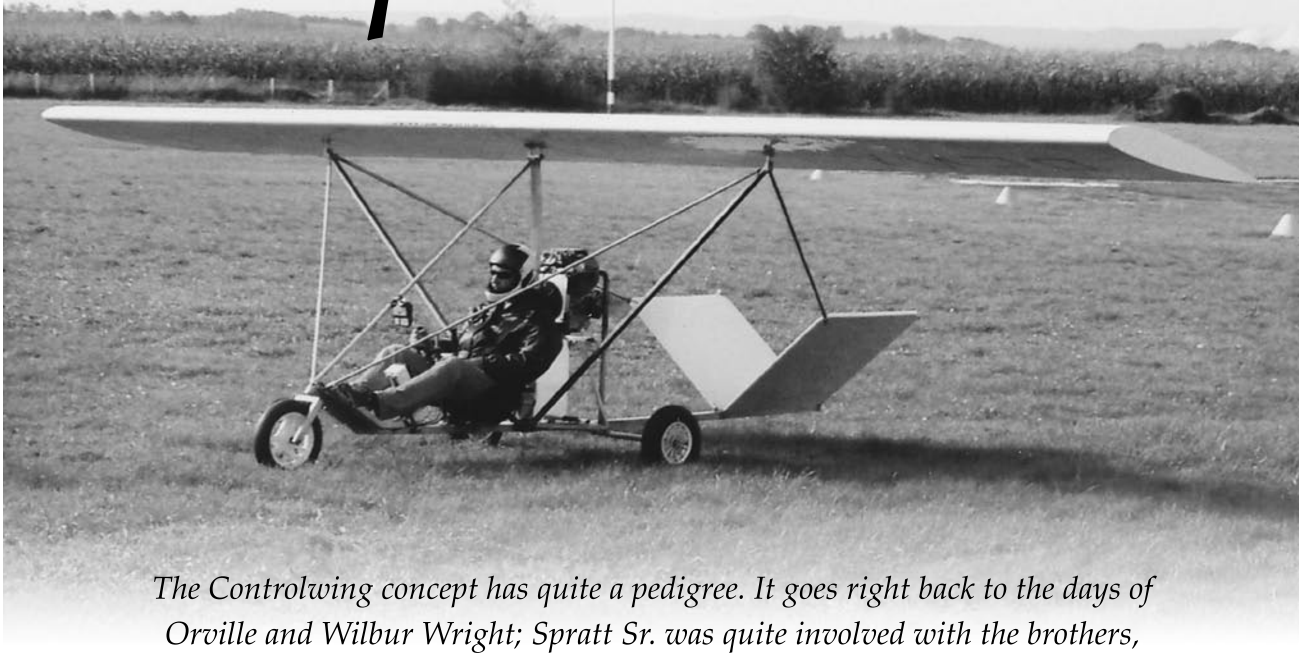
Bernard Geffray's

Spratt 103



The Controlwing concept has quite a pedigree. It goes right back to the days of Orville and Wilbur Wright; Spratt Sr. was quite involved with the brothers, though the solution the Wrights came up with and Spratt's concept represented two distinctly different schools of thought. The Wrights felt that control was everything; Spratt wanted automatic stability and then control. Ultimately, the Wrights won out, though their first successful aircraft was dangerously unstable; and the Spratt concept went into relative obscurity.

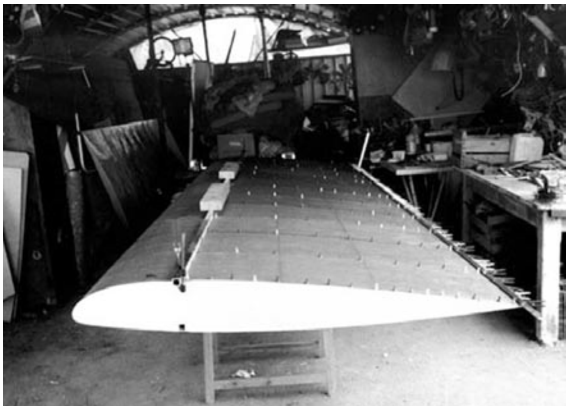
by George Gregory / Photos courtesy Bernard Geffray

Not entirely, though. George A. Spratt's son, George G. Spratt, continued to quietly develop the idea, building a series of aircraft on the concept, including a roadable aircraft, a number of flying boats and a towable land-plane version. Since then, a number of experimenters have toyed with the idea. One of the latest is Bernard Geffray.

15 years ago, with nothing much to his name but an intense desire to fly, Frenchman Bernard Geffray built a trike. It featured an engine pulled out of a Citroen and, being cash-strapped, he taught himself to fly in it. The experience inspired him to find a way to help other people of marginal means find away into the air, so he built a few more trikes with the same overriding principle: simple, safe, and affordable.

