AVGAS

Reality's OK, but it's not like the real thing

AS you may remember from a previous *Avgas*, the ancient steam-powered computer which I used for a flight sim had packed in.

Mind you, I'd bought the Microsoft sim software in 2000 due to a spell of bad weather so long that I thought I was going to be 90 before I got my licence.

So it was hardly surprising that the PC I used it on packed in, since it was so old that putting it on standby involved shovelling some nutty slack into the furnace.

But I was missing it. When I was still learning, a few circuits on the sim the night before made things much easier when I folded myself into an AX3 the next day at the airfield, the only difference being that when you crash the real thing, you can't sigh deeply and press reboot.

And on weekends when the weather was too bad for flugelling, I could go up to the study, do a few circuits in a Spitfire at Interlaken, fly around upside down for a while (inverted steep turns are a great way to fry your brain) then go on a mission and shoot down some Me109s.

Sadly, by now, the Microsoft CD-roms I'd originally bought were so old that they wouldn't work on a modern machine.

Hurrah, then, for my biking buddy Gareth, who gave me a 27in iMac he wasn't using any more with a free demo of X-Plane on it.

The only microlight on it was an Aerolite 103 SSDR, so I started on that; only to find it was so twitchy it was almost impossible, not to mention a habit of pitching up and down sharply on short final, which was, er, interesting.

Sighing deeply, I went onto the X-Plane website, found an email address for someone called Austin, and emailed him with my moan, asking if he could pass it on to the tech chaps.

He replied immediately with several solutions, and it only clicked then that he was Austin Meyer, who'd created X-Plane.

As Gareth said, it was like calling Microsoft and Bill Gates answering the phone.

Anyway, Austin very kindly sorted me out, so I bought the full version, and have been whizzing around in everything from a Tiger Moth to a Phantom.

So if you're looking for me before spring, forget it. I'll be flying in the study, and Cate's promised to slide pizza under the door three times a day.

Geoff Hill, ghillster@gmail.com

The TL-Utralight Stream brought out Dave Unwin's inner fighter pilot. Read his great flight test inside (photo, Keith Wilson).

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COVER: "In the front was good friend Shaun Crockford, who said it was an absolutely amazing experience. In the right conditions, flexwing flying is just mega," said Clive Mason.

Stream is a dream

TL-Ultralight's sleek hotship brought out **Dave Unwin's** inner fighter pilot. Photos by **Keith Wilson**

THIS sleek, sexy mini-fighter is the sort of machine that anyone with avgas in their veins would want to fly.

So within weeks of seeing it at the LAA Rally, where it was one of the few new aircraft, and the one getting the most attention, photographer Keith and I found ourselves in the Czech Republic.

As well as looking forward to testing the TL-Ultralight Stream and the company's latest design, the Sparker, which you'll also be reading about in *MF* soon, we also enjoyed a tour of TL's very impressive manufacturing facility at Hradec Králové.

A particularly interesting aspect of TL is that it makes practically everything except the engine and avionics; even propellers, wheels and brakes; and since there were several aircraft in various stages of construction on the production line, I was able to see under the skin.

Most of the metal components are made in either chromoly 4130 steel or anodized 7075 aluminium alloy, while the wings and fuselage are constructed of pre-preg hot-melt carbon fibre.

This material offers an excellent strength-to-weight ratio, enabling a designer to create light, stiff structures with a smooth, low-drag shape and aerodynamically efficient compound-curve surfaces. The quality of workmanship is extremely high.

TL is being extremely accommodating, as waiting for us out on the ramp is a Stream, along a Sparker and a Sirius, which we'll use as a cameraship.

Puts the sport in light sport

Even just sitting on the ramp, the Stream looks like it's moving, and from the tip of the sharp-pointed spinner to the top of the swept-back fin, it looks great. It definitely emphasises the 'sport' in light sport microlight, and looks rather like a scaled-down version of one of my all-time favourite aircraft, the Pilatus PC-21.

Starting at the spinner, I note the very low frontal area. Like the majority of LSMs, it's powered by a 100hp Rotax 912S, but this one is very closely cowled.

Surprisingly, there's no access hatch to check the oil and coolant, which means the entire top half of the cowling must be removed – and this is secured by a lot of Dzus fasteners.

