BEYOND SAFETY

Motorsport is chasing a sustainable pathway, but new powertrain technologies bring fresh challenges for the whole supply chain. **Chris Pickering** talks to ATL CEO Giles Dawson about the future of fuel systems

ABOVE Hand-crafting a fuel bladder for the Audi RS Q e-tron that went on to make Dakar history

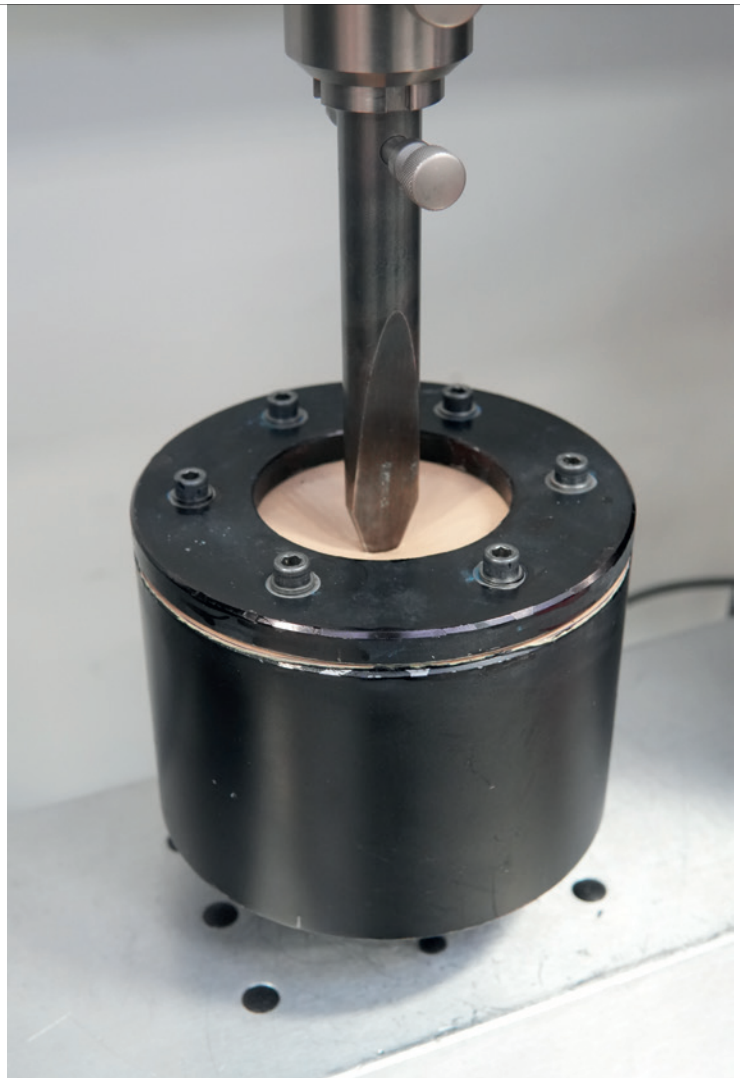
IF a vehicle races at an international level, there's a good chance the fuel tank inside it comes from one company. Aero Tec Laboratories (ATL) was founded in 1970 and has supplied the entire Formula 1 grid for 35 years. The Anglo-American company's influence stretches so wide that it's said to have built up a 90 per cent market share in professional motorsport.

So, who better to quiz about the future of fuel systems than ATL CEO, Giles Dawson? A lifelong motorsport nut and an accomplished racer in his own right, Dawson's entire career has been spent working on fuel systems of one description or another. It's a role that's keeping him very busy at the moment, with sustainable fuels hot on the agenda, hydrogen on the horizon at Le Mans, and Formula 1 teams looking ahead to the 2026 regulations.

ATL has been through some changes of its own recently. For years, the North American arm, headquartered in Ramsey, New Jersey, and its UK operation in Milton Keynes, were two separate entities, both under the ownership of company founder Peter Regna. Last year, the decision was taken to unify them into a single organisation.

