

The stage is set

'For sure it will be the biggest change in the WRC since the start of its history'

It's to be all change for World Rallying in 2022 with hybrids, a spaceframe chassis option, plus the possibility of fielding cars from very different market segments. Racecar canvassed the opinion of the existing manufacturer teams on the WRC's bold new technical direction

By MARTIN SHARP



A radical WRC revolution from 2022 onwards was voted-in by the FIA World Motor Sport Council in June. And in this particular case the word 'revolution' is very much justified, as what's being proposed will mean big changes for the World Rally Championship.

The new generation of WRC car will have a five-year homologation cycle, while another crucial change is that manufacturer teams will be allowed to use production-based bodysells or prototype tubular structures to existing WRC body size dimensions.

Also approved is the option to scale the body within prescribed limits, thereby allowing 'larger' car models to compete while complying with WRC dimensions. This new rule will enable car makers to choose the model on which their World Rally Car is based from a wider choice of car segments, not just the B segment as it is now. The FIA will also define visual elements from production vehicles in an effort to make WRC cars resemble their road-going counterparts.

But the real headline-grabbing announcement is that for the first three years, supplementary to the existing 1600cc turbocharged IC power unit, the new WRC cars will also have a hybrid propulsion system with common electrical components and software. Potential for more electrical power design freedom is planned from 2024, with the level of hybrid technical development allowed during this second phase depending on the success, or otherwise, of the first period of the hybrid WRC regulations.

Work in progress

Currently these approved rules are just guidelines, and full technical details of the 2022 regulations are expected at the end of this year, while manufacturer teams must submit 2022 WRC entries in the second quarter of next year. Yves Matton, FIA rally director, said: 'This is the time-frame we agreed with manufacturers. The normal time-frame to develop a new car is 18 months; here due to the fact that it's quite new technology they want to have more time, and they have six months over the normal time-frame.'

One of the driving philosophies of the new regulations is keeping costs down. 'The target is to stay at the same cost as at the moment, trying to make some economy on some other technical parts of the car,' Matton says. 'Everything which is not a technical return on investment for a manufacturer we will try to make as cost-effective as possible.'

On top of all this control tyres will be mandated for all the four-wheel drive World Rally Championship classes from 2021 to 2024, so as to help to reduce the costs associated with an escalation in tyre development.

WRC manufacturers might wish to field C segment cars or even SUVs



Citroen has made it clear that its future in the WRC depends on some element of hybrid/electric power in the new regulations and so it will not be disappointed with the FIA proposals

There is not much in the way of detail as yet and discussions between the manufacturers, as a group, and the FIA continue. It is clear, however, that the new tubular spaceframe concept and the 'scaling to mandatory dimensions' option opens the door to existing WRC manufacturers which might wish to field C segment WRC cars, or even SUVs. At the present time it is looking like Toyota wishes to stick with the B segment Yaris, while M-Sport/Ford, Hyundai and Citroen favour larger models.

Current affairs

Citroen has stated it will not continue in WRC if hybrids and zero emission zones are not included. Right now that seems to be the way it's going, but the question of whether it will be high or low voltage electric power has still to be addressed. Citroen Racing chief engineer Olivier Maroselli says: 'The problem with low voltage is you are talking about [such a] high current that you need huge cables and you are going away from all the current trends in hybridisation.'

'By international rules, above 60 volts you're basically switching to a high-voltage system in terms of safety issues, because when you are above 60 volts there is a risk of electric shock, which is basically only related to voltage,' Maroselli adds. 'Sixty volts is very low for a high-end hybrid or a fully electric car, which are

running more than 300, 400, up to 800 volts – the higher the voltage the less current for the same power and then a lighter system. Citroen want hybrid to be mandatory and full electric for some sections [of the stages], as well. So that is something we have [to have] to get the [board's] permission to carry on with the sport.'

Maroselli's calculations indicate the electric driveline; the battery, the electric motor, the inverter, will weigh about 100kg. Currently

the FIA plans to stay at the current 1190kg minimum car weight with the new cars and allow extra body lightening, but discussions are difficult as car weight is a secret subject between teams, because of ballasting benefits.

But there is excitement about this prospect: 'For sure it will be the biggest change in the WRC since the start of its history,' says Maroselli.

