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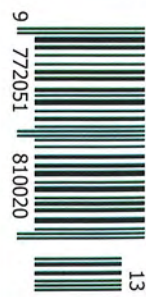


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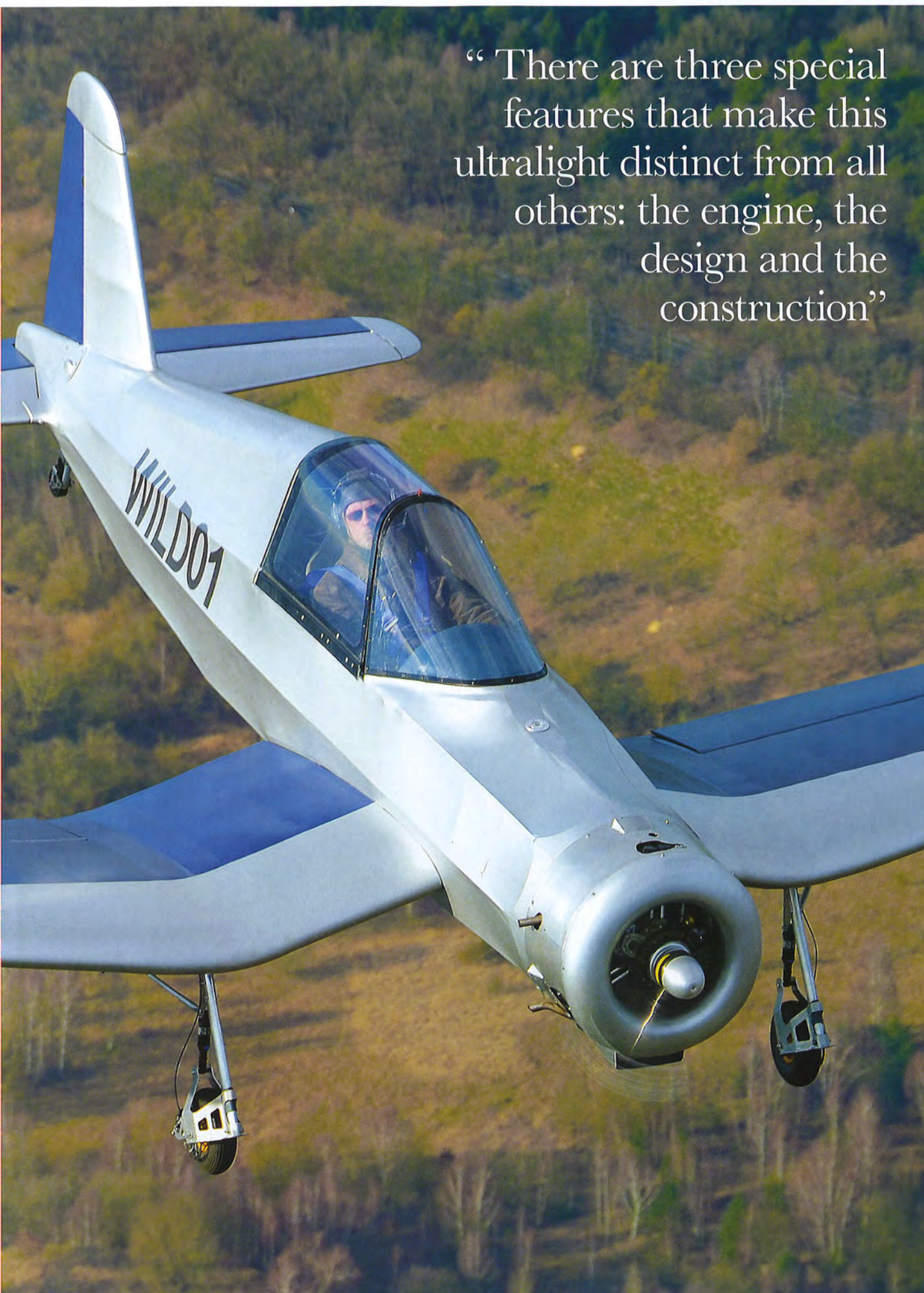


Flyweight Fighter


TECHNICAL | JH Aircraft Corsair SS DR

This pint-sized Corsair has a four-stroke radial engine and gull-wing like the original, but that's where the similarities end. Clever, ultra-lightweight construction and low stall speed makes it a single-seat deregulated category aircraft in the UK