Still, this does give you the opportunity to check the various hoses and the overall condition of the engine; and the exhaust springs in particular, as these tend to break if not set up correctly.

There's a huge NACA duct on the starboard side for the oil cooler, and a significantly smaller one on the port side for the coolant.

The engine spins a two-blade, constant-speed TL propeller, and is fed by a 91-litre main tank in the fuselage, supplemented by two wing tanks with a combined capacity of 60 litres. ▷

> "Even sitting still, it looks like it's moving

Comfy heated seats, electrically adjustable rudder pedals and swish instrument panel – lovely

▷ The hydraulically operated retractable tricycle undercarriage has a wide track but a relatively short wheelbase, as the mainwheels retract inwards and the nosewheel aft.

The mainwheels use a trailing link arrangement with rubber doughnuts in compression for shock absorption, but none of the wheel wells have doors.

Two minor aesthetic anomalies are that the rubber doughnuts are uncovered, and the single exhaust pipe points straight down. I think that if it had a 45° bend at about the halfway point, it would look racier, and might even reduce drag.

The wing's leading edges taper towards the tips, and as there is very little dihedral, the lateral stability will be worth investigating.

As it's a very clean design fitted with a sophisticated laminar flow aerofoil, I'm also curious to see how well the designers have addressed the problem of providing adequate drag on the approach, for although the trailing edge of the wing is fitted with electrically-actuated slotted flaps, they only extend to a maximum of 32°.

The flap system also includes a facet I'd not encountered before: although the flap selector has three settings – up, half and full, there are actually four positions.

During extension, the flaps go to 10° deflection at half and 32° at full, but when you select half from full, they actually retract to 21.5°; a good compromise for landing in strong crosswinds, as I was soon to find out.

Very neat LED landing and position lights are built into the wingtips and to the tip of the rudder.

Ailerons and elevator are actuated by pushrods, while the rudder is controlled by cables.

Pitch and roll trim is provided by electrically-actuated tabs, one in each elevator and one in the starboard aileron. The flaps are also controlled electrically, while the brakes and prop are hydraulic.

Being a tandem design, maintaining the C of G within the weight and balance envelope can be an issue, which TL has cleverly addressed by incorporating two baggage bays: the one in front of the cockpit can carry up to 10kg and a larger one aft 15kg.

Behind the cockpit is a frangible panel that houses a Galaxy ballistic recovery system, and I was surprised that this panel wasn't marked as such.

The tail consists of a rakishly swept back fin which carries a horn-balanced rudder, a fixed, swept back tailplane with considerable anhedral, separate horn-balanced elevators and a small ventral fin below the tailplane.

TECHNICAL DATA

TL-STREAM

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Summary
Dual seat tandem low-wing cantilever monoplane with conventional three-axis control via Infinity sidesticks and with duplicated rear-seat controls. The wings are rectangular platform with a full composite sandwich airframe using carbon-glass fibre. The wing spars are carbon composite with Kevlar spar caps.

The tail is conventional. Pitch control is by an elevator on the tail with electrical trim adjustment; yaw control is achieved with a fin-mounted rudder; roll control by ailerons.

The retractable undercarriage has three wheels in nosewheel formation. The mainwheels have a trailing link arrangement with rubber doughnuts in compression for shock absorption.

The retractable noseleg has rubber doughnut suspension with the steering connected to rudder pedals and on to the rudder. There are hydraulic disc brakes on the mainwheels.

The monocoque airframe is built entirely from composite materials, including Kevlar spar caps, and elsewhere as appropriate.

The Rotax 912S engine is mounted on a normal engine frame secured to the firewall and drives a TL-manufactured Duomax two-blade constant-speed tractor propeller.

External dimensions and areas
Length overall when rigged: 6.79m.
Height overall: 2.48m.
Wing span: 9.0m.
Wing area: 9.96m².
Root depth profile: 1404mm.
Tip profile: 940mm.
Fin area: 1.1m².
Rudder area: 0.474m².
Elevator span: 2.68m; **Area:** 1.7m².
Wheel track: 2.0m.
Wheelbase: 1.53m.
Mainwheel tyre size: (15x6).
Nosewheel tyre size: 11x4.