At the Mignet factory, he successfully fit a BMW flat twin on a Balerit, a derivative of the Mignet Flying Flea. The design is popular in France and features a tandem wing aircraft with a front wing that pivots on its spanwise axis for pitch control and gust alleviation.

He started envisaging a sort of cross between the two concepts he was familiar with, sort of a "Flea-Trike" aircraft. Attending Sun 'n Fun a decade ago, he was showing his idea around when someone pointed out that George G. Spratt had taken a similar path, and this led to a couple of meetings between the two men. There was a lot in the Controlwing for Bernard to like: it was simple -



The ribs are attached to aluminum spars and fibreglass panels are glued on. The wings were tested to 4 g before deformation occured.

Top: a fuselage doesn't get much simpler than this. A few pieces of square stainless welded together.
Above: ribs are hotwired out of styrofoam.
Below, right: the 103 is hung by its wing pivot to check its C of G. This is a pendular aircraft - like a hang glider or autogyro - and the airframe hangs from the wing pivot. What matters is that the nose is high when you're landing.

far less moving parts. It was safe: impervious to stalls. The potential for affordability was there too; the less there is to build, the less there is to buy. Mr. Spratt was able to give him a list of plans owners for the Spratt 107, plus a healthy dose of enthusiasm for the concept. Subsequent visits stateside filled in some of the gaps, mainly culled from museum visits as there were only 4 Controlwing builders he was able to contact.

Enter the Spratt 103, Bernard Geffray's vision of an ultralight that capitalizes on the Controlwing's inherent simplicity. Why "103"? It's in keeping with George Spratt's numbering conventions, but it's also meant to be a Part 103 ultralight in the FAA's terminology.

There have been design challenges. One of the most difficult, says Bernard, was overcoming adverse yaw. The Spratt 103 does not have rudders; there are some stabilizers aft to help the aircraft weathercock, but there was no positive aerodynamic means to offset the adverse yaw created when the wings are deflected. Initially, 20 kg of force was required to turn the aircraft. After much experimentation, he found that by allowing the upper wing to float free in the turn, he was able to reduce the effort required and eliminate adverse yaw at the same time.

A glance at M. Geffray's design reveals an aircraft optimised for economy, simplicity and strength. Theoretical work done at Tecnitas, a department of the French laboratory Veritas, and practical on-the -ground tests have confirmed the airframe's integrity. It's certainly not fast - about 28 mph to a maximum of 70 mph - though entirely comparable to its more conventional hang-glider based cousins. In fact, Bernard describes the Spratt 103 as a "pure trike" - albeit one with a double surfaced composite wings that pivot independently of each other.

Construction

A simple structure is TIG welded out of square stainless steel; the main wheels were liberated from a wheelbarrow, the nosewheel from a moped, brakes and all. The wings consist of styrofoam ribs, aluminium

The Spratt 103 is easy for the physically challenged to access. No rudder pedals either. Below: the airfame is short at only 13 feet long. There are no elevator or rudders.

spars and polyester resin with fibreglass fabric. The polyester was chosen for its economy, but Bernard is aware of its corrosive effect on styrofoam; one of his challenges was to find a way to use the polyester without affecting the styrofoam.

Bernard feels the aircraft can be scratch-built in as little as 200 hours for about $5000 CDN.

Amongst Bernard's design parameters were amphibious capability, able to fit pilots of various sizes, and easy for disabled flyers to handle. The

The airframe is the very definition of simplicity. There are no ailerons, rudders or elevators

open design certainly seems to have obtained these goals; the seat is right at ground level, with little in the way of surrounding structure to impede large pilots or wheelchairs. His amphibious version has what look like a pair of surfboads with slots cut in them for bicycle-like main wheels to protrude out the bottom - as Curtiss and Voisin did in the past, Geffray points out. Because the pusher prop is mounted high and behind the pilot, exposure to water spray is minimized, and bystanders are protected from the prop by the structural tubes outboard of its area of operation. The entire fuselage is a scant 13 feet long.

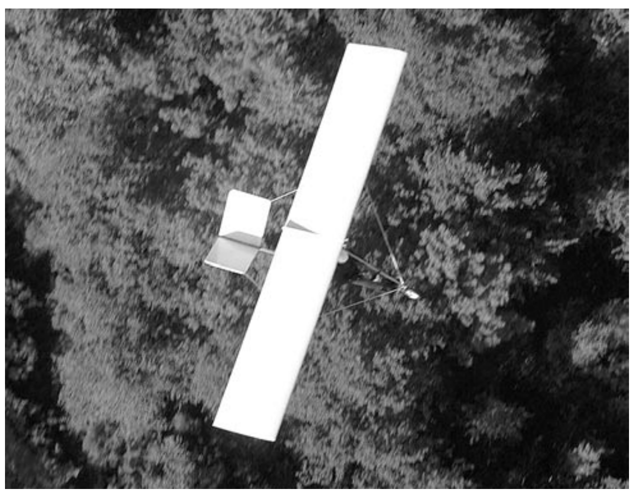
The airframe is the very definition of simplicity. There are no ailerons, rudders or elevators. The aircraft is manipulated entirely by the application of power for altitude control, and the differential movement of each wing panel to turn the aircraft, with collective movement for speed control. More on that later.

