

VOLUME 37, NUMBER 10 OCTOBER 2022

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PERFORMANCE RACING INDUSTRY MAGAZINE

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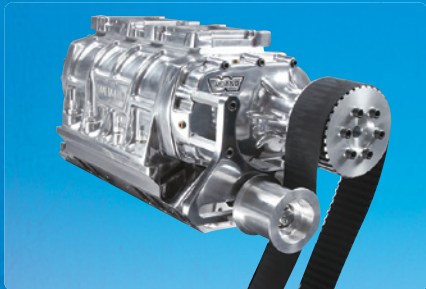
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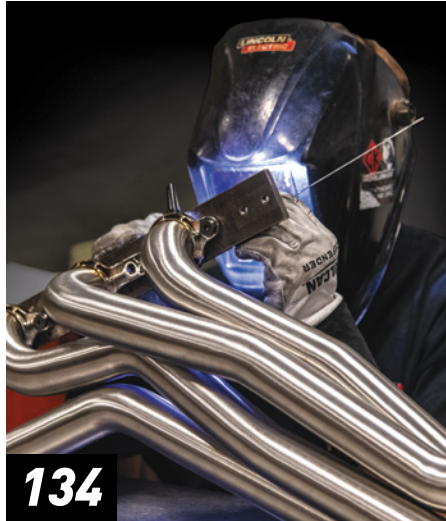
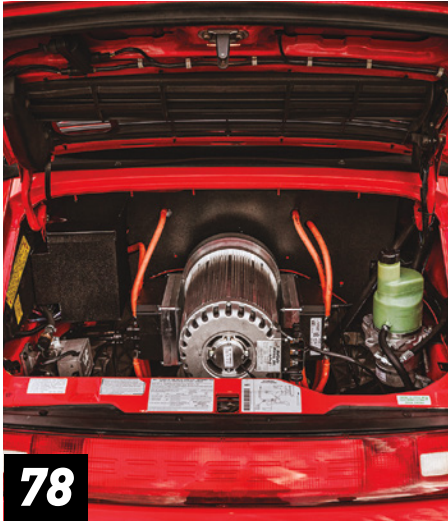
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FROM THE PRESIDENT

IT IS PRI SHOW SEASON

The leaves are turning color, racers are making their final push toward a championship, and sanctioning bodies are winding up another amazing year of motorsports across America. For the team at PRI, we are putting the finishing touches on what is shaping up to be a landmark PRI Trade Show for you. Your 2022 PRI Show is going to be a banger. We are hearing great things from all corners of our universe, and the word is all the same: "See you in Indy!" With that as an introduction, here are just a few of my favorite things about the PRI Show:

1. NETWORKING: For years, my best friend Mike Galimi has referred to PRI as "The World Series of Bench Racers" or something to that effect. His point has always been that PRI is the only real chance we have as racers to park the cars for a few days, meet up with our friends (and make new friends), and strategize about what could have been and how we are going to do it better for the following season. You have known this for years, but PRI gives you a distinct advantage in the marketplace. PRI allows great racing minds to come together, build our business, and explore opportunities.

2. EXHIBITORS: Our exhibitors are the stars of the Show, and PRI 2022 will feature more than 1,000 manufacturers of race parts from all over the globe. From specialty shops that have been built from a one-person garage effort to the largest manufacturers in the industry, PRI will

have them back in Indianapolis. And, yes, Chevrolet Performance (my alma mater) will be at PRI.

3. NEW CARS: The diversity of new cars debuting at PRI always impresses me. You just never know what is going to happen and what cars/trucks/tractors will be brought out. There is also such a diverse mix of race vehicles, you end up sharing knowledge across racing genres. Watch for big-name racers to be strutting their new designs at PRI 2022.

4. TRACK OPERATORS, PROMOTERS AND SANCTIONS (TOPS) WORKROOM & LOUNGE: PRI has been the home of the world's biggest racing sanctioning bodies, tracks, and promoters for decades. Just recently, we combined all these folks into one massive group of racing industry leaders and gave them their own space to spend time in. We did this so that we could help you accelerate the development of new tracks, sanctioning bodies, and events. If this is your business, I invite you to take advantage of the TOPS Lounge.

5. PRI EDUCATION SERIES: We have a number of exclusive educational opportunities for you at PRI 2022. If you are hungry to understand how to improve your game in the racing industry, these are the seminars that will change your life. From engine parts assembly, head porting, marketing, managing your sponsorships, and so much more...PRI Education is a trade show all within itself.



DR. JAMIE MEYER
jamiem@performanceracing.com

6. RACING MEDIA: I have always had a soft spot for members of the racing media. Having come from this community, I worked very closely with them while at Chevrolet to help promote performance cars, racing, and race parts. The racing media has changed over the last decade with fractured outlets and everyone being their own influencer. At PRI, our media members shine as they have a chance to break huge stories, share their best tips on our Content Creation stage, and even hand out awards through our Media Industry Awards program.

7. PRI SURPRISES: As an attendee of PRI for more than 20 years, I was always amazed at how PRI was able to do things that no other trade show or venue could pull off. Now, behind the scenes, I see this team in action, and they are all prepared to go above and beyond to blow away expectations of what your PRI experience will be like. This year will continue that tradition with surprise parts, cars, and people that you will not see anywhere else.

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Thank you for your support of the PRI Show. We love producing the world's largest racing trade show, and we cannot do it without you. So, get registered at performanceracing.com/trade-show/attend, make your travel plans, and I look forward to seeing you at the PRI Grand Opening Breakfast on December 8, in Indy. **PRI**

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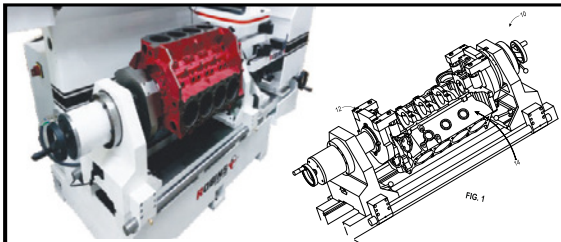
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FROM THE EDITOR

Two things I think while looking ahead to one of my favorite stops on the ARCA West Series schedule—the Bullring at Las Vegas Motor Speedway—later this month:

1) I THINK THE MATTER OF LEGALIZED

gambling in motorsports, despite the buy-in of major operators like NASCAR and the Indianapolis Motor Speedway, will remain something of a seesaw issue, at least for the near future. There's simply no clear-cut consensus at this point. Much of that is due to fragmentation: Racing is a multi-tiered enterprise—we often look at it as a pyramid, with the top levels occupied by the likes of F1, IndyCar, and NHRA pro teams, and the broader, more inclusive and attainable rungs represented by your Saturday night oval trackers, outlaw drag racers, amateur road coursers, and so forth. When it comes to support for sanctioned wagering, opinions are as varied as the sport's tracks, cars and competitors themselves, which we discovered in this month's Special Report "Let It Ride?" produced by contributor Steve Statham. The piece, which begins on page 40, explores attitudes on betting the races from multiple perspectives, including drivers and team owners, track and event operators, gaming interests, and more. Perhaps the best indicator of how divided opinions actually are came from the usually unwavering promoter Donald "Duck" Long, who told us: "I can't really say that I'm for or against it. I hate to be neutral, usually I'm black and white on something. It could benefit the sport on the one side, but then on the other side there are a lot of people who don't like gambling." We invite you to review our story, consider all sides, and draw your own conclusion(s).

2) I THINK THE COMPARISON OF

electric-vehicle conversions to "the early LS swap market" is one of the best characterizations yet of this emerging segment. In the motorsports space, a handful of companies have taken up positions on the front lines of efforts to both optimize



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performance and demystify the science behind EV systems management. Mainstream acceptance will hinge, in large part, on these operators' ability to win over hearts and minds. To that end, category leaders AEM EV, EV West, Legacy EV, and Zero Labs recently spoke with writer Bradley Iger for his feature article "Conversion Factor," which examines the capabilities of gas-to-electric competition vehicles and how leading suppliers are refining their processes while tackling challenges like excess heat mitigation and voltage isolation (in the event of an on-track incident). EVs still represent just a small fraction of vehicles on American roads—somewhere in the low single digits as of this writing. But the tech is racing forward, miles ahead of where it stood only a few years earlier. And enthusiasts are taking note, as Legacy EV's Mavrick Knoles described the draw for Iger, whose article, which begins on page 78, we highly recommend: "We've heard countless stories about people being hesitant about the technology and then going for their first spin in a Tesla in Ludicrous Mode. I think that EVs feel like the future for many folks, and they want to embrace the next wave of technology. We've spent so much time perfecting the gas engine, and now we're kind of starting fresh with EVs. A lot of people are saying to themselves, 'Okay, now how can I further optimize the performance of this?' That's where people start to get really excited." **PRI**