Powerplant
Engine: Rotax 912S.
Max power: 100hp at 5,800rpm.
Propeller diameter x pitch: 1.80m x 31° @ 350mm radius from hub centre.
Gear reduction ratio: 2.14/1.
Fuel tank is at the bottom of the fuselage with a capacity of 91 litres, supplemented by two 30-litre wing tanks.

Weights and loadings
Empty weight: 297kg Incl. BRS.
Max takeoff weight: 600kg.
Payload: 303kg.
Max wing loading: 60.2 kg/m2.
Max power loading: 8.04kg/hp.
Load factors: +4g, -2g recommended, +6g, -4g ultimate.

Performance
Max level speed: 140kts.
Never exceed speed: 184kts.
Economic cruising speed: 90kts.
Power-off stall speed with full flap: 30 deg 46 kts.
Power-off stall speed without flap: 60kts.
Max climb rate at sea level: 960 ft/min.
Best glide ratio with power off: 12/1 at 70kts.
Takeoff distance to clear 15m obstacle: 345m on grass.
Service ceiling: >10,000ft.
Range at average cruising speed: 1200nm.
(Values using TL- Duomax prop.)

*** Under the following conditions*
Airfield altitude 241m Ground temperature 15°C. Density altitude 775ft. Ground windspeed strong and gusty from 040deg. Test payload MTOW 600kg.

Available as a fully-built 600Kg light sport microlight
Cost £234,000 including VAT, plus €2,300 delivery.

In the office

Access to the cockpit is good. A very large side-hinged bubble canopy covers the tandem cockpit, and there's a useful step and big wing root walkway on the port side – again, reminiscent of a scaled-down PC-21.

Having settled onto the comfortable electrically-heated seat and set the electrically-adjusted rudder pedals, I note many features that I like and a few that I don't.

The throttle and prop levers are perfectly placed, as is the sidestick, which carries an Infinity Aerospace pistol grip. This features a big red trigger for the PTT, a 'coolie hat' switch for pitch and roll trim and various buttons: the green one is for radio flip-flop, blue engages the automatic wing levelling system and red disconnects the autopilot.

Prominently mounted at the very top of the instrument panel is a large slip ball with the control panel for the Garmin ▷

▷ GMC507 autopilot underneath, and eyeball-type air vents on either side. These are a good idea, as this type of cockpit can get very hot in the summer.

The centre of the panel is dominated by a 10in Garmin G3X touchscreen, with a Garmin GTR225A transceiver directly underneath. A GTX335R ADSB-Out transponder is integrated in the G3X, as is the GMC507 autopilot.

To the left of the G3X is an analogue ASI, single pointer altimeter and a toggle switch for the undercarriage, while to the right is a large fuel pressure gauge. Apart from the toggle switch for the master and undercarriage and the key-type rotary magneto/starter switch, most of the electrical services are operated by push buttons; a prudent choice in an aircraft where people step down into the cockpit.

The panel is braced by a centre column that carries the flap-shaped flap selector, the single fuel gauge and fuel valve. If you're wondering why – despite the fuel system consisting of three tanks, there's only one gauge and the fuel valve is only on or off – it's because the wing tanks drain into the main (fuselage) tank, so the gauge always reads 'Full' until both wing tanks are empty, and the fuel valve shuts off the fuel from the main tank downstream of the firewall.

Overall, it's all nicely thought out, but still not quite perfect, and there's always room for improvement.

I would put the undercarriage selector (which should have a wheel-shaped top) directly in front of the power levers, along with three red/green lamps to show the status of the undercarriage and move the master to the right side of the panel. Undercarriage status is shown within the Garmin multi-function display, but you do have to look for it.

I'd dispense with the key-operated rotary starter/mags switch and replace it with guarded tumblers for the mags and a start button, move the emergency hydraulic pump to the right side of the centre column, and change the T-handle for the BRS to a black-and-yellow striped loop.

I would also put a red 'Master Warn' and a yellow 'Master Caution' annunciator either side of the slip ball. I know this is a regular suggestion of mine, but the problem with units like the G3X is that there's just so much information contained in it that you need 'attention-getters'.

With such an arrangement, the small red 'charge' light could also be dispensed with and its function incorporated into the caution circuit.

