

FEATURE
Eta



Photos: **FLYER**

BIG

Really is BETTER

Eta is the biggest, most expensive glider in the world with a wicked pair of wings – as **Nick Wall** discovered





As we floated gently across the stormy north German skies like a giant bird of prey, a shaft of sunlight pierced the gloom and lit up the ground. It proffered the hope of life-giving thermals, but with some 50km to run it looked unreachable from our height. Then the voice of Hans-Werner Grosse, one of the world's greatest glider pilots, drifted back from the front cockpit: "No problem," he said, "we will make it. After all, this *is* Eta."

Faced with such a grey, unpromising sky most glider pilots would be searching the fields below for a good place to land or preparing to raise their engines and motor home. We just sat back patiently and watched the landscape roll by as Eta's amazing 30.9-metre wings whispered us along, dismissing the kilometres with the easy, loping gait of a long-distance runner. And, as we finally emerged into the sunshine, the freshly warmed air rose from the ground to carry us aloft

once more, allowing us to continue on our way.

This extended glide was a magnificent demonstration of the old gliding adage 'There Is No Substitute For Span' and why this, the world's largest glider, has been built – if you want to go a long, long, way, big really is better.

The trouble with building ever larger gliders in pursuit of performance is that splicing a few extra metres of wing to an off-the-shelf large-span sailplane works only so far (around 27 metres) after which you begin to exceed the airframe's aerodynamics. The end result can be an aircraft that has plenty of dash in a straight line, but which can handle like a three-legged hippo when you are trying to circle, and if a glider loses time wallowing around a thermal rather than climbing quickly, it doesn't go nearly as far as it should. Enter Eta (the Greek letter which represents 'efficiency') with a wingspan greater than the Ryanair Boeing 737 that carried me to

Lubeck for this flight, and with a fuselage and tailplane to match.

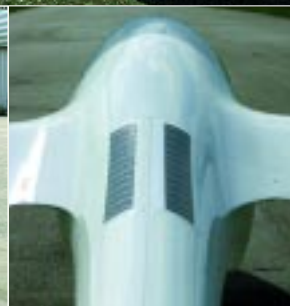
In the sky its 30.9-metre (101.3ft) span looks, and is, supremely graceful, but it's only on the ground that you really appreciate just how big this aircraft actually is; if the undercarriage was high enough you could park three C152s tip-to-tip under the wings and still have room for the crew. But join those three 152 wings together and you wouldn't even come close to Eta's performance; at some 65-70:1 it can glide from 2000ft for around 23 miles before making its mark on the landscape.

Setting records

Rather than being built by one of the established German glider manufacturers, this machine has been commissioned by six contest-winning and record-breaking European pilots to fly impossibly long distances and set new records – think in

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Yaw strings are the simplest 'instrument' in a glider – but crucial for best performance



From Ju88 to gliding record-breaker

Hans-Werner Grosse is a most amazing pilot and character – a Junkers 88 torpedo bomber pilot during World War II, he has flown 48 gliding world records and, at 80 (he'll be 81 in November), still wants to set more.

Born in 1922 he first went solo in Germany at the age of 16 and flew 30 different types of pre-war light aircraft and airliners. Barely aged 20 he was sent to fly Ju52s and

Heinkel 111s in preparation for his role as a torpedo bomber pilot. The Ju88 wasn't the easiest of aircraft to fly if it lost an engine, yet Hans-Werner survived two ditchings, once in daylight in the Baltic and the second time off the Mediterranean coast of France at night.

Although he faced immense personal danger in the Luftwaffe raids on the Arctic convoys, he is full of admiration for the bravery of the Allied ships' crews and firmly backs the pressure for a campaign medal for them.

World Championships

After the war he settled in Lubeck and began his new life selling a new type of clothing he had seen the American occupiers wearing – jeans. It was a smart move; from his first market stall he built up the business and became the largest supplier of jeans and denim clothing in the city.

He couldn't, of course, stay away from flying for long and revalidated his licence in the UK in a Tiger Moth in the early 50s and then took up gliding, gaining his Silver badge in 1955, his Gold in 1956 and his Diamond in 1958.

Since then he has represented Germany in two world championships where he attained one second and one third place, but he eventually gave up competition gliding – until this year – to concentrate on record-breaking.

