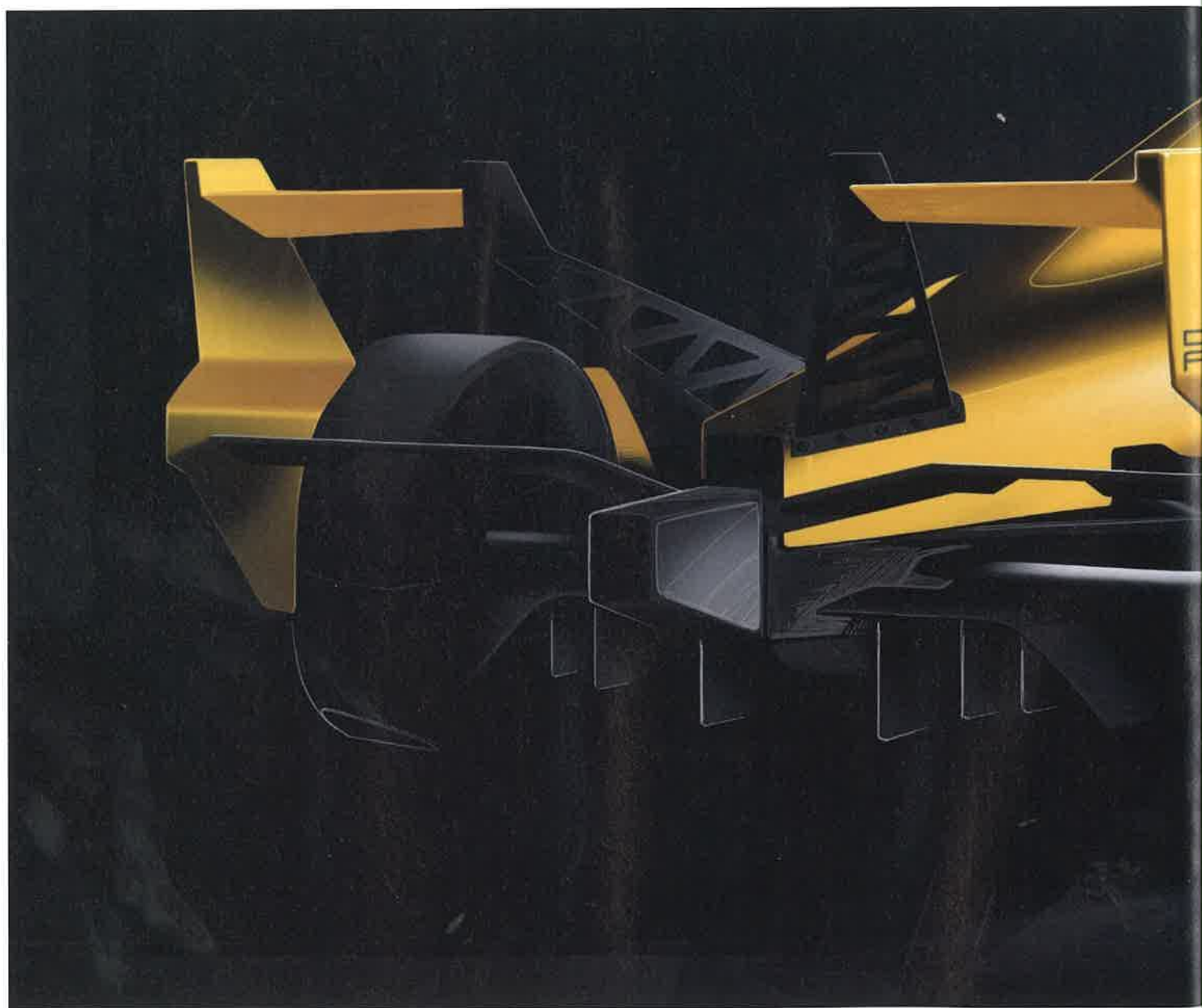


Racing into a new ERA

While Formula E provides battery-powered motorsport at the very highest level, where can young race engineers and drivers learn the basics to help build a career in this lucrative arena? The all-new Electric Racing Academy (ERA) initiative might be the answer

By **SAM COLLINS**



Electric car racing is nothing new, indeed EVs were racing at Crystal Palace in London when Queen Victoria was still sitting on the throne, but in recent years it has certainly become ever more relevant. The automotive industry is heading to a future where all passenger cars will likely have some degree of electrification. In fact, some nations are moving to make it law that by 2030 all passenger cars sold must have either a hybrid or fully electric powertrain.

This has, in part, led to hybrid vehicles being used in the two top categories of motor racing, Formula 1 and LMP1, and also the rise of the all-electric Formula E championship. Formula E started out as a purely one-make championship, but has more recently opened up a number of areas for development, such as the motors and inverters (though the battery remains fixed). Manufacturers have piled in and costs in the championship are starting to escalate.