Regular readers will probably be starting to get bored by my rants about poor ergonomics, but good ergonomics *are* important, and I find it very frustrating to keep finding the same poor designs again and again – and once again there are two plungers that are identical in shape and colour for choke and cabin heat. Not good enough.

And while I'm being picky, I approved of the colour-coded fuel valve but, strictly speaking, it should turn clockwise for On.

Closing the canopy confirms that this one has no DV panels at all and generates my usual complaint that you should really be able to open some kind of small window in flight. Take a note, TL's Chief Designer Martin Zahalka. ▷

TL Stream and Sparker.
Flight test of the later coming soon

Dave looks happy. Dave's always happy. We like Dave

You can get one with a Rotax 916iS if you really want to go faster

troubled by a strong and gusty wind from 040°, while with two on board, two-thirds fuel (100litres/72kg) and no baggage, we're still about 50kg below the 600kg maximum all-up weight.

Lining up with the centre of Runway 33, I open the throttle slowly, although the wind from the right should reduce any propensity to swing.

Acceleration is good, and we're airborne after about 240m. Climbing away, I select wheels up, closely followed by the flaps, and note there's no noticeable pitch trim change with either gear or flap retraction, but it does seem to settle slightly as the flaps retract.

Now, with everything cleaned up, I can really wring the Stream out – and it's the type of aircraft that both encourages and rewards 'flying with enthusiasm'.

The field of view is excellent, and the pedals, stick and throttle are just right. A further examination of stability and control confirms that this machine is a real thoroughbred. The ailerons are light and powerful, the elevator authoritative and the rudder nicely balanced.

Furthermore, all the primary controls are well-weighted, with low breakout forces and very little stiction, while the electric pitch trim is nicely geared. I never needed to use the aileron trim.

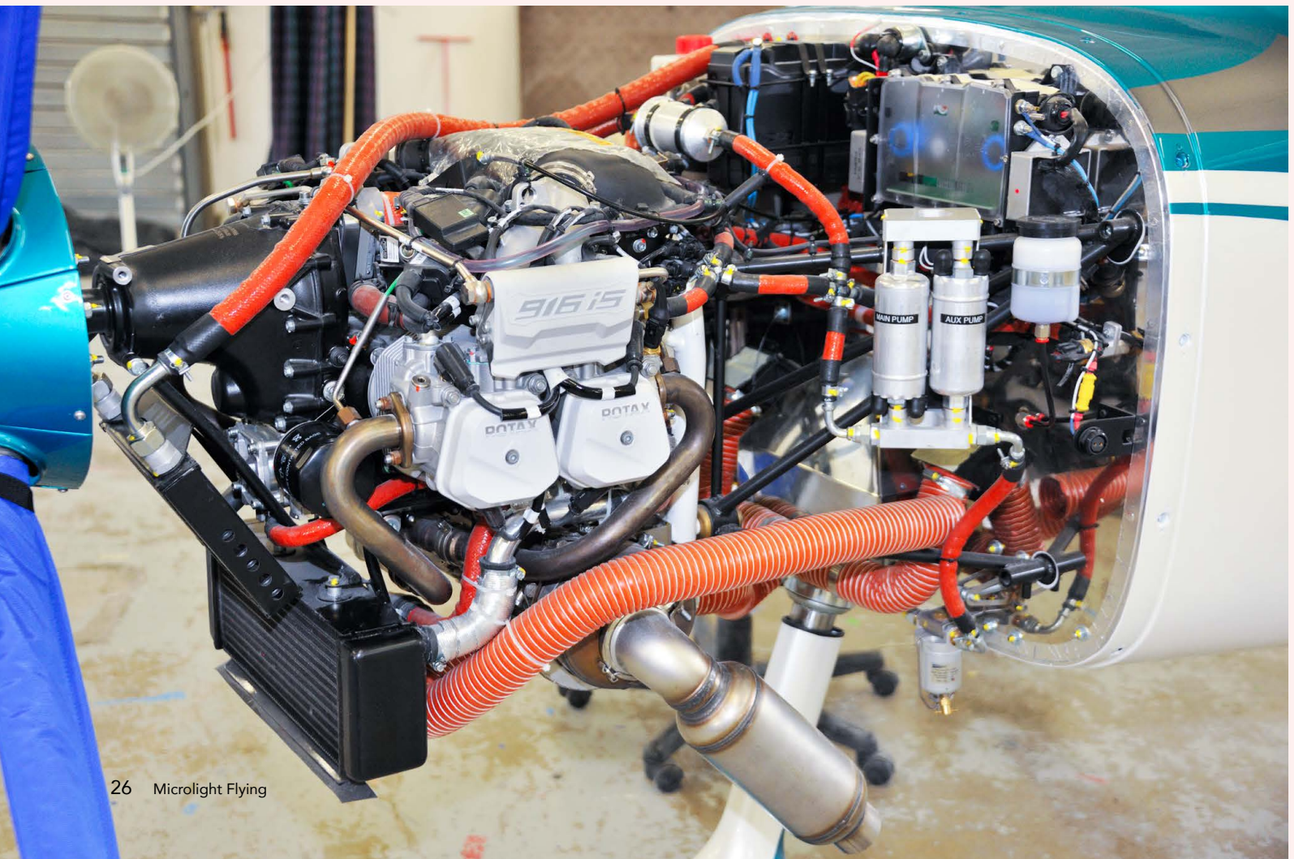
Growing in confidence, I commence a more vigorous exploration of the flight envelope with some steep turns and sharp reversals. The Stream has a commendably rapid roll rate, and only small amounts of rudder are necessary to keep things coordinated.