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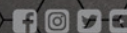
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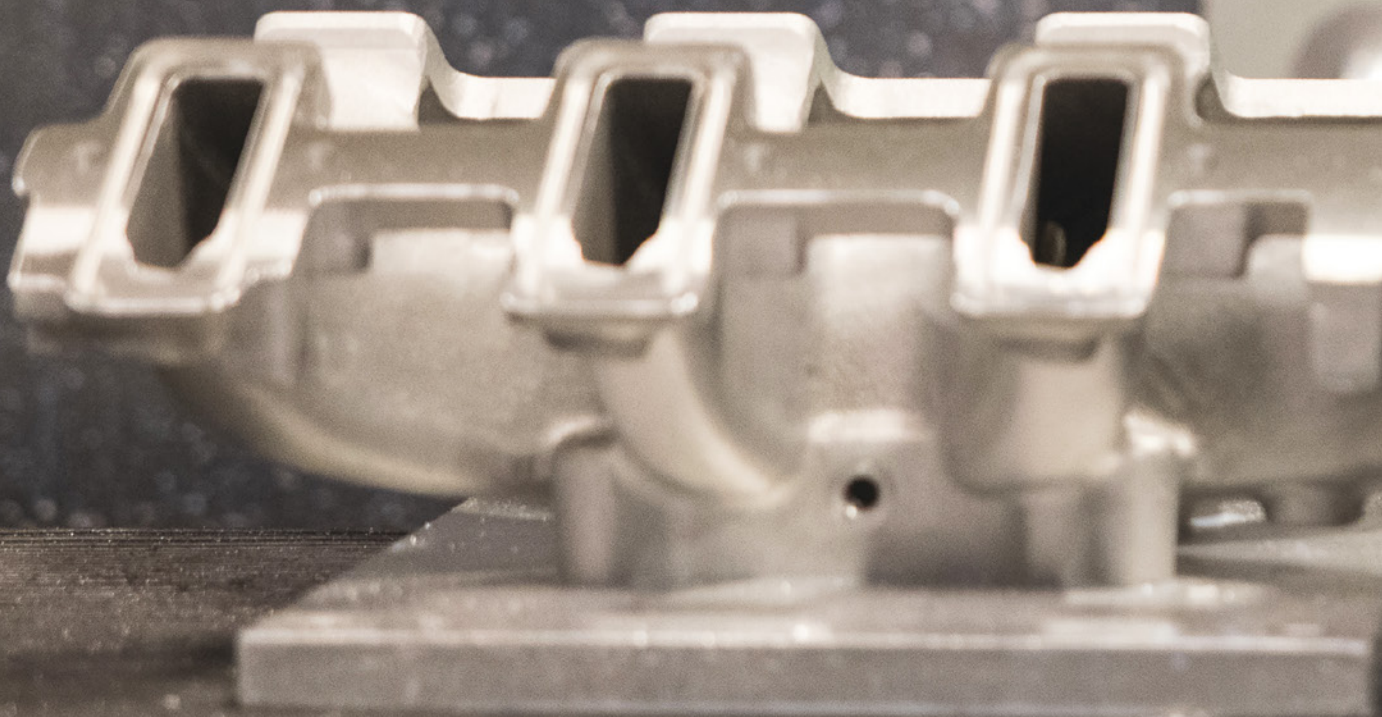
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LEAD POSITION

When it comes to building custom intake manifolds, there's almost no such thing as too much information. Just ask Keith Wilson (not pictured), whose Ft. Lauderdale, Florida-based Wilson Manifolds houses more than a dozen computerized work stations for product design and development, parts production, and large-scale data collection. "We have a four-page data sheet that every manifold customer has to fill out," Wilson revealed in this month's feature on custom intakes. "We build the manifold to their combination. We can narrow down every spec to what we need to build." In fact, each of the suppliers we spoke with for this piece offered telling insight into how they're meeting demand in a market where "everybody seems to want something different," according to Taylor Laster (not pictured) of TRE Racing Engines in Cleveland, Texas, about an hour north of Houston. For complete coverage of how one-off manifold design has become both an art and a science for many of today's shops, turn to page 126. *PRI*





ASK THE EXPERTS

SPRINT CAR FIRE SUPPRESSION SYSTEMS

Beginning next season, these units will be required on all World of Outlaws sprint cars. And manufacturers are already one lap ahead with development and product solutions.

By Drew Hardin

Earlier this year, the World of Outlaws announced that “by the first WoO racing event of 2023, fire suppression systems will be required on all World of Outlaws Sprint Series competitors.” The sanctioning body’s Sprint Car Safety Council worked with SFI to set up product parameters and testing requirements for what would become SFI Spec 17.3, for “Single Seat Open Wheel Front Engine On Board Fire Suppression Systems.”

Unlike the 17.1 spec, the sprint car systems focus solely on the driver. “They weren’t worried about spraying anything on the engine or the fuel tank,” explained Dan List of SPA Technique, Indianapolis, Indiana. “They just want to spray down the driver to get good fire-out and give them enough time to get the driver out of the car.”

In addition, 17.3 mandates the

system must be activated either thermally or manually, and it must work regardless of the car’s orientation, in recognition of the fact that sprint cars don’t always land on their wheels after an accident.

SPA Technique was the first company to receive the new 17.3 certification for its FireSense Plus system. The spec requires a five-pound bottle of suppression agent; SPA Technique uses an agent sourced from Denmark called 4 Fire Universal. All other components for the system are sourced in the USA. With SPA’s AM block, the suppressant sprays out of the same nozzles whether the system is activated manually or thermally.

4 Fire has the same fire-out times in tests as a halon replacement like Novec, List said, but it prevents re-ignition, which can occur “once the percentage of Novec in the air

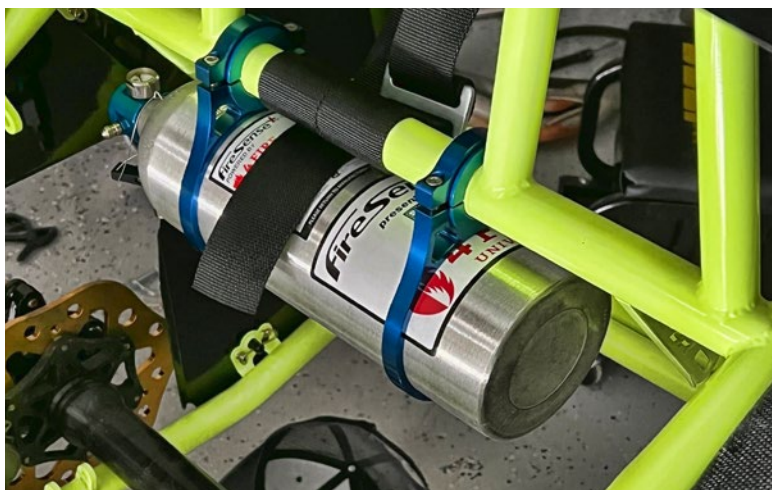
is too low. Since a sprint car is more open than a sedan type of car, I was concerned that percentage could get too low too fast. And because the engine is so close to the driver, the possibility of re-ignition would be higher than a lot of other cars.”

Though SFI keeps testing results private, SPA Technique posted video of its SFI tests on YouTube. “For the two automatic tests, we had a fire-out time of 1 and 1.3 seconds (10 second maximum) and discharged 4.98 pounds of agent (4.75 pounds minimum),” List said. “For the manual activation test with the bottle upside down and an obstruction in the way, we had fire out in 3.5 seconds (10 second maximum) and discharged 4.98 pounds (3.4 pounds minimum).”

Jim Morris of Lifeline Fire & Safety Systems in Coventry, United Kingdom, said his company is “fully aware that a fire suppression system for 99.9% of racers is ballast in the car, and it does one thing: It makes you go slightly slower, it doesn’t make you go faster. So our mindset has always been, give them the best performing, lightest weight possible fire suppression system they can have.” The Zero 360 system Lifeline developed for sprint cars has been in the works for nearly a year, and when we spoke with Morris in mid-July, SFI testing was just days away.

The system consists of a 5-pound bottle filled with Novec 1230 and a nozzle attached directly to the bottle, a feature that helps it fit in the tight

SPA Technique was the first company to receive the new SFI 17.3 certification for its FireSense Plus sprint car fire suppression system. While its 4 Fire suppression agent is sourced from Denmark, the rest of the system consists of components made in the US.



“THERE IS NO SUCH THING AS TOO MUCH FIRE SUPPRESSION.”

confines of a sprint car cockpit. “The bottle mounts just under the seat on the down tube,” explained Tyler McQuarrie of Lifeline. “The nozzle is pointed toward the area in a sprint car where 90% of the fires start—the fuel line and the fuel pump that are right under the driver’s left leg. Mounting it on the down tube takes just four Allen screws, so installation is very, very easy.”

The nozzle incorporates “valve mechanisms and some of the triggers that cross over from our traditional FIA road racing systems in terms of the compression discharge technology we use, the ability for the system to operate in any orientation,” Morris said. He described the Novec suppression agent as “a three-dimensional suppressant. It does not need sight of the fire to extinguish it, whereas a foam-based system or a water-based system absolutely has to see the fire in order for it to work.”

Lifeline has been selling the system since the beginning of the year. Lifeline’s James Clay said he was “pleasantly surprised” that “the uptake and demand for this has been tremendous, even without the homologation. People have been waiting for something to trigger an appropriate system that will fit in their car and accomplish what they want to accomplish.”

Safecraft Safety Systems of Martinez, California, has sold a sprint car system “for roughly three years,” said Johanna Higginbotham. It was “designed with sprint cars specifically in mind, with a slim, compact design crucial to making this work for our sprint car customers.” The Model SC is available in 3- and 5-pound bottles filled with Novec 1230 and capped with an activation head “that is narrower than other models we offer. This system also deploys at any orientation to accommodate race conditions. Most importantly, the thermal activation provides ultimate security for the driver if they are unable to activate the



Safecraft Safety Systems has sold its Model SC sprint car fire suppression system for about three years. It was “designed with sprint cars specifically in mind, with a slim, compact design crucial to making this work for our sprint car customers,” said Johanna Higginbotham.

system themselves.” The Model SC is sold with “slim roll bar mounting brackets that effectively use what little space there is” in a sprint car, she added.

While the new SFI spec calls for a fire suppression system, Higginbotham said “having both an installed system and a handheld extinguisher is not uncommon. There is no such thing as too much fire suppression.” **PRI**

SOURCES

Lifeline Fire & Safety Systems
lifeline-fire.com

Safecraft Safety Systems
safecraft.com

SPA Technique
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STOP DOING THAT...DO THIS INSTEAD

NITROUS OXIDE

From avoiding too rich a mixture to always knowing your saturation point, three top race engine builders share the do's and don'ts for quick add-on horsepower.