However, with the limited scope for technical development in Formula E and other series – there being only four manufacturers

building Formula 1 power units and only one racing a hybrid car at Le Mans – there is very limited scope for engineers to learn about electric motorsport. But one Belgian businessman hopes to change all that, with his new Electric Racing Academy (ERA).

'I had been talking with some of the management of the circuit at Zolder about finding a way to use the track when noise restrictions were in place,' Dieter Vanswijghoven, the ERA Championship technical and business director, explains. 'It was not until I got chatting with Beth Georgiou [now the ERA sporting director] that I realised that there was a really big gap in the market. She told me that from her work running the UK Formula Student competition she had become aware that there was a real shortage of graduates who knew much about designing and engineering electric cars. Not just in terms of Formula 1 and other motorsport, but the major manufacturers are really struggling to get people with the right skill set even for production car development. Formula Student has done a lot to raise the

skill levels, you can see that with some of the cars that run each year, like the one from ETH Zurich. But Formula Student is really a one-off kind of deal. So we decided to set out to create the solution to these issues, and that is how the Electric Racing Academy started.'

School run

In the mid 1990s there was an all-electric single seater category in the USA called Formula Lightning. It was aimed at universities and each team would utilise an identical chassis, but the teams were allowed to develop their own batteries and motors. It was moderately successful and lasted about a decade before folding, perhaps because it was a bit ahead of its time. Initially Vanswijghoven had pretty much the same idea, an all-electric racing series aimed at colleges and universities.

'We thought of it as a "super Formula Student" with grids made up of university teams, but proper wheel to wheel racing on real tracks,' Vanswijghoven says. 'The idea was simple, to use a common chassis and let



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the teams develop their own battery and motor solutions. Soon, though, word got out to some non-university teams and individuals about what we were doing and they wanted to get involved too. So we decided to open it up to anyone who wants to enter, as long as they are not a manufacturer or works backed team.'

Sparking interest

But the ethos of the championship remained the same: a proving ground for teams and organisations wanting to get involved in electric racing, and there has been a lot of interest, in particular from tuning companies. 'One of the key things about this series is that we want it to be affordable, initially because we were looking at universities, but now mainly because so many small and medium sized companies have shown very serious interest,' Vanswijgenhoven says.

One market that the series founders had not considered was young drivers, but almost as soon as this new initiative was announced many were contacting them looking for drives. 'Formula E is clearly a success, and the drivers are well paid to race in it,' Vanswijgenhoven says. 'But for a young driver there is not really any option to learn how to race electric cars. There is just electric karting, and that's really just low performance rental stuff, and then there is Formula E, a full on professional championship, there was nothing in the middle until we came along. That gave us three different key customers for the series: young engineers, tuning businesses and young drivers. Once we understood that it really had an impact on a lot of things, in terms of what the series would be, not least in terms of the car design.'

It was then decided that the series would have two classes racing together on track, both



The ERA series founder and technical director Dieter Vanswijgenhoven pictured with the Dome F110/EV monocoque

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based around the same car, but one class would be aimed at engineers and companies, the other at drivers. 'We will have two classes, the first of them is the Sport Class, where you run our basic package, and that includes battery and motor, every car will be identical,' Vanswijgenhoven explains. 'The second, which will eventually be the faster class, is the Innovation Class. Here we have created a fair amount of technical freedom. The teams will be able to develop batteries, motors and their own bodywork within some limitations which will stop the costs getting out of control and also keep things safe.'

While the full technical regulations have yet to be finalised it is expected that there will be a

TECH SPEC: ERA Dome F110/EV

Chassis

Carbon fibre F110 F4 monocoque produced by Dome Composites.

Powertrain

All electric, 130kW single motor, 24kWh lithium based battery.

Suspension

Double wishbone with pushrod actuated dampers front and rear.

Transmission

None.

Dimensions

Length: 4341mm; width: 1740mm; height: 950mm; track: 1550mm front / 1490mm rear.

Weight

Approximately 620kg.



For race engineers and drivers hoping to work in Formula E there are not many opportunities to learn about EV racing. The all-new ERA series intends to fill this gap

'The team at Dome really understood what we were trying to do and bought into it'

maximum power level for the motor (or motors) and various safety requirements. In terms of the racecar much of the core package has to be retained, including the outboard suspension, monocoque and front and rear impact structures and some body parts.

'We created that to be a little bit of an engineer's playground,' Vanswijgenhoven says. 'Every Innovation Class entrant will have to start off with a basic kit of parts from the Sport Class car. They then have the option of developing the following parts: battery, motor, inverter and driver interface. We are looking at freeing up the rear bodywork, sidepods and some other parts, and we are also considering making dampers free in the innovation Class too.'