▷Time to fly

With instructor Nicolas Hostaléry as my mentor in the back seat, I start up and taxi out.

The nosewheel steers through the rudder pedals, the undercarriage confers a very comfortable ride and the field of view is excellent. The toe-operated hydraulic disc brakes are smooth and powerful.

Runway 33 is an impressive 2,400m of pristine blacktop (it used to be a MiG-15 base), but today is



It looks fast even standing still

For a relatively light aircraft, it flies and feels like a much heavier machine. In fact, when I bank and then reef it around, the turn radius is gratifyingly small.

These are great fun, and I would just love to explore the envelope further with a few loops and rolls, but the Stream is certified as a microlight, and microlights are limited to +/- 30 °pitch and 60° bank.

One feature that I never tire of is the simply superb field of view conferred by the tandem seating and bubble canopy. It really is outstanding; only modern sailplanes and fighters come close.

Slowly does it

A quick look at the low-speed side of the envelope confirms that slow flight is easy and stalls relatively benign, with only very subtle pre-stall buffet flaps up and a mild wing drop. With the flaps down, it broke straight ahead after buffeting.

Interestingly, well-known test pilot Dan Griffith had been out to the factory a few weeks previously, and decided that production aircraft will need to have fences on the wings.

I asked Dan about this, and he explained that the stalling qualities at aft C of G and high power needed a little tweaking to make them compliant with the regulations.

If you're wondering why I didn't discover this anomaly, all the testing I do is very much in the middle of the envelope, as my reports are aimed at the consumer.

Dan's reports are for the regulator, and consequently he would have had the C of G right on the aft limit – and that makes a big difference!

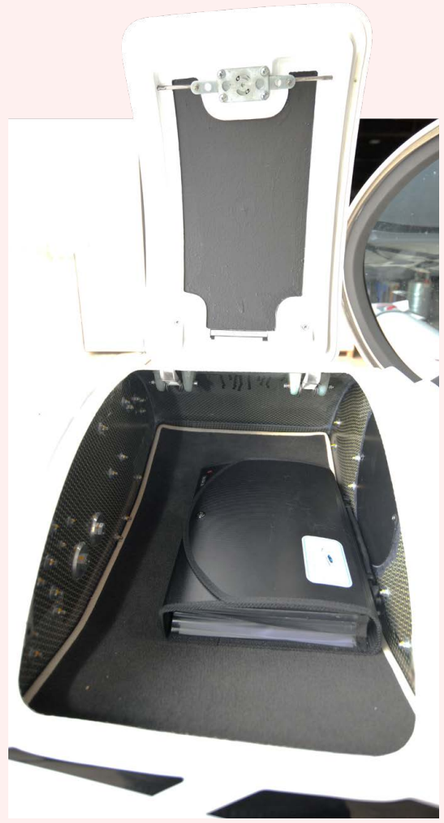
Anyway, recovery at our C of G is very easy: just release the back pressure and the wing is flying again with minimal loss of altitude. Given the Stream's sporty appearance, I had expected that the stall might be somewhat abrupt, but this is not the case, although I would welcome the opportunity to fly the aircraft in rain, as some aircraft I've flown with laminar flow aerofoils behave very differently with wet wings.