WORDS & PHOTOGRAPHY PETER WOLTER



“There are three special features that make this ultralight distinct from all others: the engine, the design and the construction”



Opposite Tiny and agile – huge flaperons enable the single-seater to fly extremely slowly
Top Jörg Hollmann was an engineer and manager at Airbus, but now he is his own boss
Left The Scarlett 3V has grown in size during the course of its development, so the rocker caps now protrude through the original cowlings. A new cowlings is planned
Below Rigging the prototype for flight



A silver and blue taildragger departs from Stade's runway 29 and climbs into the sky south of the Elbe at a still, low speed. The engine note sounds just like the rhythmic beat of a vintage tractor, as supposed to an aero engine. I instantly think of the distinctive sound of a Kinner B-5, an old US radial engine, 7.2 litres, five cylinders – which produces a similar beat. But the Verner Scarlett 3V of this small single-seater has just a 1.6-litre displacement, distributed among its three cylinders.

During the photo flight later that day, the Corsair chugs away at 1,300rpm alongside our Cessna 172, far from the Verner's maximum continuous of 2,200rpm. Some engines on German 120kg ultralights shriek in cruise flight at 7,000rpm. For Jörg Hollmann, the designer of the mini-Corsair, that was out of the question, having worked at Mosler Motors in the US, where they have the slogan: 'Friends don't let friends fly two-strokes'.

Jörg studied in aviation and aerospace with a focus on aerospace engineering, and started as a structural mechanics engineer at Airbus, progressing to senior management, before becoming a development manager at an aerospace engineering service provider – and then an independent consultant for such companies. It could have gone on, but Jörg had a purpose, "I figured I would do a normal job until I'm 50, but after that it should be about something else that's more fun." Now Jörg is 51, and his idea of 'more fun' has come in the shape of his Corsair.

There are three special features that make this ultralight distinct from all others: the engine, the design and the construction. A four-stroke radial engine in an ultralight aircraft is an eye-opener. When the Verner is running, it dominates everything about this aircraft. With fearsome shaking, one cylinder after another gets into the beat. As the idle speed settles around 400rpm the vibration is much gentler on the airframe. Both on the ground and in the air, the lumbering rpm is both intriguing and irritating, but is encouraging for the pilot. Before the throttle is even opened, it sounds like it's got plenty more noise and power to give.

Another German aircraft designer, Roman Weller, has been challenged by the vibrations of the Scarlett 3V, which is fitted in his Uli V3 Rebel ultralight, and tried a succession of ever-softer engine mounts. Jörg, however, has relied on proven standard rubber damping mounts from Aircraft Spruce. He says, "They are doing a good job of damping the vibration."

However, it's worth noting that the version of the Scarlett in the Corsair has a new electronic ignition system with more precise ignition timing and a revised valve gear. I'm sure both contribute to a smoother running engine. In addition, the composite tube fuselage of the Corsair probably dampens better than Weller's tubular steel fuselage.

Lightest weight structure

The fabric-covered tubular fuselage is made from carbon fibre/kevlar (CfK) rods, which is I think, a first in aviation. The tubular frame, says the designer, is easier than anything else to develop, and since CfK offers the best strength-to-weight ratio it was, to his mind, the only material to consider.

One of the main challenges of the new design was the joints. After all, the connections must be made so that they are not weaker than the CfK tubes themselves, so Jörg created and patented a method to co-bond the tubes using rovings. Jörg emphasises that the extreme light weight is due to the tubular CfK structure, which made it possible to use the Verner radial engine as the Corsair's powerplant. The engine at 45kg leaves only 75kg for the airframe to stay within the German 120kg ultralight regulations. The remainder of the structure, the wings and the empennage, are built with ribs and spars made of carbon fibre.

Conventional covering material such as Ceconite or Diatex was out of the question. The primer and paint those systems use are way too heavy. Instead, Jörg chose Oratex UL 600 from Lanitz Aviation because it doesn't need a

surface finish once it is applied. The larger solid composite exterior surfaces are also not painted, but covered with a UV-resistant film, which is even lighter than Oratex, and also made by Lanitz.

There were some areas however, where safety took precedence over weight. For example, in the cockpit area, the single seat is mounted within a protective aramid carbon fibre hybrid safety cell with extra strength in the sides and roll-over structure. Is that gull-wing a costly luxury in the structure, in terms of construction costs and weight? "No," replies Jörg. "With composite parts, it doesn't matter if you lay the fabric straight or curved into a mold."