By Bruce Martin

While a fine-tuned nitrous oxide system can make a racing engine happy, a poorly maintained or tuned system is no laughing matter.

Nitrous oxide is a relatively inexpensive way to boost horsepower, but there is a fine line between the right amount and too much, the latter of which can severely damage your engine.

So, to help shed light on the matter we enlisted three top race engine builders for some of the do's and don'ts when using this power enhancer: Scott Shafiroff of Shafiroff Race Engines in Bohemia, New York; Gene Fulton of Fulton Competition Race Engines in Spartanburg, South Carolina; and Pat Musi of Musi Racing Engines in Mooresville, North Carolina.

A KISS IS ALL YOU NEED

Shafiroff believes a "kiss" of nitrous to just one cylinder may be all the engine needs to get that extra boost of horsepower. "I tell customers, you might want to kiss, kiss one cylinder," Shafiroff explained. "Just one cylinder at a time. Just a smidgen to see if you are going in the right direction. Once you find that happy spot, you aren't going to improve performance a lot, but you are going to risk a lot.

"If a guy is smart and goes to an engine builder like us, I give them a base tune-up that they know the engine is going to be happy with right off the bat. He can just kiss it a little bit to where it will be happy in his car, and then he doesn't have to touch it.

"It's very risky in all these multiple,

multiple stages when you are trying to go really fast, you never get a handle on it, and then you can hurt a lot of parts," he continued.

"It's really up to what you want the nitrous to do. If you want a fast bracket motor, like in Top Sportsman and Top Dragster, just find that sweet spot and stay with it. It's not going to let you win more races if you make the thing 200 hp or 300 hp faster; what's going to win races is consistency, to where you can run it all the way and not hurt it. Then, work on everything around the engine to make it more consistent and go a little quicker," Shafiroff concluded.

THERE'S SUCH A THING AS TOO RICH

Fulton believes today's nitrous systems are more restrictive than the jets because of the controls that are built into the system. That is why he never recommends running a rich mixture because it can create havoc in the engine without increasing the speed.

"Any system should be designed where if you are controlling the flow with the jet pressure over the orifice, the jet should be the restriction in the system if you are going to tune it by the jets," Fulton explained. "All of them think they are tuning it by the jet.

"About 50% of the nitrous that a motor will take does about 90% of what nitrous is going to do. They are putting so much in it, the tuning gets

Pat Musi, at left, of Musi Racing Engines cautioned against exceeding the saturation point with too much nitrous. "The excess gets locked in the plenum and starts jumping holes," he explained. "You have to be on your game and pull nitrous out of certain holes. It really gets touchy."



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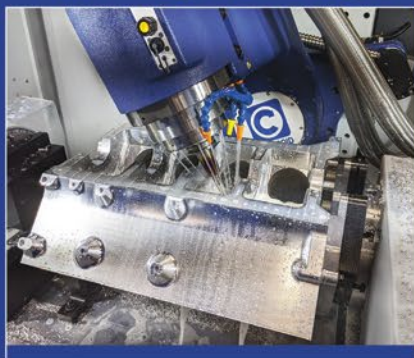


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"One minute we are doing a cylinder head and 10 minutes later we have a block in the machine"

Tony Salloum,
VAC Motorsports

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more critical, more critical, and more critical the more you put into it. It has to be more accurate, more accurate, more accurate.

"Well, a lot of them are inaccurate," Fulton added.

"Even if it's accurate, about 50% of the nitrous you are going to put in it does about 90% of what nitrous will do," he repeated for emphasis. "They put way more in it for a very miniscule gain.

"In racing, an inch will win, but it gets crazy," Fulton concluded.

ALWAYS KNOW THE SATURATION POINT

Musi has been building nitrous engines for more than 50 years and stresses the

According to Scott Shafiroff of Shafiroff Race Engines, racers and engine builders shouldn't try to "fix a car problem with a nitrous tune-up—it usually doesn't end well." He added, "It takes a pretty big change in a nitrous package to make an improvement of more than a couple hundredths."

"YOU SHOULDN'T BE CHANGING THAT STUFF EVERY WEEK SEARCHING FOR POWER BECAUSE YOU ARE GOING TO MESS IT UP. IT'S A RISKY PROCEDURE DOING THAT."

saturation point to his customers. Exceeding that saturation point with too much nitrous will force the nitrous into areas of the engine where it doesn't belong.

"When you get to the saturation point of what that motor will actually pull into charge, the excess gets locked in the plenum and starts jumping holes," Musi explained. "You have to be on your game and pull nitrous out of certain holes. It really gets touchy.

"Cubic displacement plays a big part of it depending on the size of the engine, what the intake valve will pull in during an intake stroke. Whatever is left, if you have too much

nitrous in, it will get in the plenum, jump to another hole that is opening, and that is where the burnup starts.

"It's a delicate deal," Musi emphasized.

FINDING A HAPPY SPOT

In the never-ending search for speed, the problem may be with the chassis setup of the car and not the horsepower of the engine, according to Shafiroff.

"Don't fix a car problem with a nitrous tune-up," he said. "It usually doesn't end well.

"Find that happy spot where the motor is happy, and the plugs look good, and the plugs are happy, and the cylinder looks good, and work around it on the

chassis and the car and get the car as fast it as it can be. It takes a pretty big change in a nitrous package to make an improvement of more than a couple hundredths. If you are trying to go three- to four-tenths quicker, then you need a bigger system. But you have to find that happy spot and stick with it.

"You shouldn't be changing that stuff every week searching for power because you are going to mess it up. It's a risky procedure doing that," Shafiroff concluded.

PAY ATTENTION TO THE BOTTOM END

While many racers are looking for top-end speed with nitrous, the bottom end of the engine really roars to life with extra torque.

"Nitrous is very good for the average guy to boost his power," Fulton said. "It's going to boost the horsepower up, but what it does to the torque of the engine is what makes it so fast. If it adds 200 hp to the motor, the bottom end will act like it's 400 hp stronger. The bottom end is way stronger than the peak horsepower. It's 400 hp better at bottom to mid-range and 200 hp at top.

"They think it's 200 hp, but really, it's more like 300 hp," Fulton added.

THE CONSEQUENCES OF LAZINESS

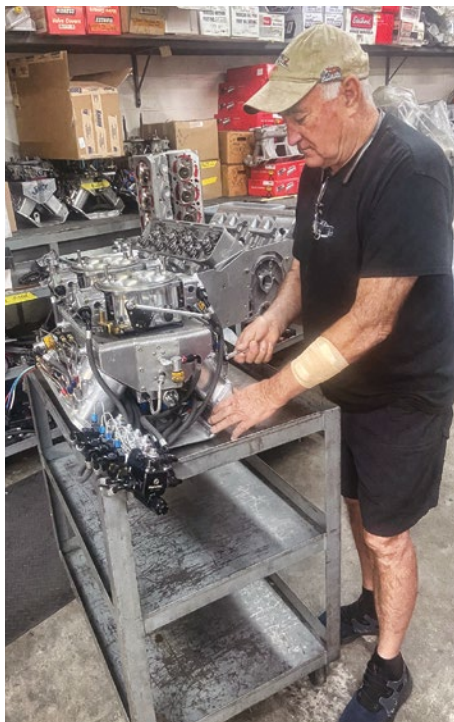
A properly maintained nitrous system will keep the engine happy. But a neglected system can be a sign of laziness, and that leads to sluggish performance.

"A lot of it becomes maintenance," Musi explained. "The guy leaves nitrous solenoids activated with no nitrous. The coils are burned up. They don't maintain their plungers.

"Peter Paul is the biggest manufacturer of all the solenoids. It's not a secret. Everybody has the same parts, but they don't maintain their stuff. They think it will run forever, and it won't. You are talking about opening a Teflon plunger against 1,000 pounds of bottle pressure. Everything is sized depending on what you are doing.

"Most of the time, the poor setups just won't run correctly," Musi continued. "It would boil down to clogged-up jets or a bad coil or solenoid. Ninety-nine percent of it is self-inflicted, poor maintenance.





While nitrous will boost up horsepower, its impact on engine torque is where the speed is really felt. "If it adds 200 hp to the motor, the bottom end will act like it's 400 hp stronger," said Gene Fulton of Fulton Competition Race Engines. "The bottom end is way stronger than the peak horsepower."

"If you take all the fuel away from a nitrous engine, it just won't burn up. I've seen timing marks move, crank triggers to bolts come loose and fall down to advanced timing. Dumb stuff, but it just comes down to maintenance," he concluded. **PRI**

SOURCES

Fulton Competition Race Engines

facebook.com/Fulton-Competition-Race-Engines-193027214119824/

Musi Racing Engines

musiracing.com

Shafiroff Race Engines

shafiroff.com



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MAKE THE CASE

WINGED VS. NON-WINGED SPRINT CAR RACING

While the two machines are very similar, the downforce offered by winged sprint cars necessitates a unique approach to racecraft, setup, and technique. But for many racers, the choice between the two often comes down to driver preference and where the opportunities exist.

By Bradley Iger



NON-WINGED SPRINT CARS:

Justin Grant,
USAC AMSOIL Sprint Car Racer

I started out racing midgets in California, and then I moved to Indiana to crew for a team for a year or so before I was able to get into a non-wing sprint car. I ran at a lot of local Indiana tracks for a while, and 2017 was the first year I followed the whole USAC schedule. Growing up in Northern California, which is kind of winged sprint car country, I remember watching the Sprint Week DVDs back in the day and thinking that the non-wing sprint cars were really cool. I always liked the wild nature they have. They're rowdy, and they spend a lot of time going sideways. That was exciting to me—it has sort of an 'X-Games' factor built into it. But I like sprint cars in general, and what

"I ALWAYS LIKED THE WILD NATURE THEY HAVE. THEY'RE ROWDY, AND THEY SPEND A LOT OF TIME GOING SIDEWAYS."

ultimately drew me toward non-wing cars is that it's simply where the opportunities presented themselves.