"Historically, 80 per cent of our revenue in the UK came from motorsport, whereas it was 40 per cent of the business in the US," comments Dawson. "That led to the situation where you'd have US companies like Pratt & Miller coming to us in the UK, because the R&D side was so much stronger over here if they needed a complete fuel system. So, we can now strengthen the motorsport R&D side in the States, but at the same time, we can bring the expertise from other industries in North America over here."

Combining its operations on both sides of the Atlantic has also effectively extended the company's working day across multiple time zones. A CAE simulation, for instance, can be set up and run in Milton Keynes and then post- ▶



RIGHT Inside ATL UK's manufacturing facility in Milton Keynes

processed and analysed in New Jersey. The end result is that ATL has been able to tap into niches that it might not otherwise have had the opportunity to exploit.

"We've been able to pack more work into these longer hours without burning people out," says Dawson. "One of the things we've taken on with that extra capacity is a number of road-going hypercar projects. It started with the Aston Martin Valkyrie where we put a lot of work in to get a bladder tank to pass the Euro 6 evaporative emissions tests. Now, we've been doing the same with aluminium tanks. The tanks for the Hennessey Venom, for instance, were designed and prototyped in the UK, but then sent to the US for production and manufacture."

On the motorsport side, ATL has drawn on expertise from the aerospace and defence industries to confront some of the challenges posed by new powertrain technologies.

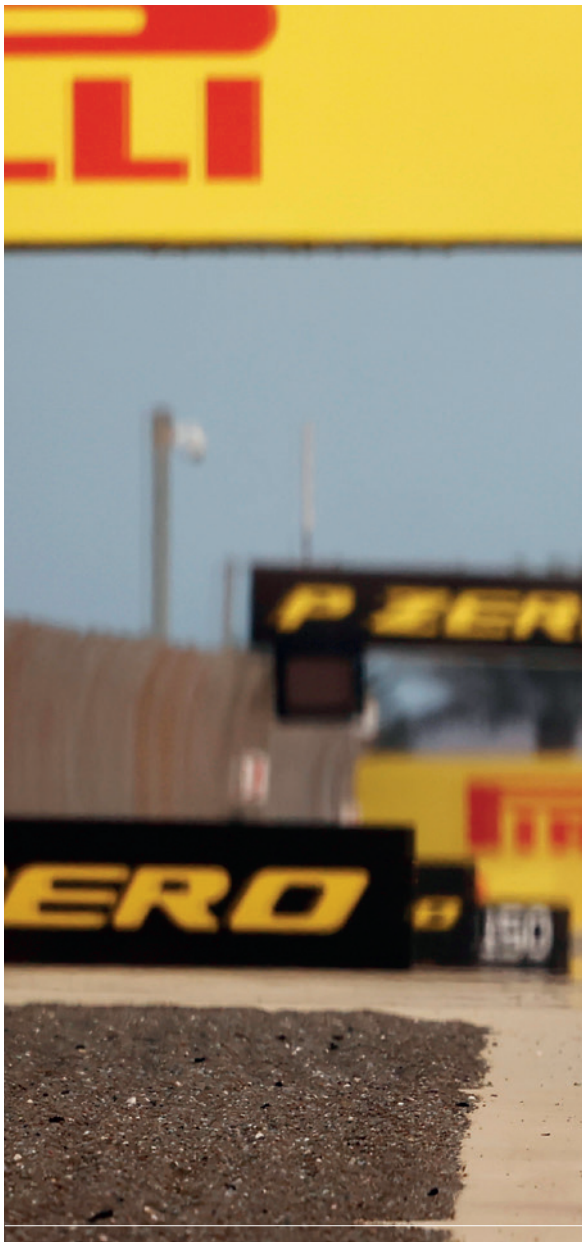
"Material compatibility can sometimes be an issue with new fuels. One of the series that we're involved in switched over to sustainable fuel a couple of years ago and the initial tests were all fine, but then a tweak was made to the fuel blend and suddenly the swelling on the Viton seals went from three-to-five per cent up to 10-to-15 per cent. People were taking dry-break couplings off and there was fuel going everywhere," he recalls.

