

# SUN STROKES

Setting up a dirt bike for the harsh terrain of the Dakar Rally route is challenging enough but, as Naouel Zenaidi discovers, one man is preparing to go solar



**T**o most riders, finding themselves in the desert without fuel is a nightmare scenario. To engineering consultant and motorbike enthusiast Ed Laurence, it's an adventure, and the opportunity to showcase the potential of a solar-powered drive system. Originally from Australia, Ed has worked with Ford and JLR, and is currently on contract at Land Rover in Gaydon, Warwickshire. He specialises in hybrid control systems and, in conversation with him, it doesn't take long to realise how passionate the 31-year-old is about the automotive industry. "Outside of work, I do spend a lot of time working on cars and bikes for projects, expeditions and motorsport," admits Ed. Growing up, he became a keen follower of the Dakar Rally and has completed many rides across Europe and Northern Africa over the years – both as solo rider and in the company of his brothers. This inspired him to embark on an ambitious project: taking a solar-charging electric dirt bike on a 6,000-kilometre ride across South America. "There are a lot of misconceptions around electric vehicles, especially in the individual transport market. Most people think of them as only suited to short trips around the city – I wanted to challenge that idea, and I thought the desert would be the perfect place to do just that." Doing online research and purchasing off-the-shelf components, Ed spent under two years developing an off-road electric motorbike in his back garage. "I started off with a 2008 Honda CRF 450, which is similar to bikes used in the Dakar Rally. I removed all the original drive components – engine, gear box, exhaust – in order to be left with only the frame, suspension and wheels." The then skeleton bike was progressively fitted with replacement parts including two motors, a controller, a battery pack and a battery management

system. Meanwhile, the Deserted EV project as a whole had started gaining momentum. The self-funded effort now had the support of friends and family, and its progression was followed with particular interest by members of online forums where Ed was posting regular updates. In May this year, the bike, complete with a battery pack designed to charge from an electric wall-charger, was ready to be tested in sandy conditions. Ed, with the help of his brothers and part-time team members on the project, took the affectionately-dubbed 'Franken-bike' to the Sahara for a test trip. While successful in terms of confirming the bike's endurance, the trip did prompt Ed to rethink the location of the end-goal expedition. "We ran into quite a bit of red tape and admin issues, and after some deliberation, we decided to move the next step of our project from North Africa to South America, which, incidentally, is what organisers of the Dakar did back in 2009 with the race itself."

In 2013, Ed will indeed be following directly in the footsteps of the new Dakar route, although he won't be racing the clock. "As much as I'd like to be able to compete in the Dakar Rally, it wouldn't make sense to attempt a project such as ours in race conditions so we are planning to kick start our expedition in March, which is a few months after the rally actually takes place." Before then, the current version of the Deserted EV bike will need further upgrading to make it fully capable of recharging from a portable solar array. "The next thing on my to-do list is sourcing twelve individual folding solar panels, which can be packed down to fit on the bike." The battery will charge directly from the solar panels, leaving bike and rider free to travel independently without any petrol stops, while food, water and the equipment needed for the expedition will be stored away in a car following the bike. Asked what the team anticipated the biggest challenge to be, Ed replied: "It's a combination of things, really. For a start, the bike will need a four-hour charge for every hour riding, so it will be pretty slow-going. We'll be covering around 200km per day as opposed to the 500 to 600 covered in the rally daily. In terms of the weather, we have to plan for temperatures going all the way up to 35°C in the Chilean



## THE BIKE

The Deserted EV dirt bike is an electric conversion running high-power electric motors and a long-range battery pack designed to charge from a portable solar array. The bike started life as a 2008 Honda CRF450R. Stripped of its 4-stroke 45hp combustion engine and all the redundant ancillaries including exhaust, transmission, fuel tank and radiator; the skeletal aluminium rolling chassis was ready to receive its electric powertrain. Twin Agni B95-R brushed DC 30kW motors on a common drive shaft turn a single ratio transmission through a customised primary and secondary drive chain and tensioning assembly. A 74V 80Ah battery pack provides up to 710A to the Agni motor units through a motor controller that employs both positive drive and regeneration under braking (allowing the electric motors to act as generators to recover spent energy). The chemistry of the high charge density lithium phosphate battery cells can make them somewhat unstable near the edges of their limits of operation. To extract the maximum performance from the cells, a customised management system monitors the temperature and voltage of each cell bank and the overall charge and discharge currents. An isolation system composing an e-Stop, contactor and fusing removes current if operating outside of safe limits. The charging system comprises several foldable solar arrays and MPPT (maximum power point tracking) charge controller. The charge controller is required to step from the array voltage to the battery pack voltage and modify the load on the array to maintain maximum efficiency. On a typical day of late spring or early autumn desert sun, this will capture more than twice the solar energy that could be stored by the on-board battery pack.



deserts and down to below 20°C in the mountain passes of the Andes. And then obviously, there's the route itself – the Dakar is one of the most challenging rallies in the world." Speaking from his perspective of rider, Ed added:

"The adrenaline you get from feeling at one with the bike and surroundings far outweighs the negatives, though, and the UK wouldn't be really suited to a solar-powered race anyway." The biggest test however will be the outcome of the expedition, something which Ed is approaching with calm and confidence: "We have invested a lot of time, money and resources into this project and we are really set on seeing it through. If we succeed, it will hopefully shake up the out-dated perception of the electric vehicle as the ugly and impractical car that only the eco-warriors buy to make us all feel bad when we're at the petrol pumps. The technology has come a long way but ultimately these are business innovations, and they're driven by demand." The Deserted EV expedition is forecast to take six to eight weeks to complete and the team will be raising money for environmental charities with each kilometre covered by the bike.

For more information on the bike and the project follow Ed's blog at [www.desertedev.com](http://www.desertedev.com)

## THE DAKAR

Inheriting its name from the inaugural off-road race linking Paris to the Senegal capital, the Dakar Rally was founded by Frenchman Thierry Sabine in 1978. Despite its name, the event is an off-road endurance race – a rally-raid – rather than a conventional rally: the terrain is much tougher and the vehicles tend to be built, rather than modified, for purpose. Stages covered vary from short distances up to more than 500 miles per day. Its route was reviewed and changed several times over the years due to political instability in the region. In 2008, the race was cancelled altogether following recommendations from the government in Paris when four French citizens and three Mauritanian soldiers were killed in a terrorist attack. Subsequently, organisers moved the Dakar from Africa to South America, where it has been taking place since, attracting spectators in their millions.

## PERFORMANCE

<b>Weight:</b>	110kg
<b>Range:</b>	Asphalt – 200km, Sand – 60km
<b>Top Speed:</b>	110kph
<b>Peak Power:</b>	52kW
<b>Peak Torque:</b>	100Nm
<b>Max RPM:</b>	6000RPM