For a time, I think that the non-wing racing was more fun to watch because there was more opportunity for passing, but the winged cars have started to catch up in that regard in recent years. Still, the lack of a wing on these cars changes things up significantly in terms of both driving technique and car setup, which is interesting in and of itself. I think that at times the lack of stability in these cars requires a little more of the driver to get the job done, whereas things are happening so fast with the winged cars that it's more about the ability to react and quickly make decisions. Although the non-wing cars are less stable and a bit sketchier in turns, things are happening at a slower rate, and that allows you to be more deliberate about strategy.

In a non-wing sprint car you can also run right on the back of a guy, but with the winged sprint cars you have to worry about your position relative to the other cars on track and how that's going to affect the air that's getting to you. With a non-wing car that's not really a factor—the air doesn't really have any effect on how fast the car is going to run or how much grip you have. That opens up your options a little bit more. Instead of being concerned about downforce, in a non-wing car you're really

more concerned about finding moisture on the track to maintain those grip levels. Conditions change as the cars are running, so you spend more time searching for what's left of the race track. You're always looking for some moisture for your tires in the non-wing cars. With a wing car you can just get grip with more mph—the faster you go, the more downforce the wing generates.

The lack of downforce on non-wing cars means that the approach to setup is pretty different, too. We set our cars a lot lower in the back, so our left rear corner sits a lot closer to the ground. Our right-side tires are also a lot further out because that exaggerated offset adds some stability to the car. We're basically trying to create the same attitude of the winged sprint cars without the downforce, so we'll run a lot more rebound in our left-rear shock just to try and hold that corner down.

I came up through quarter-midgets and outlaw karts, and I've noticed that the kids who are coming out of the 600cc micro sprints are switched on really quick. But I don't know if there's anything that can truly prep you for the way that you need to drive non-wing sprint cars. You're so sideways in these things, and you have to really bend the car around to get it into a corner. In most everything else you're leading with the front tires. With a non-wing sprint car, you're basically steering with the throttle.



WINGED SPRINT CARS: Geoff Dodge, World of Outlaws NOS Energy Drink Sprint Car Series Racer

I started off in karting, and early on I was mostly focused on road racing. I had ambitions of going to Indy, but the budget was not going to allow for it, so I got to a point where I couldn't take the next step and I had to make a decision. My dad was a sprint car racer and I grew up around it, so I naturally gravitated in that direction at that point. At the time there was still a decent number of car owners in the game, and I felt like there might be an opportunity to get hired to drive someone's race car. I started in winged 360s back in 2003, and by 2005, someone put me in their race car, which gave me my first shot at winged 410 racing. In 2007, I also did some 410 non-wing racing. While I like both winged and non-winged cars, I was more competitive in the winged cars, and I enjoyed it a little more.

When I got into sprint cars, I wanted to stand on the gas and go as fast as I could, and the non-winged cars feel kind of slow by comparison. The World of Outlaws is also just the greatest show on dirt, and part of the allure was the big names, the big purses, and being on the road. All of that sounded pretty cool as a young kid. Watching my dad race winged sprint cars locally was a major factor, too.

Ultimately winged sprint cars are capable of doing things that a non-winged sprint car just can't do. You've got more downforce at 100 mph than the car itself weighs, and that has a profound effect on the car's behavior at speed. In a winged sprint car you not only have the grip levels of different tracks and the things you can do based on those conditions, but you also have an added

layer of aerodynamic grip based on setup and what the other cars around you are doing. It brings another level of complexity to the racing. A non-winged sprint car is probably a little bit harder to get around the race track, but a winged sprint car is harder to be truly competitive in. It takes a lot longer to get good with these cars.

Winged cars also require a very different approach to setup because the ride height changes significantly at speed, whereas a non-wing sprint car doesn't have something pushing down on it more and more the faster you go. That said, I think the most important thing is to give the driver the feel they need to drive the car as hard as it needs to be driven to win. You don't see everybody doing the exact same tricks on their cars—it's really just about giving the driver the confidence to drive wide open into a corner. More speed equals more grip here.

Because of that, I also think it's really important to build a strong relationship with whoever is doing your engines. In winged sprint car racing the faster you go, the better the car works. So if you don't have your engine running hard, you can't really begin to work on the rest of the car. If you find another 2 mph of straightaway speed, you might discover that it fixes that handling problem you were chasing. But for the aero to work right, the engine needs to work right, too. Winged sprint cars are more competitive than ever now, and small things can be the difference between success and failure. **PRI**

"ULTIMATELY WINGED SPRINT CARS ARE CAPABLE OF DOING THINGS THAT A NON-WINGED SPRINT CAR JUST CAN'T DO."

EDITORS' CHOICE

Hundreds of new product announcements cross the desks of PRI editors each month. Following are our top picks for October.

ECORSA MOTORSPORT NON-PETROLEUM RACING OIL

EVOLVE LUBRICANTS

evovelube.com

Environmental concerns are putting pressure on motorsports, especially in the area of increasing sustainability in fuels, lubricants, and even tires. The new ECORSA Motorsport racing oil from Evolve Lubricants in Reno, Nevada, is an advanced plant-based oil that is proven to be very efficient in reducing heat and friction in a racing environment.

"There's no sacrifice in racing green," stressed Rick Lee.

Currently available in 20W50, 10W40 and 10W40 for motorcycles with more viscosity options coming soon, ECORSA Motorsport oil comes from carbon-negative base stocks that can be made from a variety of plants, including soybean, palm, rapeseed, and others. While bio-degradable engine lubricants have been around for some time, they were esters and not true hydrocarbons. Evolve has developed a process that produces a true hydrocarbon molecule with a thicker carbon backbone and extreme linear design.

"We have a unique molecular structure that draws heat through this long chain more efficiently," explained Lee.



Testing by Porsche AG with results presented at a prestigious engine conference showed low viscosity changes and a 12-horsepower gain over the course of a 100-hour test. That oil was the company's production-car formula, which has the basic formula as the race oil, the latter boasting additional additives for extreme use. Evolve also has a diesel formula for tow vehicles. —Mike Magda

FORGED SUPERLITE (FSL) SPRINT INBOARD RACE KIT

WILWOOD ENGINEERING

wilwood.com

When it comes to brakes in the sprint car market, racers must balance the benefits of weight savings, costs, and performance along with the driver's personal style. In addressing all those objectives, Wilwood Engineering in Camarillo, California, developed the Forged Superlite (FSL) rear inboard brake kit.

"Danny Dietrich—who is one of the hardest drivers on brakes in sprint cars—asked for a setup to meet his braking demands in the central Pennsylvania sprint world, and we developed this package," said Dave Brzozowski. "After numerous wins during 2021, we have finally released this setup, and it has taken off with teams."

Anchoring the kit is a 12.19- x 0.81-inch rotor constructed from proprietary Spec37 high-friction iron. The rotor features 36 directional cooling vanes and is dynamically mounted to an aluminum two-piece hub and adapter. The forged-aluminum FSL4R Superlite caliper is unique in that the two piston bores are different diameters: 1.88 and 1.75 inch. This arrangement provides progressive engagement and increased brake pad life.

"This kit provides the highest brake torque available with pad options to customize feel and track conditions," added Brzozowski. "A FSL4R stagger bore caliper, fade-free Spec 37 rotor, and .80-inch thick pads all contribute to the most reliable brake lap after lap in the harshest environment." —Mike Magda



VIKING 2450 ADV SERIES WELDING HELMET

LINCOLN ELECTRIC

lincolnelectric.com

Welders have long been asking for integrated LED lights on their helmets, and the new Viking 2450 ADV series helmet now offers that feature as standard equipment.

"The intelligent modular LED light was custom designed to improve productivity, quality, and safety in one simple attachment. It dynamically adjusts to the environment to improve users' visibility of the weld, work piece, and weld joint," said Mike Clifford of Lincoln Electric, Cleveland, Ohio.

The LED light is turned on and off with a low-profile external control. The light illuminates the work area for increased workspace visibility during off-welding time. The LED automatically turns off when the welder strikes an arc to save battery power. The light also features a removable battery pack powered by one AA battery.

These auto-darkening helmets also feature a cutting-edge user interface and 4C optics. Moisture- and abrasion-resistant push buttons easily control shade, sensitivity, delay, and mode. The 4C optics provide 1/1/1/1 optical clarity to provide the best view of the material, arc, and puddle.

The helmet features an extra-large 9.3-square-inch lens, and the helmet comes with a three-year warranty. Comfort is enhanced with the innovative X6 headgear that distributes weight and optimizes balance. —Mike Magda



HBM453 FLOW METER

J-TEC ASSOCIATES

j-tecassociates.com

Need a quick check of possible blow-by in your race car's engine? J-Tec's HBM453 flow meter provides an indication of piston-ring leakage under actual operating conditions by measuring the flow out of the crankcase vent or sump vent.

"Just hook it into one of the crankcase vents on the engine, most likely on the valve cover, and plumb it in with a fitting of their choosing. Use a rubber hose and hose clamps for an airtight seal," said Tom Oliver.

The flow meter can help detect problems of ring flutter, improper ring gap, cylinder wall distortion, ring clearance, and ring tension. The handheld meter is easy to use in the field with a digital readout.