In general, we're told, the individual fuel blends aren't too aggressive on their own. The real danger comes when machines like GT3 cars race across a number of different championships, potentially clocking up half a dozen different fuel types over the course of a season. If these attack different ends of the polymer chain, the material can resist degradation for tens of thousands of kilometres before failing practically overnight when another new blend is introduced.

There can also be a cumulative effect that builds up over time. This has led to more conservative – and hence, more expensive – maintenance schedules. Parts that might have lasted 10,000 kilometres are now being changed pre-emptively after 5,000 kilometres, because the risk

> *"There's a tendency to blame renewable fuels when the problem lies with the choices made elsewhere in the system"*

LEFT Puncture testing FT5 material to the FIA standard



RIGHT ATL has dominated the supply of fuel cells in Formula 1 for 35 years

is considered too great to start a 24-hour race without doing so.

Extreme environments

One of the techniques that ATL uses to assess material compatibility is accelerated durability testing. This combines long-term exposure with extremes of temperature to stress the polymer beyond its normal operating conditions. Away from motorsport, however, those conditions can be the norm.

"If you have a missile that's stored in the belly of an aircraft carrier, it might be expected to sit there full of fuel for 20 years before it's strapped to a wing of a fighter aircraft," comments Dawson. "We have materials on the aerospace side that are good for temperatures down ▶

Pirelli

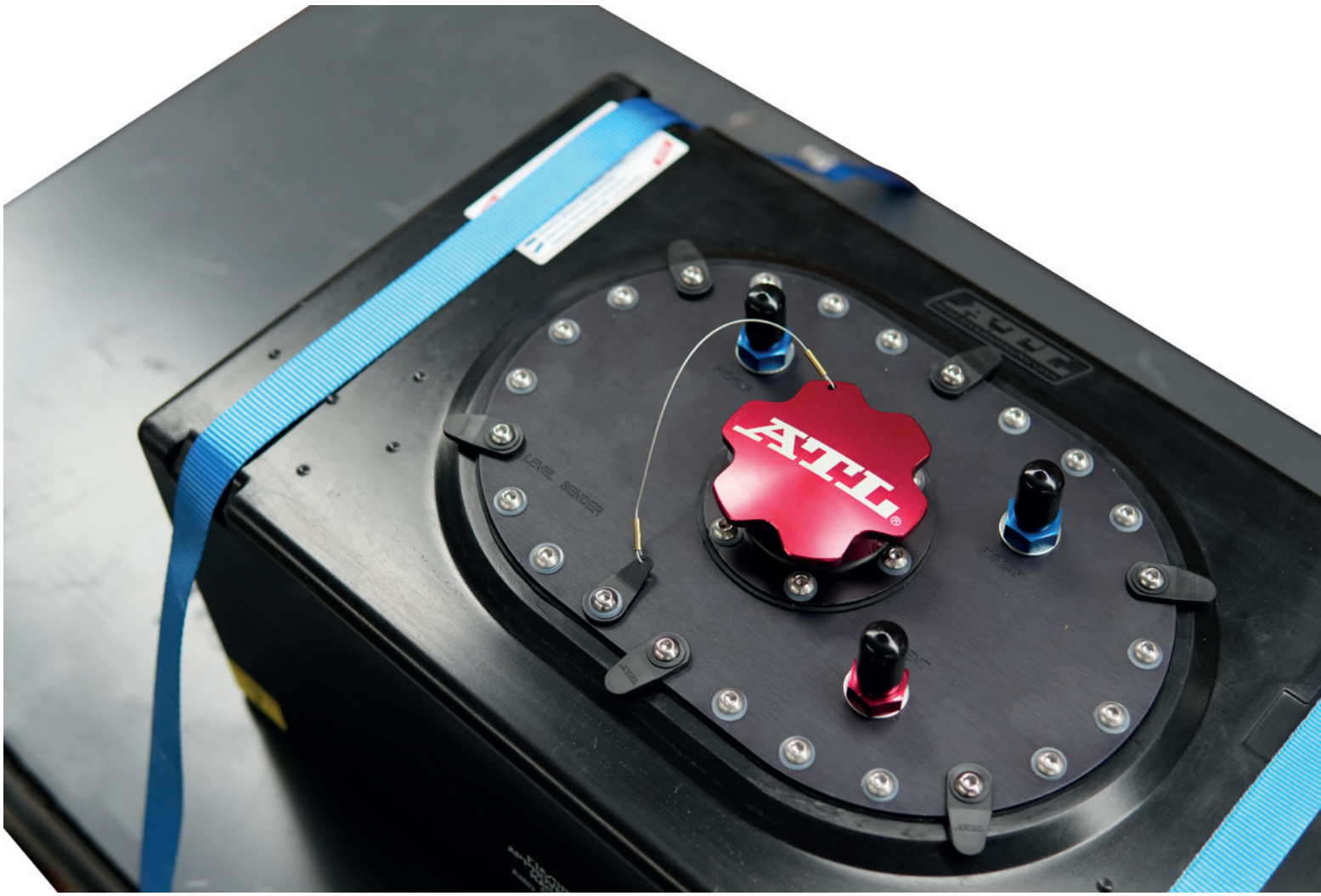
to -40 deg C and some that are good up to +120 deg C. You're not likely to see those extremes on a racing car, but it's led to some very robust materials that we can use."