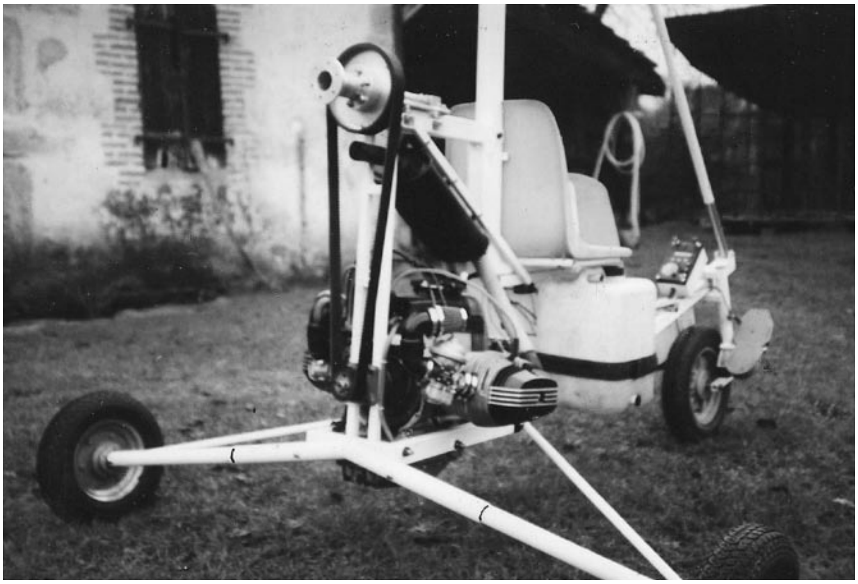
Another area where Bernard sought economy was in powerplants. Several have been tried, none of them conventional aircraft engines. Industrial 4-strokes have been the engine of choice; he 's tried a 25 hp Kohler ("fine but heavy"), a 20 hp Honda, which he feels is a little on the weak side, and a 22 hp Briggs. None of these engines consumes more than a gallon per hour. A diesel engine is being considered, and electric power is an exciting possibility (Electric Flight Corporation is already promoting a package for use with conventional trike wings that could have an endurance of up to 1.5 hours).

Bernard says the aircraft can be disassembled in about an hour. There are no wires or bellcranks to disconnect, and it will fit in a "small van (or trailer or back of RV)".

In flight

"Foolproof" is how Bernard describes it. The Controlwing concept is immune to stalls and spins. It cannot be rolled, looped, or spun, and you can't put one into a dive. The wings absorb turbulence like shock absorbers (this could take some getting used to. It is akin to the Mignet Flea concept and feel); and this means there is feedback in the control wheel as it moves with the wings. You just ignore it unless you want to turn. The gust loads felt by the pilot are, according to various NASA reports on the





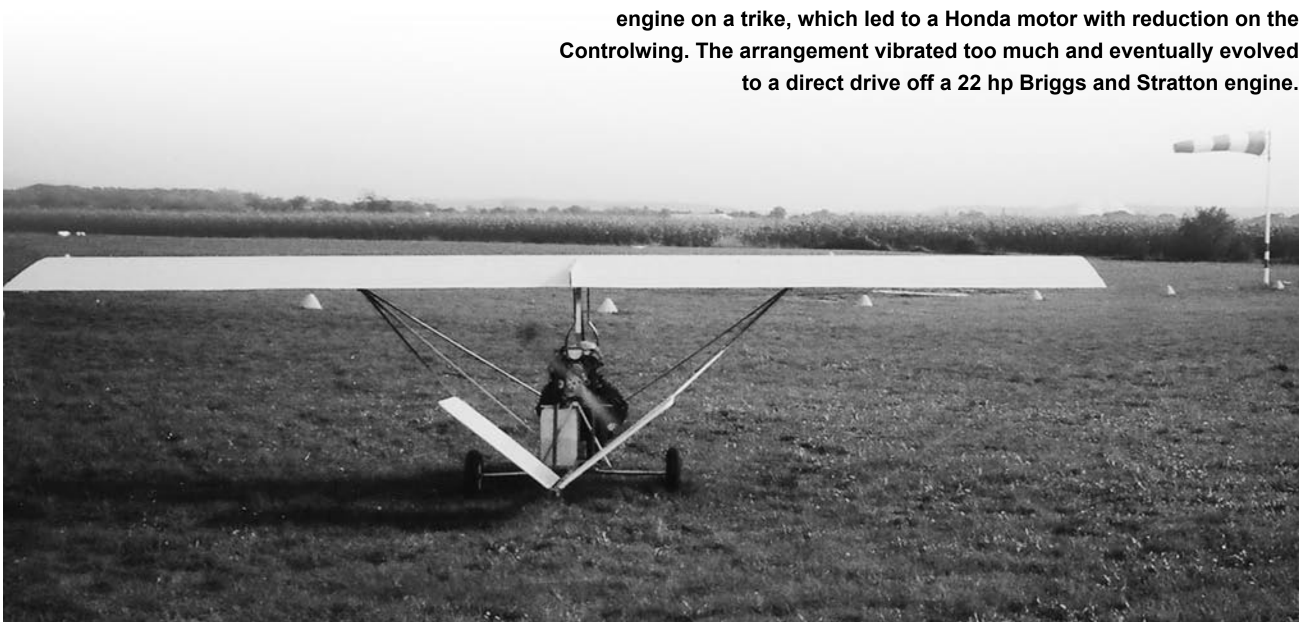
concept, about one-quarter what are normally experienced in a fixed wing aircraft.