Baseline readings can be noted when the engine is assembled and running for the first time. Then if there's any perceived problem, a reading can be obtained quickly in the field. Oliver said the flow meter will not work if the engine is equipped with a vacuum pump.

"The vacuum pump would have to be disconnected," added Oliver.



The readout unit is powered by four AA batteries, and it supplies the necessary power to the actual flow meter. The meter measures flow from .80 to 16 CFM. —Mike Magda

BIG BLOCK CHEVY 3-INCH INTAKE MANIFOLD KIT

HILBORN FUEL INJECTION

holley.com/brands/hilborn/

Nostalgia-racing gassers and dragsters will drool over this Hilborn EFI-R intake manifold that features 3-inch butterflies and stacks.

"Hilborn EFI-R injector manifolds are designed to deliver extreme airflow for high-horsepower racing engines and produce an intimidating aesthetic," said Evan Perkins of Holley Performance Products, Bowling Green, Kentucky. "They combine the benefits of stack injection and tunable runner length with all of the modern attributes of electronic multiport fuel injection."

Separate kits will work with either a 9.800- or 10.200-inch deck height. The intake is a heat-treated aluminum casting with dark gray ceramic coating. The machined valley cover provides two -10AN O-ring sealed ports for crankcase breather or dry-sump scavenge pickup.

Large 3-inch butterflies provide maximum airflow and are recommended for race applications. Similar BBC intakes are available with 2 7/16- or 2 5/8-inch butterflies for street performance. High injector placement helps optimize fuel conditioning.

"The big difference with Hilborn EFI-R injector manifolds is the integration of Holley's years of EFI experience. This is a very 'old school meets new school in all the right ways' type of product," added Perkins. "For example, a series of tubes converge into a vacuum block to deliver



a more consistent signal to the MAP sensor. Rather than a manifold that leaves the end user piecing the rest of the setup together, Holley's involvement creates a complete racing manifold solution." —Mike Magda

DIGITAL NITROUS PRESSURE GAUGE

NITROUS OUTLET

nitrousoutlet.com

Tired of getting out of the car and opening the trunk to check the pressure in your nitrous bottle? Now you can monitor the pressure in the system at all times from the driver's seat with the new digital nitrous pressure gauge from Nitrous Outlet in Waco, Texas.

"Reading nitrous pressure with a sensor is typically far more accurate than a mechanical gauge. Racers can also mount the sensor at any location along the main feed line or in the gauge port on their bottle, and have the gauge mounted somewhere else. This helps make pressure readings more accessible and easily readable at a glance," said Mark Wennin.

The gauge measures 2 1/16 inch and comes with a 0–1,500 psi pressure sensor, wiring, and mounting hardware. It also features a backlit display, tinted lens, and LED digital readout. Installation is simple: mount the gauge; install the pressure switch; plug in the harness; and connect to a power source, ground, and headlight dimmer switch.

"When combined with our remote bottle opener, the racer can operate the entire nitrous system from the driver's seat," added Wennin.

The remote bottle opener allows the racer to open and close the nitrous bottle from the cockpit of the vehicle. The high-torque motor operates on 12 volts and will fully open and close the bottle valve under full pressure. —*Mike Magda*



EXTREME DUTY INCONEL EXHAUST VALVES

MANLEY PERFORMANCE PRODUCTS

manleyperformance.com

Higher combustion pressures achieved with increasing boost levels put a strain on exhaust valves, so Manley Performance Products in Lakewood, New Jersey, expanded its Extreme Duty valve line. Originally developed for supercharged, nitromethane-burning engines, these valves are manufactured from the company's unique XH-432 XtremeAlloy Inconel material and proprietary heat-treat process. They are engineered to operate in temperatures exceeding 1,600 degrees F.

"For racers and engine builders who have engines producing excessive EGTs, combined with higher stress levels, these properly manufactured and heat-treated Inconel exhaust valves provide the safety margin necessary to prevent catastrophic engine failure," said Trip Manley.

In addition to stocking a line of application-specific valves for most popular engine families, Manley offers Extreme Duty valves through its Gen II program for custom valve orders. Manley keeps an inventory of 'blanks' in popular stem diameters and finishes them to the desired length and head specs. Notable features of the Extreme Duty line include swirl polishing, chrome stems, and hard tips.

"Our 3/8-inch stem, overcut fillet area, special heat-treated Inconel



exhaust valves help allow Top Fuel and Funny Car teams get down the track without failure in a brutal high temperature and stress environment," added Manley. "The same goes in many offshore powerboat applications." —*Mike Magda*

NEWLY APPOINTED

KURT MILLER

SCORE's new marketing sales manager is plotting a course to expand the sport's reach to a wider audience while building new opportunities for manufacturers and fans.

By Jim Koscs

Kurt Miller recalled the pivotal event that helped spur his career in off-road racing when he was in his early 20s.

"It was just a lucky break," he said. "My father lived across the street from off-road motorsports legend Mike Thomas of Chenoweth Racing in La Mesa, California. Mike was an exceptional man, and he introduced me to many prominent racers, sponsors, and builders in the mid-1980s. He provided me a unique behind-the-scenes opportunity."

"DON'T BE AFRAID TO GET BEYOND YOUR COMFORT ZONE, BUT DON'T GET TOO COMFORTABLE EITHER."

That opportunity, Miller explained, gave him unique insight into the time commitment, planning, strategy sessions, and engineering required to succeed in the brutal Baja environment. "After experiencing the people and beauty of Mexico, and talking with racing icons like Ivan Stewart, Bob Gordon, and Walker Evans, I was addicted to off-road racing," he added.

Fate stepped in again when Mickey Thompson offered Miller a

position in his tire company, where he stayed 17 years. "That position helped to open doors within the industry. After Mickey created SCORE International with Sal Fish in 1973, he dreamed of filling stadiums across America with side-by-side short-course racing. That convinced me he could bring the exhilaration of desert racing to the masses. The MTEG Series generated significant network TV and media exposure, which drew celebrities and racers from other motorsports and was foundational to today's popularity and growth of off-road racing."

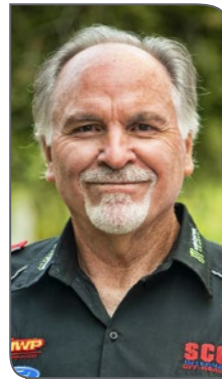
Miller recently shared with us his goals and plans for his new role.

PRI: Have you been a racer yourself?

Miller: During my time at MT Tires, I first co-drove with a team we sponsored in Southern Nevada Off Road Enthusiasts (SNORE), LaRana Desert Racing and MDR, and then later as a driver, in a Class 7 2WD Ford Ranger. I also raced as part of the classic Dirt Sports Magazine Class 11 Volkswagen "Das Elf" team in a vintage NORRA (National Off Road Racing Association) race. Aside from potential future Wide Open Baja trips with SCORE Journal clients and advertisers, my racing days are likely behind me, but not the memories.

PRI: What are you most looking forward to in this new role?

Miller: Sharing the vibe of Baja California, Mexico, and the community lifestyle of off-roading



KURT MILLER

TITLE: Marketing Sales Manager

ORGANIZATION: SCORE International

HOMETOWN: Vista, California

FAST FACT: When he's not immersed in following off-road racing, Miller said he loves watching baseball and surfing, and spending time with his wife, family, and friends.

with new readers and fans of SCORE Journal. Also, showcasing the innovative products readers can use to equip their daily drivers and recreational rigs with Baja-proven products.

PRI: Describe the enthusiasm you have for off-road racing, and why it is unlike any other sport.

Miller: Baja is so unpredictable that just completing the quest is often the goal. You can find a comfort zone and a budget range to compete—from a motorcycle, UTV, Trophy Truck, or maybe join a chase team, or follow the live tracking experience during the race.

PRI: Does off-road racing offer any specific marketing challenges, and if so, how do you plan to address and overcome those?

Miller: Yes, starting with the logistics of capturing a race spread over hundreds of miles, with numerous classes and countless evolving variables is a massive undertaking. SCORE has had almost 50 years to refine the process but has recently used technological advancements to take coverage to new levels. Live tracking and live streaming options put the entire race course within the scope of coverage, and the levels of photography, video, drone footage, and satellite uplinks have also progressed to unprecedented levels. These advances afford manufacturers and advertisers new opportunities to see their products and sponsored teams in action while branding to a global audience. I hope to work with new companies to

harness this reach and excitement.

PRI: What are your near-term and long-term goals in this position?

Miller: With the record growth of overall race entries across the spectrum, from UTV classes to record numbers of entries in Trophy Trucks and TT Legends, I want to reach a younger audience of future buyers and make a new generation familiar with manufacturers' offerings. Utilizing the newest technology, I hope to modernize and expand the methods and toolbox available to help advertisers customize campaigns capable of achieving these goals.

PRI: What is one professional or personal accomplishment you are most proud of?

Miller: Having been a part of Dirt Sports Magazine from its inception, I enjoyed showcasing the full spectrum of racing from the drawing board to the pits to the podium. I'm also proud to have delivered motorsports coverage and built excitement and fans for more than a decade.

PRI: What is a mistake you've learned from?

Miller: I've had a few setbacks, so I try to live by pro hockey player Wayne Gretzky's philosophy, which is, "You miss 100% of the shots you never take." So, don't be afraid to get beyond your comfort zone, but don't get too comfortable either.

PRI: Who do you look up to, and why?

Miller: I've had lots of influences. America's founding fathers and pioneers were inspiring to me.

PRI: What non-fiction book has been most influential on you and why?

Miller: The Bible. It shows mankind's warts and all, but it still offers hope.

PRI: Excluding your cellphone/tablet/computer, what's one thing you can't live without?