Toyota Gazoo Racing WRC chief engineer Tom Fowler also believes the choice between



Working on hybrid/electric rally cars will bring added complications but most in the WRC believe safety will not be an issue



Toyota is likely to stick with its Yaris model and not take up the option to build a new WRC car from another market segment

high and low voltage needs to be made. 'That's a question the teams and FIA need to find a solution to,' he says. 'Safety mitigations can be made to make it safe, but I think in general that answer needs to come from good data and research and not just speculation about what's safe and what isn't. So a real technical and safety analysis will have to be done to

The FIA's plan is for WRC cars to run exclusively on electricity in cities

decide whether a low or high voltage route is safe in one direction or the other.

'From a packaging and performance point of view, generally speaking the low voltage is generally a bit more of a challenge,' Fowler adds. 'From a true performance point of view in terms of the power output and the power-to-weight ratio the high voltage has its advantages, but that then needs to be traded off against the safety, so it's not a simple topic.'

Quiet zones

The FIA's plan is for WRC cars to run exclusively on electricity in cities, while also having an electric power boost which could be deployed on special stages. Current estimates set the hybrid kit at producing around 90bhp. 'I think that's in the ballpark, but it's more about the duty cycle we're discussing, so that's how much time can you actually use it for,' Fowler says. 'That's related to the size of the battery from a capacity point of view and also how do we arrange the software or the control systems; how do we re-deliver and how do we regenerate? The answers don't come [exclusively] from the technical [side]; they come from the sporting side as well. There will need to be changes to the sporting regulations to accommodate it because if it's a road section-based system, then it's going to have to be regulated as to when you use it and what



The marketing-inspired Peugeot 307 CC WRC in 2005. The new regulations should make projects such as this much easier

happens if you don't use it, which is going to be a bit difficult from a regulation point of view.'

One thing that is often talked about when it comes to hybrid rally cars is the safety. But fear of injury or death by electric shock from the hybrid is mistakenly driven by today's chassis-grounded systems, and high voltage hybrids would not be grounded to the chassis. 'There's an awful lot of ways you can minimise the risk,' says chief rally engineer at M-Sport, Chris Williams while also making this very valid point: 'If you told someone we were going to carry round 70 litres of highly explosive stuff that leaks on the floor and will burn you to death, everybody would think you were mad!'

More generally Williams says of the hybrids: 'There are a lot of proposals on the table, it's just [about] trying to steer the direction. I don't think the manufacturers will get the choice. I think it will just be put down by the FIA: "This is what you're going to have to have and this is how you need to work to it". It depends on how you want to do it, everybody's got a different agenda, so it's very hard for everybody to actually agree on exactly what it should be.'

Congestion charge

While supercapacitor/battery combinations are likely to be used, Williams makes the interesting point that batteries cannot be charged fast enough when using energy from, say, a brake energy recovery system. 'Think of how much energy you actually have from braking and if you were to use all that energy and try to ram it into the battery in a few seconds. That's why KERS works so well because you go *bang!* and you suddenly accelerate a flywheel and then it's there and you can use it immediately; you can't do that with a battery,' he says.

Flywheels have been discussed, although Williams doesn't think this will happen. However he adds: 'I think it [would] be interesting, I think it suits rallying. [But] the big players with KERS have battery technology which is ridiculously priced and maybe their stuff will accept really fast charge rates, but I don't think that's something that we're ever going to get [in rallying], I think it's cost-prohibitive.'

Williams also points out that electricity based assistance is effectively a torque infill to the internal combustion engine, and that teams already have experience with this from using anti-lag systems. More broadly he believes the new rules are timely. 'I'm not sure that it's sustainable, not as we are now [in the WRC],' he says. 'I think some of the teams have put in an awful lot of funding and not actually got anything out of it as it stands today. Which could jeopardise their future and this would be my worry if you just leave everything as it is now.'

Compared to its rival teams it's not long since Toyota entered the WRC to market its Yaris and it's believed it will stick with this model for the new regulations. One problem it has faced is packaging within the small engine bay, and it



Hyundai welcomes the new regulations, its team principal saying the wider the chassis options for manufacturers the better

will face further headaches with a hybrid WRC version of the Yaris, but as Fowler points out: 'If you had a completely open choice about which model of car from your brand you could take rallying with a hybrid it still depends heavily on the hybrid regulation, because the hybrid can be positioned in different ways. It is effectively our job to read the regulations, understand what the limiting factors are, and then look for the car which suits it the best.'

'But everybody's already thinking what car they're going to use, so that's how we end up driving the regulations originally towards a specific car, because we're looking at it from the wrong way round,' Fowler adds. 'In order to choose the car you are going to use you should have the regulation book in front of you, but we

of regulations that don't meet their marketing structure, they are not going to invest [in the WRC]. So we have wasted our time.'