'But we have to retain all the safety critical parts,' Vanswijgenhoven adds. 'I think it will give young engineers a lot to work on, and will also help drivers learn not only how to drive an electric car but also how to develop one. But we are taking care to ensure it does not become a spending war. To race in the Sport Class you simply have to buy a car and enter it into the series, but there are enough common parts that if a team wanted to step up to the Innovation Class then it would be totally achievable.'

Sourcing a chassis

With the classes and overall objective of the series defined Vanswijgenhoven had to find a racecar to use. But while the open wheel single seater market is crowded in Europe, there were no obvious solutions for an electric powered car. 'I didn't see the point in creating something entirely from scratch, there are plenty of good chassis out there so we looked around to see which one to go for,' he says. 'We considered initially opening it up to allow any F3 tub car homologated in the last 10 years to be used but it quickly became clear that costs could get totally out of control that way. So we decided that we would have to go for a one-make chassis and realistically that would have to be a current Formula 3, F3-R or F4 chassis. We did think about the old Dallara SF14 or Swift Super Formula cars, but that was overkill.'

'We met with most of the major European manufacturers of course, but a chance meeting lead us to Dome in Japan,' Vanswijgenhoven adds. 'They already had two different F4 cars racing, one in the JAF series and one in the FIA series and a Formula 3 Regional chassis under development (see RCEV29N6). The team there really understood what we were trying to do and bought into it, and when we visited their facility in Japan we were blown away, they had everything we needed.'

One of the questions that the series had to tackle was whether to utilise a Halo on the car, for while usage of the cockpit protection structure is becoming more widespread it



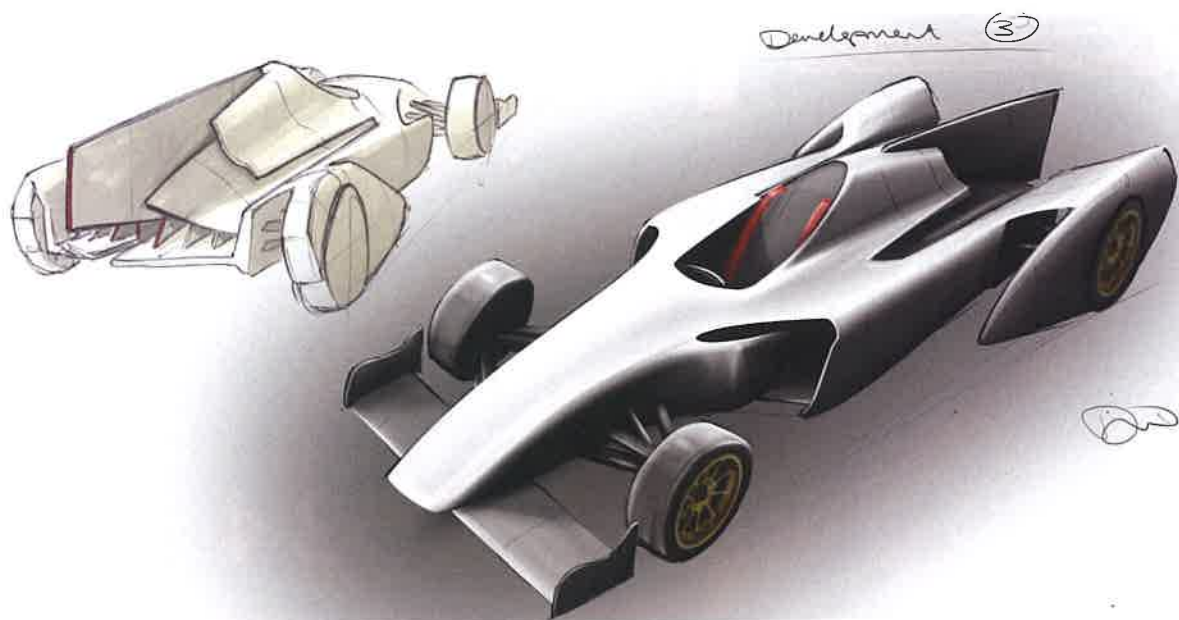
Dome F110 in standard F4 trim. ERA has designed a frame for the rear so the suspension pick-ups will remain the same



Coventry University students were asked to create concepts for the ERA series bodywork; this design is by Daehyeon Kim



Kim's design from the front. ERA has decided to run without a Halo but it did toy with the idea of a fighter jet style canopy