The use of the classic NACA 23015 profile with a large nose radius and a lot of thickness does not seem to be as ambitious as other aspects of the project. In the beginning, the designer had actually considered developing a profile specifically for the mini-Corsair. "Maybe I could have gotten a few more knots out of it, but the effort would have been out of proportion to the reward," says Jörg.

Undercarriage

The Corsair's undercarriage may look simple and almost too light-weight, but Jörg has used materials to deliver light, strong, yet compliant solutions. He explains the simple-looking tailwheel strut and the supports of the main landing gear, which has astonishing construction. While their surface looks like that of a braided hose, they are CfK wrapped around a CNC-milled foam core – light with strength!

The main undercarriage legs are engineered to use a trailing-arm with oil-gas damping courtesy of the latest mountain bike shock absorbers – it's above average technology of what is often seen on ultralights, and possibly two or three times lighter. Mountain biking is also the source for the aircraft's disc brakes.

Regarding the undercarriage, perhaps the only question for me is, was it wise to imitate an aircraft from WWII with retractable gear? I'm not sure, as somehow, in the air, with its fixed gear, the micro-Corsair always looks as if it's on approach or departure.

Aside from that, it's just the greenhouse-look of the cockpit canopy and the lean-looking fuselage compared to the original that perhaps affect the aesthetics. Jörg says this will be different in the production aircraft. The Verner 3V became larger in the course of its development, which is why this prototype's final cowling has two inches more diameter. The next version will see the fuselage contours blend more smoothly from firewall to windscreen. Some of this will be in the form of a new CfK fuel tank which replaces the aluminium tank fitted to the prototype. Ultimately though, does it matter if the undercarriage doesn't retract, or if the shapes aren't quite like the original? In my experience, compared to other aircraft categories, the 120kg ultralights are much more about how it makes the pilot feel. The package needs to be exciting, visually a pleasure. And the Corsair certainly is that.

In flight

The unusual engine, the unique construction, the Corsair airframe influences – you like me, of course are curious about



Top In blue, with some US Navy markings, this would look the business...

Above CfK fuselage tubes co-bonded with rovings keep the weight down. Levers on the stick control the brakes

Right Tailwheel and rudder are joined and provide steering by a CfK rod

Below right Trailing arm main gear with oil-air damping units from a mountain bike

Left Seat base is a CfK aramid mix, the panel surprisingly well-equipped for the weight category

Below The Corsair is light! It's an SSDR in the UK, and ultralight in France and Germany



An Unusual Engine

Czech engine manufacturer Verner engine became known in the 1990s for an air-cooled two-cylinder boxer, the 84hp VM 133. For single-seaters, the water-cooled JCV 360 with 35hp came out later, also a two-cylinder boxer using Aprilia motorbike engine components. Neither of those engines is manufactured now and instead Verner offers four radial engines that build on each other. From three, to five, seven and then nine cylinders, they range in power from 42 to 158hp. With a bore of 92mm, the stroke for the three-cylinder motor is 82mm, while the others are 102mm.

The Scarlett 3V is an air-cooled OHV four-stroke direct-drive with electric start. It has dry sump lubrication with the oil reservoir below the bottom cylinder to allow the oil to circulate. Fuel metering is handled by a Walbro diaphragm carburettor, which works independently of position. Mogas of at least 95 octane is enough.

The engine has two unusual features. After shutdown, the propeller must be manually turned to a parked position. To do this, you match two marks on the propeller flange and the crankcase, to prevent oil running into the bottom cylinder. Oil can however be drained via a plug in the intake tract of this cylinder. The priming is unusual, too. As part of his external checks, the pilot can turn on the electric fuel pump so that the carburettor gets fuel, and then through an access panel in the cowl, press a button on the carburettor. This allows fuel to enter the intake system. While the prime lasts for a few minutes before evaporating, the pilot shouldn't delay and make this the last action of his checks.





TECH SPECS

JH Aircraft Corsair

Tiny and light with warbird looks...

what it's like to fly. Currently, only Jörg as manufacturer knows that, the aircraft being not quite ready for someone else to fly it.

The stick forces, says Jörg, are extremely low, two fingers not a whole hand, throughout the CofG range. A trim has proved unnecessary. "It's a lightweight machine, so you won't want to let go of the controls anyway," says the Corsair pilot.

The effect of the huge ailerons is very good and not surprising. Their size is due to the need to work as flaperons – a small amount of deflection creates plenty of extra lift. This is necessary for the desired low stall speed.