One area where those sorts of temperatures might be encountered is hydrogen storage. The gas heats up under pressure when it's pumped into a tank, but then cools dramatically as the vessel empties. A range of +80 to -40 deg C is entirely possible over the course of a stint. Current hydrogen vehicles – both for fuel cell and combustion-engined applications – are limited by the packaging constraints and cooling requirements of their powertrains, which ATL believes it can help to address.

Big hydrogen advantage

"Optimising the fuel system design could offer a big advantage in hydrogen vehicles – more so than it does with traditional powertrains – but it's going to come down to integration," comments Dawson. "At the moment, everyone's making a cylinder, strapping it to the chassis and off they go. I think there'll come a point where people will start looking at how to integrate that immensely stiff structure into the chassis and then line it with ▶

LEFT Seam tensile testing a material sample after accelerated age testing



BELOW Mindful of the harsh environment it will have to operate in, an ATL Saver Cell is strapped into place on the shaker rig

> *"We started evaluating the 2026 F1 fuels earlier this year with accelerated age testing. So far there have been no unwanted surprises"*

something to contain the gas.

"We're working on coatings that will do that. And once you move the hydrogen storage inboard you can adopt a more conventional cooling system layout in the sidepods, which helps to address one of the other challenges with hydrogen."

At the moment, he believes, the legislative aspect is just as pressing as the technical challenge: "The biggest problem with hydrogen motorsport is that nobody's talking about the regulations. The agenda is being driven from the technical side rather than the safety side. It's time that the FIA started working with people to develop a standard for hydrogen, as they did with conventional fuel tanks in the '80s and '90s and are doing again right now. Currently, it's quite difficult with hydrogen as we don't know what the goal is going to be."

The coatings that ATL has developed so far can be applied to carbon wound vessels or steel tanks to seal them against hydrogen in either gas or liquid form. However, a question mark remains over crash test requirements.

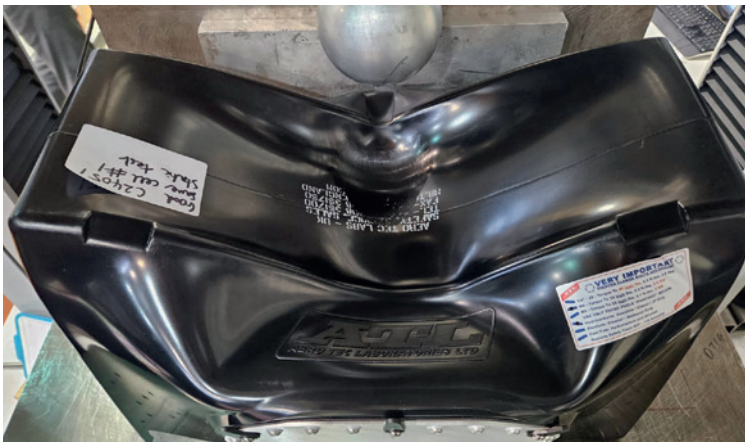
"We're at the stage now where we've had enquiries from major OEMs who are looking into hydrogen and we have to decide whether to go with our best guess or wait for a standard to come," notes Dawson.

