Preview:

ProAirsport's Innovative Jet-Powered SSDR Self-Launcher

By Dave Unwin

I love soaring. The first time I ever flew and my first solo were both in gliders and for me, soaring flight exercises a fascination that is both difficult to explain and hard to resist. Often described as "three-dimensional sailing," the ability to fly a heavier-than-air machine for several hours and hundreds of miles by using the atmosphere as the fuel and your intellect as the engine possesses an undeniable attraction. Of course, two inevitable downsides of the pure sailplane are that assistance is required to get the thing airborn, and landing out. Furthermore, we all know that gliding can be almost as frustrating as it is fun – aircraft serviceability, airspace and airworthiness issues, licensing, and of course the capriciousness of the weather. However, what I find really frustrating is when everything else is beautifully aligned and the gliding club is closed or distant! Indeed, some of the subtlest soaring conditions are often found in the morning and evening. Air is a fluid, which means that the atmosphere is an ocean. And just like an ocean the atmosphere is rarely flat calm; there are endless ebbs and flows, ripples and waves, and this means there is usually some energy somewhere that can be utilized. Furthermore, from an aesthetic view point the low light of early morning and late evening can be stunning. These are two of the reasons why, although I live only 20 minutes away from the gliding club, I keep a Jodel D9 on a farm strip only ten minutes from my house. I've had some fabulous soaring flights, but I do find the engine intrusive.

Of course, what I really need is a sailplane that I can rig by myself and then safely self-launch from a 500 m grass strip. I've never really been a fan of the engine-on-a-stick configuration, while the jet-powered self-sustainers just don't have enough thrust to self-launch. In fact, I have no desire to go back to the performance offered by early motorgliders, which were desperately underpowered and possessed two distinctly unattractive traits – a marked reluctance to leave the ground and a disturbing eagerness to return to it! In fact, some were rumored to depend heavily on a little-known device called a "dirt sniffer." Reputedly designed for underpowered jets like the Republic F-84B and early versions of the Boeing 707, the dirt sniffer remained passive until it smelt the dirt beyond the end of the runway. Somehow (I have never had how a dirt sniffer works satisfactorily explained), sensing the end of the runway and its own imminent demise induced it to produce a bit more thrust, thus allowing the motorglider to stagger into the air. Of course, your problems were far from over, as these contraptions were so gutless that encountering even slightly sinking air was enough to turn the already lamentable climb rate into a descent, and as the ASI and vario needles sagged and the oil and cylinder head temperatures went "off the clock," the best thing to do was just look out of the windscreen and do your best to avoid tall trees and double-decker buses. They weren't very nice to fly.

Above: GLoW 13.5 m span self-launcher.

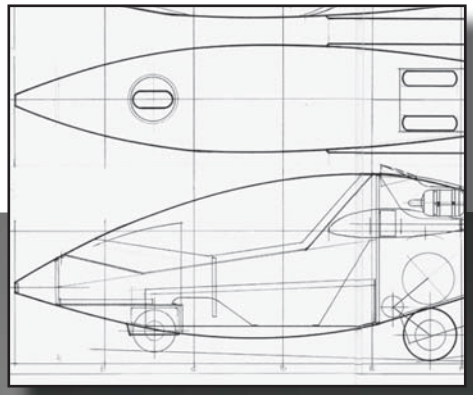
Consequently, when I heard that ProAirsport was proposing a new type of self-launching SSDR sailplane, powered by a lightweight turbojet, my initial reaction was one of skepticism. The history of flight is littered with the wrecks of ill-conceived aircraft, because trying to squeeze a thousand kilos of ingenuity and enthusiasm into eight hundred kilos of possibility almost always seems to end in tears. ☛

Subsequently, I must admit to being more than a little doubtful. Having flown a first generation jet fighter (a de Havilland Vampire), I know what it's like to fly an underpowered jet, and having taken a cursory glance at the specifications and weights, I doubted that this thing would have enough thrust to even taxi to the far hedge, let alone fly over it!

But then Roger Hurley, ProAirsport's CEO revealed that "project GloW" sitting in his computer was a hybrid, and that the wheels would be driven by a powerful electric motor. Instantly my initial skepticism turned to enthusiasm, and I made an appointment to meet Roger at the ProAirsport factory. Here I studied the blueprints and CGI, inspected the fuselage plug, and marveled at the small size of the jet engine.