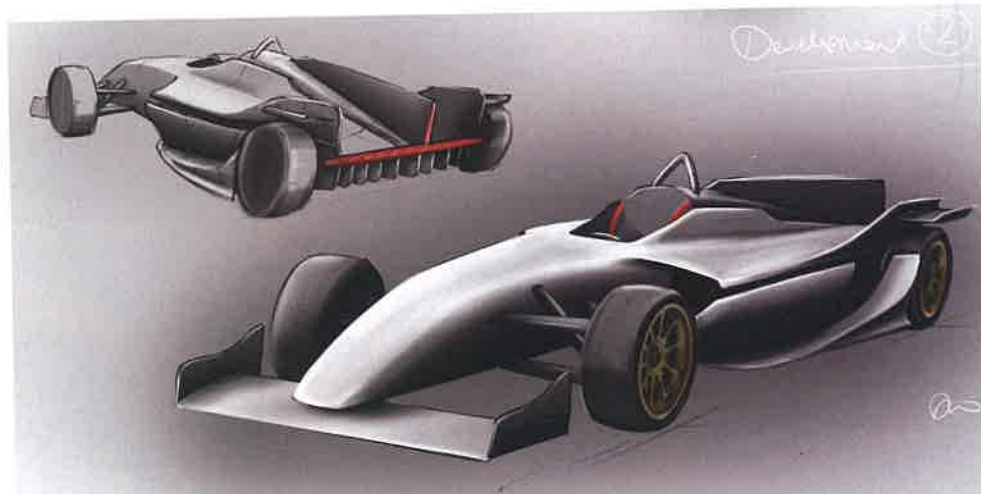


Left and below: Dylan webdale's visions of an Innovation Class car. In this class development of the bodywork and the sidepods is allowed

'We have designed a frame to carry the loads on pretty much the same paths as they would do on the combustion powered Dome F110'

is not mandatory outside of FIA classes. 'We considered the F111/3 regional F3 car with the Halo, or we thought about trying to retrofit Halo or a fighter plane style canopy to the F108 JAF F4 car,' Vanswijgenhoven says. 'Mooncraft did a version of that tub with a canopy and it looked great, but really all it did was add weight, complexity and expense. We knew by then that our car would already exceed the safety requirements expected at national level so we opted for the initial car to go without Halo. So we eventually settled for the F110, the car currently used in FIA F4 in Japan. It's a decent car, well proven, and from a great constructor.'

However, the Dome F110 was designed specifically as a FIA F4 car, with a combustion engine and sold as a complete package. The ERA car, being electric, did not need many elements on the bill of materials so a project started to re-work the F110 into the Dome F110/EV. 'In terms of the wider car we are using the complete monocoque, front impact structure, rear impact structure, suspension and uprights from the standard Dome F4,' Vanswijgenhoven says. 'At the rear we wanted to retain the entire suspension layout. But the F110 rear suspension picks up on the transmission casing, and we have no transmission at all, so no casing. The engines too are semi-stressed, and we have no engine, so basically behind the back of the monocoque we had a big hole and some wishbones dangling there. To fill this big void



we have designed a frame to carry the loads on pretty much the same paths as they would do on the ICE powered F110, the suspension pick ups are in the exact same position. There is just not a combustion engine and gearbox there. This also allowed us to retain the rear impact structure and rear wing mounting points.'

Design study

The F110/EV will also look very different to the standard Dome F4 car. With all cars racing in the Sport Class being identical Vanswijgenhoven decided to give the car something of an aesthetic overhaul. To do this he engaged a group of automotive design students from Coventry University, and asked them to come up with concepts of what an electric racecar, based on the draft regulations, could look like. The results were striking, and one of the designs will be used by all the Sport Class cars, while the other designs give an idea of what could potentially be done in the Innovation Class.

'We wanted the series to have its own distinctive look, not be just another open wheel class, so we have come up with a look for the car which is something a bit different,' Vanswijgenhoven says. 'We are finalising that

package now but it's pretty cool, and we will be testing it over the summer to make sure it is stable and not too draggy.'

One area of the car is still being kept under wraps, and that is the Sport Class powertrain, the organisers will only give vague details of it. 'I have to keep that a little secret for now, as we don't want any teams to get a head start, but it is a 130kW single motor, a 24kWh battery capacity, and we have some nice custom-designed safety features included,' is all Vanswijgenhoven is willing to put on the record. However, *Racecar* understands that a number of the components used come from current production cars, in an attempt to keep costs under control. This is very much an aim of the ERA initiative, and the organisers expect the series to be low cost, comparable to buying and running a F4 car for a season.

The first Dome F110/EV is currently under construction and by the time you have read this will have conducted its first shakedown runs. It will then undertake an extensive testing programme before the final car is revealed later this year. The series is expected to start in mid 2020 with races in the Netherlands, Belgium as well as potentially in the UK and France.