The ultralight (LTF-L) 120kg category requires that the aircraft does not exceed a number of criteria, including empty weight, stall speed, wing loading and fuel tank volume to qualify for airworthiness, these are 120kg, 55km/h, 25kg/sq metre, and 25 litres. However, there's confusion here because some ultralight makers say the accepted practice since 2016 is that only the requirement for empty weight must be met – not so Jörg who's a stickler for detail.

So far in cruise, Jörg has seen 160km/h, but he has not reached the optimum cruise rpm for the Verner of 2,200rpm and work is still underway on the right propeller settings. Calculations suggest that a maximum cruise speed of 170km/h should be feasible.

Because of the low wing loading, Jörg prefers not to use flaps for normal landings – with flaperons extended, the flyweight would be even slower and more prone to gusts. The approach speed is 80km/h, aiming for just over 65 on touch down. For take-off, the flaperons remain unused. Unusually for a taildragger, the pilot has a good view of the runway in the three-point position, with the cowl only obscuring the immediate area in front of the nose. The seating position is adjustable fore and aft, while the pilot's head remains about the same height as it's adjusted. Jörg says that the canopy can be removed and the aircraft flown open cockpit. If you chose to do that, a cover must be installed behind the seat, so that the air doesn't flow into the rear fuselage.

Plans for production

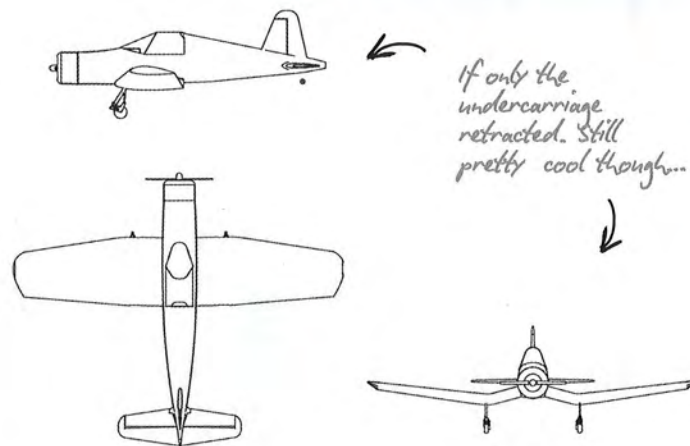
Jörg Hollmann's project was not easy. A new aircraft with a new engine for many designers is a taboo combination. Jörg recognises that, but nonetheless, he didn't shy away from what has clearly been a very challenging design project. In the 120kg class, designers usually want freedom in design.

Deciding to use a warbird as inspiration adds a challenge to designing for a category where it's already difficult to cope with the weight restriction.

In the town of Buxtehude on the Este River in Northern Germany, JH Aircraft has built a factory and have hired employees. Series production of this fly-weight fighter is already running. The investment in time and money has been significant and it's not about fun anymore – now the business idea has to work.

Fortunately, interest in the micro Corsair has proved strong. At AERO 2019 the aircraft was voted best new ultralight by readers of German GA magazine, *Flieger*.

Kilo for kilo, the little Corsair certainly makes a spectacular impression.



Performance

Vne 113kt
Cruise speed 85kt
Design manoeuvring speed 154km/h
Stall 28kt
Load limits +6/-4 g
Rate of climb 790fpm
Range approx 300nm plus 30 min reserve

Weights & loading

Seats 1
Max take-off weight 250kg
Empty weight 110-120kg
Tank capacity 25 litres

Dimensions

Wingspan 7.5m (24ft 7in)
Wing area 10sq m (107.6 sq ft)
Length 6.3m (20ft 8in)
Height 2.4m (7ft 10in)

Spec

Airframe Carbon fibre kevlar tubular fuselage, carbon fibre wings and tail. Oratex and UV film covering
Engine Verner Scarlett 3V 3-cylinder four-stroke radial
Max power 42hp at 2,500 rpm
Propeller Helix, three-blade, fixed, CFK, 1.75 m
Undercarriage Tailwheel, fixed

Manufacturer

JH Aircraft GmbH
 Philipp-Reis-Straße 321614
 Buxtehude, Germany

www.jh-aircraft.de

Price

€75,970 gross



Above It's a challenge building a 120kg ultralight, even more so when it's based on a US WWII warbird. We think Jörg has succeeded

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