I learned that the wings are "standard" – with some aerodynamic tweaks – from an existing glider which straight away increased the project's credibility as, in my opinion at least, there's no point in constantly reinventing the wheel (or the wing in this case) and that choice just greatly reduces project risk and cost. Designed to meet the requirements of the new UK Single Seat Deregulated (SSDR) class and the US Light Sport category, GloW will have a MAUW of 300 kg and an empty weight of about 180 kg, leaving a payload of 120kg. If you fill the tank to its 27 kg, that leaves 93 for pilot and parachute. Although many lightweight machines these days sport Ballistic Recovery Systems, there simply isn't room for one in GloW.

Both the methods and materials used in its construction are standard sailplane technology. The fuselage is essentially fiberglass with aramid and carbon fiber used only for local strength. The wing is foam core and



Below: Aft view showing turbine exhaust and dual main electric assist gear.

fiberglass sandwich construction. Modern composites are fantastically strong, and as the cockpit area also has local carbon/aramid reinforcement, I would expect it to be pretty crash worthy. The acrylic canopy, also standard, is forward-hinged and features a direct-vision panel.

The fuselage carries the wing, engine, fuel tank, batteries, and the cleverly powered undercarriage. The shoulder-mounted wing gently sweeps at the tips and uses a modified NN18-17 laminar flow aerofoil with only a small amount of dihedral. Large Schemp-Hirth type airbrakes are fitted to the top surface of the wing at about 45% of the chord. The location of the Titan jet engine is particularly interesting as it is fixed internally behind the cockpit and features an automatic open/close intake scoop. This very neat little turbojet is less than 40 cm long and weighs an astonishing 3.7 kg, yet produces a creditable 390 N. This should be enough to produce reasonable climb rates at around 50 kts, while the 34 liter fuel tank should be good for several further climbs. Fuel quantity carried may improve, but current thinking is that only having a single fuselage tank is much simpler, particularly when rigging and de-rigging. As the engine can burn a variety of fuels, from Jet A-1 and JP-4 to diesel, kerosene, and domestic fuel oil, it can not only be readily refueled from a variety of sources but is incredibly cheap! I had a delivery of domestic fuel oil only yesterday, which was 50 p/liter. As it is expected that a take-off and climb to 3,000 ft will burn about eight liters of fuel, the cost of a relatively high go-where-you-want launch will still be less than the average winch launch, and a lot less than the average aerotow! In the cruise, fuel flow is predicted to drop as low as half a liter a minute. The Titan is a standard commercial item which is used successfully in large R/C models and drones.

All maintenance is "on condition" and, compared to a piston engine turbines, these engines do offer several advantages. They are light, compact, and have only a few moving parts. Vibration levels are low, and they are very reliable. They are also much easier to start. Indeed, there are few engines more capricious than a two-stroke that is neither hot-nor-cold (and they usually demonstrate their fickleness at the most inappropriate times, such as when you're getting low over hostile terrain). Unlike a two-stroke, starting the jet is very simple; select start, the airscoop opens, and it starts. Shutting it down is equally simple, while a significant advantage of mounting the engine inside the fuselage is that while it is spooling up (and starts producing thrust) there's very little drag produced. Unlike a large windmilling propeller mounted on top of a pylon! However, in aeronautics, as with most things in life, there is no such thing as a free lunch … or, as would be more ap-

posite in gliding circles, a free launch! Now, although very small jets have been used on self-sustainers for some years, they simply don't have anywhere near the static thrust required to take off in a reasonable distance – if at all.

GloW has been designed for easy rigging, and a special trailer that allows solo rigging will be an option. And as the completely empty weight is only around 180kg, rigging shouldn't be too taxing. The elevator connects automatically, and I'd prefer it if the ailerons did too. Pushrods actuate the ailerons and elevator; cables the rudder; and the tailplane, fin, and rudder are entirely conventional in both construction and appearance.

The dual main gear come with electric assist.