He made history on April 25, 1972 with a free-distance flight in an ASW 12 from Lubeck to Biarritz in south-western France (he was only stopped by the Pyrenees!) a distance of 1460.8km (907 miles). It was a brilliant achievement in those days and it's a record that has only recently been broken. Now he is keen to reclaim it with Eta, accompanied by his wife, Karin. I wouldn't bet against it.

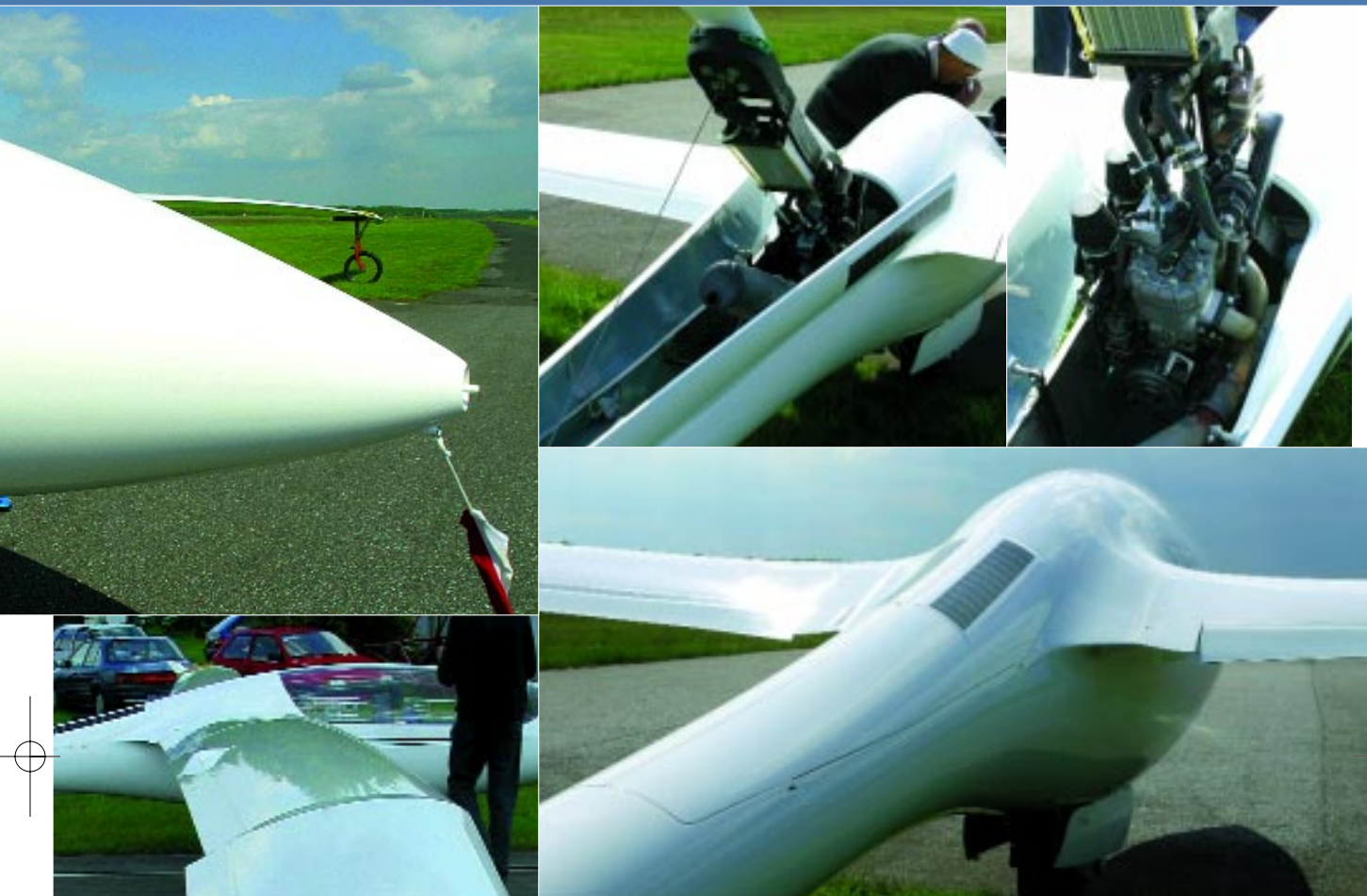
Far left: Hans-Werner's hangar has grown over the years to accommodate ever-bigger gliders

terms of 1000-2000km in a day. As this feature was being written, two of the first Etas, including Hans-Werner's, were flying in this year's World Gliding Championships for the first time.

