor type which could be

MORE TO LOOK FORWARD TO!

LURKING IN THE back of the hangar at TL's base, I was intrigued to see a beautiful, low-wing, four-seat tricycle-undercarriage aeroplane, looking like the product of a blissful liaison between Cirrus and a Lancair 4. It turned out to be a mock-up of a design that TL is working up for future production, possibly as a certified aircraft but quite likely, initially, as a kit-built competitor to Van's' highly successful RV-10 and Filip Lambert's Mission, both of which are already LAA accepted types. TL is currently seeking funding for this project apparently, and as they are past masters at extracting EU grant money, they expect to be moving ahead with detail design before too long.

As if this wasn't enough, in the workshops we were shown the initial stages of a new, racy low-winger being developed with two seats in tandem, its shark-like profile clearly aimed at satisfying the aspirations of the would-be jet fighter 'jock'. TL's record for rapid prototyping and its superb manufacturing facility means we may see the results of this programme sooner than you might think.

felt creating considerable break-out force when exercising the roll control when static on the ground. The effect was not noticeable in normal flying, however.

The static directional stability of the aircraft was strong with normal use of the rudder, insofar as deflection of the rudder pedals caused a corresponding change in yaw angle and centralising the pedals brought the aircraft straightaway back to ball-centred. Where it was not so obedient was in the rudder-free situation, where releasing the rudder pedal in a sideslip showed some reluctance for the pedals to return or the rudder to self-centre, leaving the aircraft continuing to fly in a yawed state. This was almost certainly a function of the amount of friction in the rudder control circuit induced by the coupled nosewheel steering. As with many of the competing designs, this can probably be improved with a little further attention in this area, and while non-compliant with CS-VLA requirements did not in this case present a safety issue. Despite the generous dihedral angle and high wing configuration, which in extreme cases on some other designs makes the rudder into the predominant steering control, the Sirius could be flown through turns in either direction on aileron alone quite happily, even with the rudder displaced 'against' the turn. ➤

FLIGHT TEST

The static longitudinal stability was positive and clear, even at the aft cg limit, and the overall harmony of pitch and roll forces seemed about spot-on for an aeroplane optimised as an easy-to-fly touring type. Unlike many Light Sport types which tend to over-sensitivity by normal certified light aircraft standards, the Sirius's handling will I think seem straightforward (though delightful) to any pilot coming off a typical club trainer. Stall characteristics were very well-behaved with flaps up or down, power on and power off, both from straight and level and in turns, with the nose dropping gently at the break and not a trace of wing drop. Indicated stall speed was 35kt power off flaps up, dropping to just 28kt indicated with full flap. Considering the wing-loading of the aircraft, these results suggest a considerable pitot-static system position error at low speeds as the actual stall speeds are likely to be at least seven or eight knots faster than this.

This is something to investigate later on; the LAA's flight test equipment now includes a trailing static cone, which can be trailed behind an aircraft on the end of fifty feet or so of thin flexible neoprene tube, to provide a reliable static pressure source and help calibrate a new type's pitot-static system.

HIGHLY-REFINED LSA

The only criticism in this area was that there was no artificial stall-warner fitted to the demonstrator aircraft, nor any noticeable pre-stall warning buffet, so we suspect that the pre-stall warning will need to be improved for UK approval, perhaps by adding leading-edge stall strips to the wing roots.

Using a cruise altitude of 3,000ft, a quick look at the indicated cruise speeds at different power settings yielded the following results, using the 912-ULS engine and coarse-pitched DUC propeller.

DUC PROPELLER.

| RPM | MP | FUEL FLOW | L/HR | KIAS |
|-------|------|-----------|------|------|
| 4,450 | 24in | 22 | | 93kt |
| 4,150 | 22in | 18 | | 85kt |
| 3,800 | 19in | 13 | | 77kt |

The aeroplane was easy to land, thanks to very good forward and downward view, right through the approach and into the flare, using an approach speed of 55kt with full flap. The angle of descent with full flap was moderate, but adequate, the flaps being more effective in steepening the approach than the RV-12 but not as powerful as on the Europa or C150.

The plus side of the not-overly-powerful flaps is that there's remarkably little change in pitch trim with changes in flap position and power, which coupled with the very convenient and direct mechanical pitch trim control makes the approach and go-around a very straightforward exercise. There was just insufficient pitch trim authority to trim for the idle power, full-flap descent, particularly with forward C of G, but the residual force needed on the yoke to hold the speed was only a pound or two and this was therefore considered acceptable.

Overall, the Sirius seems a very pleasant little aeroplane of high quality, which in some ways looks just like what Cessna might have built as the Skycatcher, had they not chosen to go down the more traditional route with all-metal construction and a Continental O-200D engine. Not so many years ago, high-wing types

TL SIRIUS



SPECIFICATIONS

PERFORMANCE

Maximum speed: 225 km/h (140 mph; 121kt)
 Stall speed: 65km/h (40 mph; 35kt) flaps down
 Vne: 250km/h (155mph; 135kt)
 Range: 1,400km (870mi; 756nmi)
 Climb rate: 6.0m/s (1,180ft/min) maximum, at sea level

DIMENSIONS

Length: 6.75 m (22 ft 2 in)
 Wingspan: 9.40 m (30 ft 10 in)
 Height: 2.25 m (7 ft 5 in)
 Wing area: 11.15 m² (120.0 sq ft) gross

Engine: 1,168.4mm (46in)

WEIGHTS

Empty weight: 297kg (655 lb)
 Max take-off weight: 598kg (1,320lb)
 Fuel capacity: 130lt (34.3 US gal; 28.6 Imp gal)
 Engine: 1 x Rotax 912ULS or iS flat four, 7 4.6kw (100hp)

Seats: 2

Contact: www.tl-sting.co.uk

DETAILS

- 1 | The Sirius awaits its initial flight appraisal
- 2 | All glass instrumentation. Back-up analogue airspeed and altimeter will be required in the UK
- 3 | Steerable nosewheel restricts self-centring of the rudder

dominated the microlight market – and there was nothing to offer for those who prefer the wing to be underneath rather than overhead. Nowadays with the proliferation of light sport types there's a great deal more choice, but the swisher, all-composite models tend to favour the low wing configuration and the high wingers tending to be more basic. The Sirius seems to set a new standard bringing top quality to the high-wing format and may well challenge existing success stories such as the kit-built Jabiru and factory-built CT. ■