Miller: Family time. **PRI**

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INDUSTRY INSIGHTS

BETH PARETTA

This trailblazer leads by example, establishing an IndyCar team featuring women in prominent roles—including the driver—and working to bring greater diversity to all aspects of motorsports.

By Jeff Zurschmeide

Beth Paretta didn't set out to be a revolutionary. She studied broadcasting and film in college, and then went to work in the hustling environment of new car sales at auto dealerships. From there she climbed the ladder in business development at Volkswagen of America, then Aston Martin, and finally Fiat Chrysler Automobiles, where she ran marketing and operations for the company's Street and Racing Technology (SRT) division and its racing programs.

It was there, working simultaneous efforts in NASCAR, Trans-Am, and IMSA, that she really learned the business of racing. Under her direction, SRT teams won three national championships in GTLM, Trans-Am, and the NASCAR Xfinity series. In that role, she made the connections needed for her next big idea—to run her own IndyCar team and set an example for all of racing. After an initial effort in 2015–2016, she's back with a whole new team this year, consisting of about 70% women, including Simona De Silvestro in the driver's seat.

We recently sat down with Paretta to ask how she got here, how she finds value in diversity, and where it's all headed.

"SOMETIMES, TAKING WHAT YOU MIGHT THINK IS A RISK ISN'T REALLY A RISK; YOU JUST HAVE TO BE WILLING TO DO IT."

PRI: How did you get to where you are today?

Paretta: In high school and through college and grad school, I worked in the Alpine skiing business. But when I graduated, I didn't want to work in something dependent on the weather, so I pivoted to my other love: cars. I literally walked into a dealership and asked for a job. I remember saying to the general manager that I'd like to learn how this business works, so I would come in on my days off and sit next to the service manager and the parts man.

One day an Audi factory rep came in. I mentioned that I was trying to learn all the facets of the car business, and he asked for my resumé. Two weeks later I had an interview for a job with Volkswagen Credit.

"IT'S ACTUALLY YOUR RESPONSIBILITY TO INVEST IN NEW PEOPLE."

They plucked me out of obscurity to go work on the finance side. This gave me a fantastic foundation because I learned it all from the ground up. From there I went to Aston Martin, and then I got hired to run marketing and operations for Fiat Chrysler's SRT division. That job involved overseeing motorsports.

I wound up changing the way that we were supporting the NASCAR program internally, and we won the championship with Team Penske in 2012. That was Roger

Penske's first Cup championship, and it was the first time Dodge had won since 1975. It was a big deal!

PRI: A lot of people work at the highest levels of the auto industry and even manage racing programs, but forming your own IndyCar team is a huge step. Why did you do it?

Paretta: It's funny because somebody asked me, what made you think you could do this? And I don't mean to sound dismissive, but it literally never occurred to me that I couldn't. The idea started with the Indy 500 because you can do it as a one-off race. That uniqueness was the spark of the idea, but it's no different than running any other business, really.

PRI: The unique thing about your team is the



Consistency is the goal of Beth Paretta's IndyCar team, she said. "I want to have a multi-year full-time team because that's the only way you're going to get results. Stability leads to success in racing."

number of women you employ. Tell me about that.

Paretta: I saw firsthand that there weren't a lot of women involved in racing, but I knew there was room for more. I also saw that car companies were lamenting a serious talent shortage. Engineers were retiring at a faster rate than they were being backfilled. A lot of institutional knowledge was going out the door.

That's when I connected the idea of using racing to solve the problem. We need to get more people to want to do this for a living. How do we do that? What if we start talking about skills and technical careers to kids? Yes, racing is a sport but we can use it to get

"We're going to be a curiosity," Beth Paretta admitted about her IndyCar team with a female majority. "There's going to be people staring at you while you're at work. Drivers are used to that, but mechanics and engineers aren't used to being stared at."

"I ALWAYS SAY, I DON'T WANT MY TEAM TO BE 100% WOMEN. I WANT WOMEN ON 100% OF THE TEAMS."

your attention, and you can use these skills to make a living.

Then someone asked me about a women's team for the Indy 500. Since it could be a one-off, I thought, "Why not figure out how I can make this work?" So I left Fiat Chrysler to work full time on making it happen.

PRI: You got early support from Roger Penske.

Paretta: I've known Roger a long time, so when he bought the IndyCar series and announced this diversity push, I called him. My intention was to start an LMP3 team, then move to Indy Lights, and then IndyCar, to properly grow. But then I met with Roger and told him what I was thinking. He asked me, "Why not just do IndyCar now? Let's work together."

PRI: Do you think you would've gone for a

women's team without that diversity push?

Paretta: Yes. When I was trying to do the Indy 500 in 2016, it was supposed to be a majority women's team. That was always the plan. I wanted to use the team to showcase the many roles women can have on a team. I knew women respond to seeing other women, so our team is meant to be a visible example. IndyCar's diversity push made it easier to have the conversation, but I was already working on this.

PRI: Driving race cars is very glamorous, but it's good to hear you talk about bringing new people into every job on the team.

Paretta: Everyone says there's no people. Well, are you investing in new people? Because it's actually your responsibility to do that. We hire men, women, whatever. I don't care if you've got stripes or leopard spots.



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If you have that passion and that love for racing, there's a place for you in this sport. This is why Lyn St. James and I started Women in Motorsports North America (WIMNA), to try to profile all the jobs. How about running a race track? We don't talk about the layers of racing, like being an official or being safety personnel. All of those things make the show happen, and all of those people love racing as much as we do.

PRI: Do you think being a woman has helped you in your career?

Paretta: I think in some ways being a woman has helped me only in that you remember me. I used to joke about this when I was at Aston Martin. In a given day you might meet 10 Daves and you met one Beth. Don't get me wrong—I have to be able to do the job. I have to know my stuff. Being a diversity candidate might get you an interview, but it's not going to allow you to keep a job. At the

“YOU'RE BUILDING PARTS IN YOUR RACE SHOP, WHY NOT BUILD SOME PEOPLE?”

end of the day, especially on a race team, you can't phone it in.

PRI: What goals do you have for your team?

Paretta: My goal for our team is to run full-time because that's the only way we're going to get results. You can have small lineup changes here and there, but it's the consistency on track that only comes with time that leads to success in racing. I always say, I don't want my team to be 100% women. I want women on 100% of the teams. I want to see more women and more people of color on all the teams.

PRI: How can the racing industry support WIMNA?

Paretta: We're going to have a jobs board. If you're looking for talent, come to us! We can help you create a job posting and try to direct people your way.

We're also mentoring young women. If we



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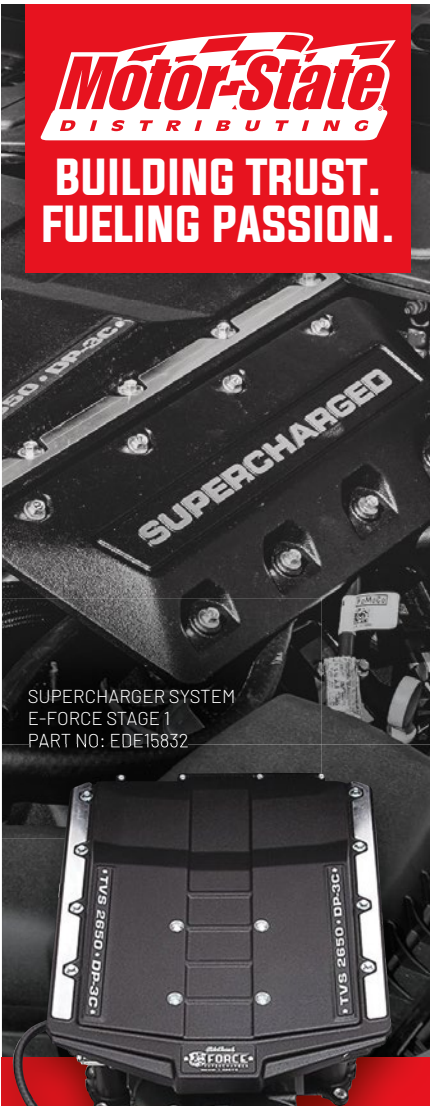
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ask you if someone within your organization can do a mentoring session, please say yes because we're trying to reach high school students who are considering getting into the sport and young people who are just finishing university or are early in their career and might want to make a pivot.

Another thing we hope to do is offer microloans. Let's say you want to hire somebody as a junior engineer at your race team. Your team is based in Indianapolis, but they live in Seattle. They need to move, but they need to break their lease and get a new place and pay their first month's rent. Literally, giving somebody a small loan or grant of \$5,000 could ease their burden and change their life. Things like that are low-cost solutions that would really help someone on their journey.

WIMNA is really meant to be a resource for information. If you've got a program within your organization that you want us to highlight, let us know so we can help you get the word out. And if you're inclined to support us, we are a nonprofit, so you can donate directly.

PRI: What are the big challenges to make all that happen?

Paretta: Getting the word out. We want women to share their knowledge and experiences, to help younger women navigate the early years of their career. Answering questions like: What happens if you take a break to have children? Do you leave for a couple of years? Do you go back and forth in between? Those are real considerations for people, and it helps to talk about it with people who have gone through it. There are three women on my team right now who are new moms. Between them,

they have an 8-month-old, a 9-month-old, and a 10-month-old. One of the women is nursing. So this weekend, at the race track, we had to find a place for her to pump and freeze her breast milk. The team had to solve for that and we did, and at first, I don't think any of the guys on the team knew that was going on, but we got it sorted. Women are resourceful.

PRI: Let's imagine a future where WIMNA is completely successful. What will that look like?

Paretta: I think just more women on all teams across all roles, across all series working at all tracks. Let's just get more good talent! This isn't about women at the expense of men. I'm always very careful to remind people of that. It's not about taking someone else's seat at the table. It's about building a longer table. We're better together. Case in point: I'm not trying to replace a team. We're an additional team.