There are three main controls: directional control is managed with the control wheel, which actuates the wings via control cables (earlier versions used push-pull tubes attached directly to the leading edge of each wing panel). The throttle controls altitude, and the collective control is achieved with fore and aft movement of the wheel. Trim is simply a device that attenuates the wheel's fore and aft movement to a desired setting. The wings can be locked at zero degrees incidence for parking; in this position it even sets the parking brake.

If you are flying level at a certain speed and want to go faster, you adjust the collective so that the present power setting resulted in a descent, then adjust the power to maintain level flight. If you leave the collective alone, when you add power the aircraft does not accelerate; it starts to climb. If you reduce power, it descends. At first I thought this rather limiting, until I thought about how seldom I actually dive an aircraft unless involved in aerobatics.

When landing the aircraft, you can flare with the application of a bit of power or a tug on the collective to increase the angle of attack momentarily; the wing

Above, right; Bernard Geffray, designer; the 103 on its amphibious "floats" - actually a pair of surfboards. Top, left: Bernard tried a BMW engine on a trike, which led to a Honda motor with reduction on the Controlwing. The arrangement vibrated too much and eventually evolved to a direct drive off a 22 hp Briggs and Stratton engine.



cannot be stalled, however.

How a Controlwing works

Two things that are critical in a Controlwing are the selection of the airfoil and the location of the spanwise pivot. The airfoil used a NACA 23112, a reflexed airfoil chosen for its low pitching moment (remember, a controlwing is essentially a flying wing with a fuselage hanging underneath it). Like the gyrocopter or a trike, it's a “pendular” aircraft though in this case true only in pitch as there is a positive aerodynamic input for roll. Maneuvering is accomplished by manipulating the orientation of the wings, and the airframe follows along for the ride. The wings pivot an a spanwise axis at a point below the chord and 25 percent aft of the leading edge. They are free to float in response to aerodynamic forces but are connected to the pilot’s controls so they can be tilted differentially without restricting their collective freedom.

This means they can move to absorb gust loads, and aerodynamic forces will not allow them to stall: when flying at low speed, any attempt to increase the angle of attack is met with increasing resistance. Around the top of the lift curve, a differential wing displacement - as when turning the aircraft - results in no (practically speaking) increase in angle of attack; almost all of the rotation will be in the wing having decreasing angle. If a gust strikes only one wing, it tends to maintain its angle of attack and lift, but reduces its incidence. The aircraft does not roll if allowed to absorb the gust in this way.

As before, the main altitude control is the throttle. When the power is applied, aerodynamic forces automatically increase the angle of incidence and the aircraft starts to climb; the opposite happens when power is reduced. Landing speed is 45 km/hr.

Speed is controlled by first selecting the default incidence with the collective and then applying power for the desired result, whether climbing, level flight, or descending.

Conclusion

I think Bernard’s on to something. Pilots used to conventional aircraft may feel a little disconcerted by the lack of elevator controls or its movable, gust-absorbing wing panels; but after five prototypes with a variety of configurations and engine/prop combinations, the design is getting a degree of refinement, and the safety of an aircraft that can’t be stalled or spun is evident. For a small one-seat aircraft just to putt around the sky as cheaply as possible, M. Geffray may have just the ticket. Bernard hopes to be selling plans by the summer of 2008.

For More Information:
http://spratt.103.free.fr/spratt103_english/welcome.htm
http://www.flyingflea.org/
http://www.georgespratt.org/
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