'It needs to be relevant and interesting to new manufacturers as well,' Millener adds. 'It's so important to get the manufacturers on-board at an early stage. The regulations for 2022 do need to attract new people [manufacturers] but they also need to ensure that as soon as the FIA turns around and says: "Right, you have to sign-up now that you are going to commit to 2022", then we [the manufacturers] all do it.'

Size matters

M-Sport's Williams has considered the engineering implications of the options in the new rules and he predicts difficulties in the mixed model segment scenario: 'A fundamental problem is that everybody's going to have to scale the car,' he says. 'There will be dimensions of the box that your car needs to be in; not just maximum, but minimum as well.'

'I would imagine you'd have some that are maximum and some that are minimum,' Williams adds. 'Just think of your basic car: how long is it? How wide is it? What's the wheelbase? What's the roof height? And you'll very quickly get to a car. (There will be no change to the 3.9m minimum length rule, incidentally).'

But Williams believes such difficulties can be overcome. 'This is not something that isn't done elsewhere,' he says. 'I would not be too sceptical. There are ways and means; you have just got to have the freedom to adjust what you need, where you need to do it. At least this way people will come with multiple different cars and I think that was the problem with the manufacturers; you have got the people who want to use a B car; you have got people who want to use an SUV, and how the hell do you compete with all [these] cars together? As long as the opportunity is there for everybody to get to the

'I'm not sure the WRC is sustainable, not as it is now'

don't have that, so now we're at the point where we're now going to write the regulations from different viewpoints, based on what vehicle they [the manufacturers] want to use.'

Marketing drive

While admitting he is not an engineer, M-Sport team principal Rich Millener is very experienced in the sport and, as a motorsport fan and team boss, identifies the critical essence of the potential success of the new rules. 'From my viewpoint you have to involve the manufacturers' marketing people,' he says. 'Unless you go to the marketing department of every manufacturer and ask: "What do you want out of this?", if you come up with a fantastic set

same competitiveness, that is key. We need the regulations to be open enough to allow you to be comparable with your competitors.

'As an engineer, can you come straight out with no compromise in your design? I don't know,' Williams says. 'If you had to have a tubular chassis with certain constraints; or your own chassis with no constraints, which one would you go for? It's guiding principles and there's no detail in the regulations [yet].'

Pump action

Fuel consumption has been discussed, but Williams has concerns here. 'We've got to be very clear of what the World Rally cars are and try not to introduce too many smaller things that are simply additions,' he says. 'If they were to suddenly throw in a fuel restriction which has a reasonable effect we are just starting a combustion war, which means combustion modelling; and the person with the biggest and best models and most money will win.'

Some consultation documents on the new regulations from the FIA have been written by Michel Nandan, the ex-Hyundai Motorsport boss, who is now working as a consultant for the FIA. 'He's been there and done it on multiple cars,' says Williams. 'He's not stupid either, but I don't think it's going to be easy

to do the new regulations. If they've got him involved it's better than the FIA, which has *never* developed a World Rally car, trying to tell the manufacturers: "This is what you're having". At least there's somebody credible in the rallying fraternity with recent knowledge working on this, somebody who has a good idea of what's plausible; what's remotely plausible [and not] you're having a laugh here.

'It is better that people understand we are in 2019 and no longer in the 1980s'

Anybody who's looked after a World Rally team you have to have some respect for.'

The man who has replaced Nandan as team principal at Hyundai, Andrea Adamo, welcomes the new regulations. 'It is clever because I want everyone to use the car they wish to... And it is better that people understand we are in 2019/2022 and no more in the 1980s, so it is

better that people understand that the wider [the choice] the better if we want to let WRC survive,' he says. 'Life is a matter of choices.'

A time-served motorsport engineer, Adamo is also in favour of the new chassis rules. 'These kinds of rules will allow much safer cars than the present ones because you can build a proper chassis, because you can build a proper safety cell. You can put the seat in the proper way; you have a proper space to put the deformable foam structure along the side.'

IC engine position is not, as yet, specified, but the general feeling among teams is it will remain in the front of the car. But an interesting take on the subject is put forward by long-time Citroen Racing engineer Alexis Avril. 'Perhaps it's not the best solution, but as some manufacturers don't want to change too much I think we will keep the engine at the front,' he says. 'But for sure to go to the dream rally car for me it would be at the back. It's a lot more easy to have the electrics at the front, IC engine at the back, and to have no exhaust in the tunnel, only a propshaft, with the electric machinery on, but this is perhaps too radical.'

As things stand things are quite radical enough, but we will have to wait a little while yet before we know exactly what the 2022 WRC revolution will look like.



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