It's funny, last year I got a note from a guy that said, "Okay. So you're saying if a woman and I apply to your team and we're both equally qualified, she's going to get hired before me?"

I said, "Yes."

He said, "Well, that's not fair. That's bullshit." I said, "Now you know how we feel."

This is literally the stuff that's been happening for hundreds of years. The way that you felt in the pit of your stomach and you were angry; sit with that for a second. That's literally how we've been living. So

Simona De Silvestro is the driver on Paretta's IndyCar team. She's seen here at the Sonsio Grand Prix at Road America in June.

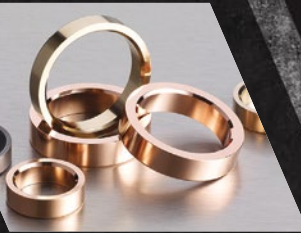




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Roger Penske, at right, was an early supporter of Beth Paretta's efforts to build a race team staffed primarily by women. His diversity push for IndyCar prompted her to start the conversation, and he encouraged her to jump straight into IndyCar.

many people are blind to the fact that this actually has happened. That's why there's been anger, frustration, disappointment.

PRI: Has the IndyCar organization been welcoming to you?

Paretta: IndyCar has welcomed us. We have seen the data from last year of the uptick in women viewers as well as those who said that they've been fans for less than 12 months. You can draw a pretty easy dotted line from that to our entry in the series. So, viewership is up. Does that help Ganassi and Andretti and Penske? Of course.

PRI: If you could write your future Wikipedia entry, what would be the first sentence?

Paretta: I would probably lie about my height! Seriously, I would just say, automotive and motorsport professional who endeavors to make it better for everybody.

PRI: And won the Indy 500 along the way?

Paretta: Listen, if I can kiss those bricks again, that would be amazing. I've kissed the bricks in NASCAR and IMSA. If I could kiss them in an Indy car, that would be quite the trifecta! So it would say, Beth Paretta, three-time brick kisser!

PRI: What leadership traits have you learned along the way that you incorporate into your day-to-day interactions with your team?

Paretta: I try to always be available to my team, so they know that I'm there to support them, to make sure that they have the tools they need and that they're given clear direction. I'm not a micromanager by any

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"IndyCar has been a welcoming experience," claimed Pareta Autosport team owner Beth Pareta, "and we couldn't do it if it wasn't." She is seen here at right, with driver Simona De Silvestro, center, and Ed Carpenter, left, at the Honda Indy 200 at Mid-Ohio in July.

means, but it's that idea that you know that I'm there if you need me.

Last year with our team, some of the women hired were completely new to racing; completely green. The elephant in the room was that our team was going to be a curiosity. There may be people staring at us while we're at work. Drivers are used to that, but mechanics and engineers are not. Also, we're carrying the weight of the gender on our shoulders. If you make a mistake in the Indy 500, it's like, do we deserve to be there? Literally, if we drop a gun and the Andretti team drops a gun, it's the same mistake, but obviously there's this added pressure. So, I'm definitely a bit of a mother hen and

protective of our people!

PRI: Is there anything that I haven't asked that you would want to say?

Pareta: If I look back at my career, there were three times when I was being hired where in the interview, people said, "We're going to take a chance on you," like I was a risky bet. It's funny because I know I was never the risky bet. The point is sometimes, taking what you might think is a risk isn't really a risk; you just have to be willing to do it. Hire someone who doesn't look like you. As long as the interest and the passion is there and they have the aptitude to learn, teach them the skills. I would tell anybody reading PRI Magazine, "You're building parts in your race shop, why not build some people too?" **PRI**

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LET IT RIDE?

Sports betting is becoming legal across much of the nation. Here's how the motorsports industry is gearing up to catch the wave.

By Steve Statham

Life is a gamble, especially in motorsports. Every time drivers suit up, they are playing the odds—calculating their chances to win, while not letting themselves get distracted by the odds of making it to the end of the race unscathed. Increasingly, though, fans are now able to have some skin in the game, with the ability to wager on the action taking place on the track. Over the past four years, a growing number of states have legalized sports betting. The motorsports industry is in the unaccustomed position of being a backmarker as stick-and-ball sports rush to embrace the gambling wave. But legal sports betting will soon be coming to a track near you...if it isn't already.

What has changed? In decades past, encouraging gambling was seen as unwise public policy, as gambling had a (mostly earned) reputation for preying on the most vulnerable as well as inviting corruption. Sports betting had long been corralled into gambling outposts like Nevada.

Consequently, most wagering on sporting events went underground. In the motorsports world, betting has thrived in late-night contests conducted away from the bright lights of the authorities, although if the volume of YouTube street/grudge racing videos is any indication, there is big money changing hands, and the gamblers aren't working too hard to conceal it.

More and more, however, motorsports fans will not need to conduct their wagering in the shadows, as states have had a change of heart on the issue of gambling. Over time, the pot of potential tax revenue that gambling generates has proven irresistible to state legislatures. Once lotteries were adopted by most states, the moral high ground was ceded, and arguments

against legalized sports betting sounded increasingly hollow.

What opened the floodgates for the current round of legalized sports betting was a 2018 Supreme Court decision that ruled in *Murphy vs. National Collegiate Athletic Association* that the Professional and Amateur Sports Protection Act that outlawed most sports betting was unconstitutional, thus freeing states to set their own rules. The process of legalizing and regulating sports betting has been working its way through state legislatures ever since.

As it stands today, some states allow in-person-only betting, but most are legalizing online sports betting as well. Indiana, Iowa, and Pennsylvania were early adopters of online sports betting in 2019. Colorado and Illinois joined the party in 2020. Arizona legalized sports betting in April 2021, even going as far as to allow in-stadium sportsbooks. Louisiana legalized online sportsbooks in January 2022, as did New York. Arkansas legalized sports betting in February 2022. Ohio is set to go legal on January 1, 2023.

Other states either have sports betting on

“WHAT WE BELIEVE IS THAT THERE IS A REAL OPPORTUNITY IN THE DRAG RACING MARKET SPECIFICALLY, AND ALSO IN THE GRASSROOTS MOTORSPORTS, TO INCORPORATE LEGALIZED GAMING SO THAT IT ASSISTS ALL OF MOTORSPORTS.”

the ballot for voters to decide in upcoming referendum elections (California) or have legislation working its way through the process (Massachusetts). In Florida, legislation allowing sports betting was signed into law, although that law is tied up in legal challenges that may not be untangled until 2023.

Even as legalized sports wagering becomes more commonplace across the US, it still likely won't be nationwide. Some states, such as Utah, Hawaii, and South Carolina, for historic, religious, or cultural reasons, won't allow legalized gambling of any sort. Texas is the big prize still on the board for the gaming industry, but the state has historically been hostile ground

for gambling interests. Despite high-profile backing by the state's major league sports teams, the last attempt in the 2021 legislative session to legalize gambling went nowhere. Adding to the challenge is the fact that making sports betting legal would require an amendment to the state constitution.

Still, the trend is clear, and that trend shows more sports betting. The American Gaming Association (AGA) has a Revenue Tracker that collects data from brick-and-mortar casinos as well as Internet-based sportsbooks and casinos. “Despite macroeconomic challenges and increasingly tougher year-over-year comparisons, March, April, and May 2022 have been the three best gaming months in industry history—

Legal sports betting is growing, and it's reaching the top levels of motorsports. Earlier this year, the Indianapolis Motor Speedway signed with Caesars Sportsbook, and as part of that partnership a new betting lounge was opened in Pagoda Plaza at the Speedway.



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Betting on racing is not new; what is new is the number of states around the country that have legalized sports betting. It's not yet as popular in motorsports as it is among stick-and-ball sports, but the trend is growing, from the grassroots to the highest levels of the sport.

each surpassing gaming revenue of \$5 billion," the AGA stated in its May 2022 Revenue Tracker report.

Of that total, sportsbooks account for a growing percentage. "Land-based and online sportsbooks generated \$555.0 million in May revenue from commercial operations in 26 states. This is a 78.2% gain from 2021 when commercial sports betting markets were live across 20 states and the District of Columbia compared to 30 states and DC today. (More states are legalizing sports betting, but not all are going active or reporting at the same time, which accounts for the varied reported number of states above.) Through the first five months of 2022, commercial sports betting revenue stands at \$2.70 billion, 78.0% ahead of the same period last year," the AGA reported.

Certainly, the top levels of American motorsports appear to be on board with the expansion of sports betting. In May, the Indianapolis Motor Speedway (IMS) announced that it had signed with Caesars Sportsbook to be an Official Sports Betting Partner of the Indy 500 and IMS. As part of

that partnership, a new betting lounge was opened in Pagoda Plaza at the Speedway.

Take a trip to NASCAR's website and you'll find a BetCenter page that includes a Betting 101 tutorial for beginners, betting odds for the drivers, sports betting calculators, and links to sportsbook apps. For NASCAR races, sportsbooks typically offer bets on futures, which is who will win the race, or driver matchups, or group matchups. Even individual teams are getting involved. In 2021, Richard Childress Racing (RCR) became the first NASCAR team to form a partnership with a sports betting operator when it signed a deal with BetMGM.