You don't, of course, knock together an aircraft at the cutting edge of aerodynamics (and composite materials, for that matter) in your garage, so the Eta group commissioned one of Germany's foremost aerodynamicists, Dr Reiner Kickert, to design it and then went to expert aviation manufacturers to build the various parts. The result of six years' work is a beautifully proportioned and built (the glass-like finish on the wings would make Waterford proud) ultimate soaring machine.

To take full advantage of the wings' potential performance, excellent handling characteristics had to be a focal point of its design. Really big high aspect ratio wings do raise some aerodynamic issues. While increasing the span reduces induced drag and improves lower speed performance, it also increases profile drag at higher speeds. To reduce this profile drag you want a thin wing, but if the wing is too long and too thin you can find tip stalling problems. A tip stall isn't too clever if it happens as you circle low down, because





The 64hp two-stroke engine powers electrically out of the fuselage for takeoff and to get Eta and its crew home if the day turns to worms; solar panels on the engine cover charge the glider's batteries in flight; the step change to a larger wing chord towards the tip gives better low speed handling in turns

big-span gliders have enormous momentum in a spiral dive or spin and can be reluctant to come out. The design gurus addressed this complex problem by building a high aspect ratio wing – 51.33 – for most of its length with a sudden increase in the chord (low aspect ratio) towards the tip to give decent slow speed handling. This step change improves stall behaviour and controllability in steep turns – to put it another way, you can circle more slowly to get a better climb rate with less risk of a spin or spiral dive.

For roll control and to help cope with the secondary effects of these enormous wings (adverse yaw), Eta uses differential flaperons which stretch the length of the wing. The length of the fuselage tail tube has also been significantly increased over other large-span gliders to assist directional and longitudinal stability and the T-tail (which is just over 6ft high) is electrically adjustable to enable the pilot

to optimise the tailplane/elevator performance for the various phases of flight.

Despite the aircraft's size, the cockpits aren't huge; while the front where P1 sits is Formula One-style – comfortably reclined with feet out in front and raised up – the rear has more of an upright seating position and is a bit of a squeeze if, like me, you have long legs. All the major instruments and engine controls are sited in the front with a necessary few – GPS-linked glide computer, variometer and ASI – for the P2.

As we sat at the threshold of a 250-metre tarmac strip set in Lubeck airport's grass it should have been simple to get airborne. There's no need for the traditional glider aerotow behind a tug aircraft as Eta has a well proven 64hp, two-stroke Solo engine tucked away in the fuselage. Simply switch on the master, flick a trip switch to electrically power the pylon-mounted engine up out of its bay through

90° until the two-bladed prop is facing the airflow, turn on the fuel, give it a quick prime, press the starter and away you go. In theory... But nothing's ever straightforward with aviation engines, even in gliders, and pressing the starter produced nothing more than the click of the solenoid followed by me learning some new Germanic curses over the intercom.

Long, flexible wings

After several failed attempts to start I was about to hang up my headset when Hans-Werner, who is never one to give up (which is why he's still pursuing records and flying in this year's gliding world championships at the age of 80), pushed the button one last time and the twin-cylinder engine grudgingly turned over and fired into life with a chainsaw-like buzz.

Jamming my headset back on, I just had time to smile at our wingtip runner, Hans-Werner's wife Karin, before she let go and the long, very flexible wings curled upwards in the airflow before lifting the fuselage off – it was all rather like takeoff in a heavily laden U-2.

Talking about climb rates is largely academic because the engine is designed only to get Eta up to a height of around 2000ft where it can

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soar away in thermals, or to get the pilots and aircraft back home if the weather takes a turn for the worse. For the record, though, with an MTOW of around 950kg we climbed at an average 450fpm at 65kt.

For the first part of the flight we climbed to 9000ft so that we could pop the engine back in its bay and glide gently down, pulling chandelles for some arty shots for the photoshoot before setting off on our way. And, as we slipped into the 8/8ths gloom below the clouds, I got my first demonstration of this machine's capabilities on that long glide to the sunlight.