The lowest speed I see with full flap is just below 45kt, while with flap up its nearer 55 at our weight.

Moving on to an examination of the control and stability reveals that the handling is both taut and responsive. Directional stability is slightly 'soft' (the fin isn't that big, and although it does have a ventral strake, there is still quite a lot of side area forward of the centre of pressure), while longitudinal stability is weakly positive, and lateral is essentially neutral but acceptable.

I'm less happy with the limiting speed for full flap. This is only 66kts – only six knots more than a typical approach speed. The undercarriage extended limit is a much more useful 86kts, which means it can be used as an airbrake. ▷

Now, Dave, whatever you do, don't press this big red button



Baggage spaces fore and aft allow you to control the C of G

This can be a useful attribute in an aircraft as slippery as the Stream, as it can be quite difficult to simultaneously slow down and come down.

In for the long haul

Accelerating out of the final stall, I adjust the throttle and prop levers for 75% power, trim forward, climb 100ft above my target altitude, then descend and let the aircraft accelerate. The airspeed soon stabilises at 125kts for a TAS of 133kts at 4,000ft, which is pretty speedy for a two-seater with only 100hp.

A more conservative power setting of 65% still gives an impressive TAS of 128kts for a fuel flow of around 16 litres an hour. As it has three generously-sized fuel tanks, the maximum range is around 1,200 nautical miles (plus VFR reserves).

The air today is rough, with turbulence generated by the Sudetes mountains upwind, but as the wings are quite stiff and have a reasonably high loading, the ride quality is pretty smooth – unlike some LSMs that I've flown.

Back to base

I could have happily spent the rest of the afternoon testing the Stream for – in case you haven't guessed – I really enjoyed flying it.

However, I still must fly the Sparker, so turn back towards Hradec and descend with the speed at the top of the green. It doesn't take long to get back.

On downwind, I can see that the crosswind has, if anything, increased, and observe to Nicolas that it's a shame that using the old cross runway isn't allowed, as it looks like about 400m is still useable.

Established on downwind and still zipping along, I pull the throttle right back, turn the fuel pump on and push the prop lever forward.

As the speed slowly bleeds away, I select undercarriage down and search for the three greens, before remembering that they're in the Garmin display.

I now select full flap, and then once the position indicator shows the flaps are fully extended, return the selector to half, which will give 21.5° of flap and provide more aileron authority.

Mindful of the narrow band between a sensible approach speed for the turbulent conditions and the flap limiting speed, I'm grateful that the Stream is quite speed-stable, while the reasonably high (for a microlight) wing loading helps it ride out the gusty curl-over, and despite the crosswind I easily land and make the first turnoff, so don't even bother repeating the exercise.

It had already been a long day, and I wanted to get my hands on the Sparker from the left seat before the weather broke, which as it transpired proved to be a very prudent decision.

I greatly enjoyed flying the Stream. It's very much an aircraft for the frustrated fighter pilot that lurks within many of us, without actually having to have the skills to be able to fly a fighter.

However, that said, it is a microlight, and if your microlight flying up to now has been restricted to Thrusters, C42s and their ilk, I would urge you to have some familiarisation training first. By comparison to them, this thing is a rocket ship! □

Beer thoughts

OVER a beer that evening, I discussed my criticisms with the Stream's UK agents, Paul Sanders and Peter Ronfell.

Paul explained that UK aircraft will be subtly different from the Stream I flew. For example, the constant-speed prop will be electric (as it's lighter), all three wheel wells will have doors, the wings will have fences, and the frangible panel will be appropriately marked as hiding a live and powerful pyrotechnic. Paul also reminded me that there's a camera that allows the pilot to visually check the status of the undercarriage, but I still think three LEDs near the lever is best. They should be red whenever the undercarriage is unlocked or in transit, green for down and locked, out for up.

Paul countered my biggest criticism – the very low Vfe – by explaining that the factory has raised this to 78kts, which is much more useable.

Beautifully sleek fin and rudder