Now we come to GloW's most unconventional aspect, the undercarriage. This consists of four wheels of three different sizes mounted along the fuselage centerline. There's a small steerable pneumatic nosewheel, a tiny solid urethane wheel (more of a "tail bumper" really) at the very tip of the tail, and dual retractable mainwheels, so the aircraft sits upright, wings-level. And this is where GloW gets really interesting, as these wheels are driven by a powerful electric motor. Modern electric motors put out a lot of torque and this can produce incredible rates of acceleration (check out the Tesla car on YouTube if you don't believe me). Roger explained that this hi-tech, brushless motor is a standard commercial unit that has been specially customized for ProAirsport. The bespoke controller is supplied by the motor's manufacturer (to ensure compatibility) and the LiFePO4 battery pack and charging system all use standard parts.

Using the powerful electric motor to accelerate GloW up to take-off speed is the design's "secret sauce" – and I am utterly convinced of its virtues. For take-off, GloW can be wings-level taxied, even reversed into position, with the motor also acting in place of mechanical brakes (further advantages of electrically driven wheels) before starting the jet and setting full power. With a peak output of 7kW and clever gearing, the wheels will easily and quickly accelerate the aircraft to the safe speed above which it will fly (the wing has a slightly negative angle of attack on the ground), then a smooth rotation will ease it into the air, and it will climb away using the thrust of the jet. As the electric energy required for take-off is wanted for only a few seconds (the acceleration really should be outstanding, in fact wheel spin could be an issue if power is applied too quickly) then take-offs from farm strips should be an option.

The design certainly looked extremely professional (Roger has assembled an impressive team of pilots and engineers, including renowned aerodynamicist John Gibson, aero-engineer Vittorio Pajno, and Finance Director Stephen Lynn) and Roger emphasized that although the SSDR class is not regulated or subject to mandatory airworthiness approval, ProAirsport decided from the start that recognized standards would be adopted. Consequently the company is following guidelines in the Standard Specification for Design & Performance of a Light Sport Glider (ASTM F2564) that's now tacitly accepted in many territories.

Cost? A priority price of GBP 43,950.00 ex-works has recently been released for a limited period. Further details can be found on the company's website http://www.proairsport.com/order.html. I have the impression that this experienced team has put together a very doable project.

I came away from my visit to ProAirsport completely converted to the idea. Imagine owning a self-launching

Basic Stats

Span: 13.5m
Length: 6.3m
Empty Mass: c.180kg
MTOM: 300kg
Load Limits: +4g -2g
Max L/D: about 36 (estimated)
Min Sink: about 120 fpm (estimated)
Turbine: Titan, max thrust 390N
Electric Motor: Customized, Peak take-off output 7kW
Batteries: Capacity options

microlight sailplane, free from regulatory hassle and able to take off from any reasonable field or strip. It could revolutionize soaring for many pilots, particularly those who either can't get to the gliding club as often as they like or don't even live near a club. There are trade-offs of course. As the aircraft is – by definition – very light, although the projected best L/D is expected to be mid-30s, this will be achieved at relatively low speed. However, the same is true for the minimum sink, so GloW should climb very well indeed. All aircraft are a compromise, and what's the point of owning a seriously expensive 50:1 supership if you only get to fly it twice a month? Furthermore, the reliable engine and easy starting (without any drag penalty while it starts) means I could use it to explore gentle wave systems, sea breeze fronts, and shearlines, and also to investigate hills and ridges that simply aren't accessible by pure gliders. As it says on their website, convenience, simplicity, independence, and lower cost can make the "Fly More, Fly for Less" idea a real possibility.

So taken was I with the project that as I left I gave my card to Roger and said that if ProAirsport needed any help with the test flying program, I'd be delighted to help ….

About the Author: *Dave Unwin is Pilot magazine's Flight Test Editor. Dave has been flying for 30 years, and has around 5,000 hours in about 300 different types, ranging from antique gliders and vintage biplanes to modern turboprops and jet fighters via WW2 bombers and fighters. He has an FAI Silver C, BGA 'B' category instructor rating, and a CPL/IR for SEL, MEL, and SES. He currently owns a Jodel D9 Bebe and also flies the Buckminster GC's Robin Remorquer (he is the Tug Master) and the Black Mountains GC's Piper Pawnee.*

www.daveunwin.com