ABOVE The work on Audi's successful Dakar programme was actually ahead of where F1 is heading with its sustainable fuels

Sustainable F1

The success of Hypercar and LMDh at Le Mans has perhaps overshadowed the ACO's plans to phase in hydrogen powertrains from 2026. Formula 1's intention to switch to sustainable fuel in the same year is less technologically ambitious, but likely to generate more mainstream coverage – especially with a growing conversation around the use of low- ▶

BELOW An ATL Moulded Saver Cell after impact testing



> *"A missile stored in the belly of an aircraft carrier might sit there full of fuel for 20 years before it's strapped to a wing of a fighter aircraft"*

carbon drop-in fuels on the road.

"I don't see the 2026 F1 fuels as too much of a challenge," comments Dawson. "We started evaluating them earlier this year with accelerated age testing, and so far there have been no unwanted surprises. I think the work that we did with Audi on their Dakar programme is actually ahead of where F1's going at the moment."

The Dakar-winning Audi RS Q e-tron used an 80 per cent sustainable blend, which included bioethanol, bio-derived ETG gasoline and e-methanol.

"Audi knew we'd been working on sustainable fuel systems with Porsche, so they gave us a call after they ran into permeation issues with the tanks that they were originally using," Dawson recalls. "We had a month to get the tanks in, as well as carrying out permeation testing to demonstrate that we could overcome the issue.

"We used a polymer from the aerospace side that has no measurable permeation with the new fuel. Audi has now run that for two years and won the Dakar with it. From what I've seen so far, there won't

ABOVE ATL has drawn on its experience in the defence sector to confront some of the challenges posed by new powertrain technologies in motorsport. This is the Foxhound Light Protection Patrol Vehicle

Porsche AG

Toyota GAZOO Racing

ABOVE Always a company with an eye on future technologies, ATL produced the bladder for Toyota's hydrogen -powered Corolla

LEFT Staying ahead of the game helped ATL deal with the switch to sustainable fuels, a route the World Endurance Championship has pursued

be as many aggressive constituents in the 2026 F1 fuel, so that should be a considerably smaller challenge. But the important thing now is to do our homework and ensure that we stay one step ahead with that research."

He stresses the need to look at the whole fuel system and take a common-sense approach. A lightweight motorsport fuel filter, for example, can be a false-economy if the debris released by more aggressive fuels causes it to clog up and fail. "I think there's sometimes a tendency to blame renewable fuels, when in fact, the problem lies with the choices that have been made elsewhere in the system," he notes.

RIGHT Giles Dawson's indefatigable work has built the company into a global powerhouse in the motorsport world

Technology transfer

Fuel tanks may only be one part of the puzzle, but ATL's breadth of involvement from road cars to aerospace gives Dawson and his colleagues real insight into where these industries are heading. In the long term, he predicts that hydrogen will be a major factor in the global energy mix, but he also believes that hybridisation will continue to be a significant trend.

"Audi's win in the Dakar shows the potential of combining electrification with sustainable fuels," he comments. "We've seen a similar thing with drones. A lot of companies thought that they could go fully-electric with heavy-lift drones, but the reality is that they're now going for electric drones with gas turbine engines to supplement the battery. I don't think we'll see BEVs with big batteries dominating in the future – it'll be some form of low-carbon fuel with a degree of electrification. And while factory motorsport will have the budget for hydrogen, I think combustion-engined hybrids could be the solution for customer racing."

Either of these options will ask new questions of the fuel system – whether it's the packaging and structural challenges associated with hydrogen storage or the materials compatibility with sustainable liquid fuels. There will also be input required from fuel system suppliers and vehicle manufacturers to draw up the accompanying regulations. So, whatever happens, companies like ATL will have a major role to play. RT