For those unused to large-span gliders, they can produce unusual sensations; because there's so much flexibility in the wing you first see the wings bend upwards before you feel the lift under your backside, rather than the more normal feeling of a positive thrust upwards through the whole airframe at the same time. As the wings bend up, you ease back on the stick, bleed off the speed and the whole glider rises upwards in a gentle dolphin motion and gains height. Get it right and choose

your route carefully, and many miles can be covered without the need to stop and circle in lift.

As we eventually reached the sunshine, I turned Eta in a weak thermal to start to regain some height. And that's when I discovered that the step change to a larger chord some three metres from the tip really does give better handling; the qualities were more like those of a machine with half its span, a point made quickly by Hans-Werner.

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enough, even though there was still no tendency for a wing to drop. Hans-Werner had made his point well and we headed back into the weak thermal. This time I gave the fairly heavy rudder a firm prod as I put on around 40° of bank and kept the speed hovering around 45-50kt (the ASI was calibrated in kph and I'm useless at

Slow flying

"Fly more slowly, and stop over-ruddering," came the somewhat impatient voice from the front as we lurched around the turn. "Okay, enough," he said eventually. "Leave the turn, fly straight and level and ease the stick back and see how slowly she will fly." I did, finally deciding that 35kt was slow

Above left: As the panel shows, gliding at this level is a high-tech sport; from top left: ASI, GPS-linked navigator, mechanical variometer, electric variometer, A/H, transponder, glide computer, engine management system, mechanical variometer, 720-channel radio; rear cockpit is simpler

Below: Keeping the wings spotless is a long job, but every bug costs a little performance



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Bending moments

If you are wondering about those bendy wings and how much load they can take, the answer is plenty. A wing this large has to be flexible, and indeed many other gliders have wings which bend a long way. For certification of Eta's extreme wing structure a fatigue test was carried out lasting several months and covering 42,000 simulated hours of flight; the wings now have an approved life of 14,000 hours, exceeding the usual life of a glider by 2000 hours. With that level of strength, fatigue isn't an issue, even if the amount of bend can be eye-opening.



doing running conversions in my head). Then, using the rudder sparingly, and with relatively small stick movements Eta wheeled around the turn with the grace of a seagull and climbed smoothly; it was a revelation in big glider flying. Another surprise was the ailerons/flaperons; in a machine such as this you might expect them to be heavy and the roll rate to be slow. Far from it, they were reasonably light and responsive and the roll rate for the span was excellent.

Long glides

Having learned how to get the best out of Eta, I'd love to say that we then strolled off on a brisk 1000km glide around Germany, but the weather was deteriorating. So we confined ourselves to long, leisurely glides, pulling up and climbing in sniffs of lift and occasionally using weak thermals as we explored the beautiful Baltic coast and revelled in the go-anywhere freedom of the skies that Eta gave on a day when most gliders in Northern Germany were housed snugly in their trailers and hangars. Eventually the heavy showers ganged up on us and Hans-Werner prudently suggested a return to base. This itself was an education. The tower asked us to orbit for a few minutes (in a glider!) while another Ryanair 737 busily tried to keep to its schedule. Unfazed, Hans-Werner merely said



"Ja, okay," and we drifted around under 8/8ths of cloud until the jet and its wake turbulence had drifted away. By this stage the showers were edging onto the airfield, the wind had swung 90° cross and it was gusting 20kt. I didn't fancy it, but Hans-Werner simply said "We'll do the approach a little quicker than normal and without flaps". I sat entranced as he made a long, flat (around 70:1 glide angle without flaps, remember) fast approach, finally using the

airbrakes to touch down perfectly at the threshold of the 250m of tarmac and stop just before the end. A quite brilliant piece of flying, but then Hans-Werner has been at it for 60 or so years.

Oddly, Eta's span isn't unique in gliding. Robert Kronfeld had the same idea back in 1930 and his Austria had an almost identical span – but it

broke up in cloud, probably during a spiral dive. With its excellent handling, that's unlikely to happen to Eta.

As with everything in aviation you don't get something for nothing and the price for all this performance is high; to buy one you'll have to pay the thick end of £400,000 – but at least you'll never suffer someone saying "Mine's bigger than yours..." ■

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