CALL OR FOLD

The Big Boys may be making moves in the wagering field, but support for sports betting on racing is uneven. In many states, the laws and regulations are new and untested, and the gambling infrastructure is not yet fully in place. For every RCR ready

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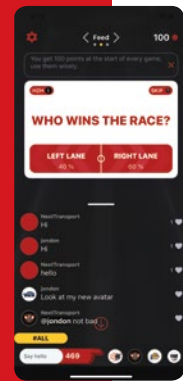
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Winlight Bets formed a sports betting mobile app for drag racing fans two years ago. Drag racing presents an opportunity “to bet every 45 seconds to a minute, which is ultimately really pretty exciting to do,” said Rex Simmermaker. The Fast Brackets podcast announced Winlight Bets at last year’s PRI Trade Show, at left.



to dive in, there are other organizations taking a more cautious approach. Knoxville Raceway in Knoxville, Iowa, is a sprint car hotbed where the action is fast and furious. But when it comes to sports betting, “We’re definitely taking a ‘wait and see’ attitude,” stated John McCoy of Knoxville Raceway. “If it does come up, we would take a look at it, of course.”

Donald Long of Duck X Promotions in

Zephyrhills, Florida, promotes races in Georgia and Alabama, two states where sports betting is not yet legal, so it is not a front burner issue. Even so, Long said he has been contacted by gaming interests pitching their programs and establishing networks. He’s open to the idea but can’t entirely set aside the shadier aspects of betting on sports.

“I can’t really say that I’m for or against

it. I hate to be neutral, usually I’m black and white on something,” he said. “It could benefit the sport on the one side, but then on the other side there are a lot of people who don’t like gambling. There are a lot of Christians and others who might be completely against gambling. Then you have the companies that are represented.”

It’s also the case that some forms of motorsports are probably better fits for

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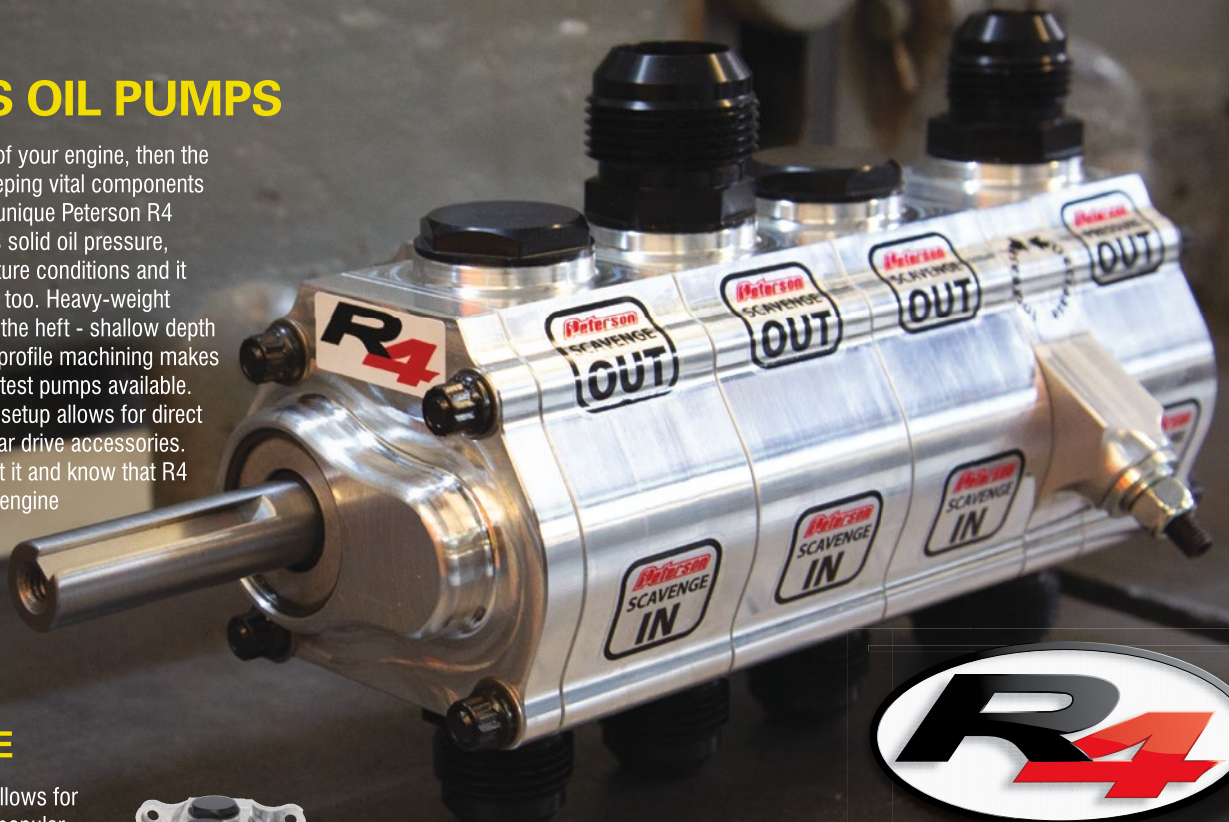


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wagering than others. Winlight Bets, a sports betting mobile app for drag racing fans, was formed two years ago and was set to go live as we were assembling this article.

"What we believe is that there is a real opportunity in the drag racing market specifically, and also in the grassroots motorsports, to incorporate legalized gaming so that it assists all of motorsports," said Rex Simmermaker of Winlight Bets. "In our case specifically, drag racing gains more eyeballs, more interest, and then turns revenue back into the tracks, the associations, and the racers themselves."

Simmermaker believes there is a lot more at stake than merely the injection of more money into the sport, however. "There's a really fluid arc of what is called 'fan interaction.' And the ultimate end of fan interaction is sports wagering," he said. "That's the ultimate interaction you can have with an event—your hard-earned US dollars being wagered on the event."

"DRAG RACING IS REALLY THE SLOT MACHINE OF SPORTS BETTING."

"At the beginning of that arc is what is called the 'free-to-play' model," Simmermaker continued. "There's fantasy sports, there's a lot of free-to-play opportunities that allow you to have fan interaction. At this point, Winlight Bets is merely a fan interaction model that allows fans and drivers themselves to have interaction with the event. Legally what we have operating is a free-to-play model. Ultimately, we will get to a legalization of it, which will in turn allow us to push some of the handle back to the tracks, associations, and racers themselves. We've got a detailed plan to do that. Today, it all revolves around the fan interaction model, which starts with the free-to-play."

What makes drag racing such fertile ground for sports wagering? "Drag racing is really the slot machine of sports betting," Simmermaker said. "It is a chance to bet every 45 seconds to a minute, which is ultimately really pretty exciting to do. There are going to be options for us in the grassroots motorsports world, but because my history and experience is around drag racing, we started there. We know there is huge opportunity, given the fanbase and the amount of illegal action that has already taken place."

"It all revolves around the fact it is fast action, and your reward is pretty quick in the process. What we know in the gaming world is that legalized gaming is spiking. The industry says there is going to be a 40-times increase over the next 10 years in sports gaming, and 70% of that is going to be in what's called the 'in-game play,'" which is also referred to as in-play or live betting.

"Well, drag racing, every pass is in-game

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“Legal sports betting is just like going to a horse race,” said three-time NHRA Top Fuel champion Antron Brown. “It just brings more awareness, it brings a lot more people into the sport because they feel they are a part of it, because they have part of the stakes.”

play,” he continued. “We’re already to where all the major sportsbooks want to get with other sports. Major sportsbooks will ultimately get to where they can bet on whether it’s a pass or run every play. We already have that in drag racing. Every minute you’re going to be able to get rewarded or have another opportunity to earn your money back.”

Simmermaker has a vision for how the wagering ecosystem could look once sports wagering is hitting on all cylinders. “First off, they’re going to increase their fan interaction and the fan experience in general,” he said. “What I accepted as a fan 20 years ago isn’t acceptable today as a fan. We are demanding better as fans. You take a look at a local drag strip that gets 500 people showing up on a Saturday night. And you allow them to have gaming on their action—we have the technology to do that today. That could easily double their gate. So they have 1,000 people walk through the door

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because not only can they watch great action, but they can be involved with it and maybe make a few bucks. People love that. Now you take a local drag strip that counts on a 500-person gate, and they get it to 1,000, that's a difference maker for that track. I really believe that legalized gambling is the answer from that standpoint."

Antron Brown is a three-time NHRA Top Fuel champion and owner of AB Motorsports, and he also sees the potential for increased fan engagement that sports wagering could bring. "I think legal sports betting is just like going to a horse race," he said. "It just brings more awareness, it brings a lot more people into the sport because they feel they are a part of it, because they have part of the stakes. It's not just the teams winning the races or the prize money—you have people on the side who are rooting for their favorite team or the best team that they think can win on odds. It's like bringing fantasy football to the drag strip."

Few businesses willingly turn their backs on increased customer engagement and new revenue streams, but not all the stakeholders in motorsports will be eager to cozy up to the gaming industry. Jhonnattan Castro competes in the Formula Drift series and races primarily in the US. He's from the Dominican Republic, where gambling is a thorny issue, and he's not convinced a coat of legality is going to improve gambling's reputation anytime soon.

"Gambling is something that I'm not sure I feel comfortable with. Does it help motorsports? I believe it can help, sure, it can give options to people," Castro said. "But I'm not sure I agree with it."

Long of Duck X Productions sees sponsor communication as crucial for any tracks or organizations that sign on with sportsbooks. "I'm sure that it could cause problems," he said. "Let's say I get on board, but you might have somebody else out there, let's say Mickey Thompson, Summit, or whoever,

maybe they don't want to support gambling. That could definitely cause some problems. If you have people for and against it, you know how that goes sometimes, people will get a little hurt about it. It would definitely be one of those things where you almost want to run that by all of your title sponsors."

Brown has a more optimistic take on sponsor acceptance of legalized sports betting. "I believe that manufacturers and sponsors that are all involved on race teams, their full mindset is the same thing—to win," he said. "They are out there to win on Sunday and sell on Monday, and from that perspective, they're not going to think about the wagering or the betting.

"But for all of us as competitors, we're going out there to win," Brown continued. "Win, lose, or draw, we work hard, we put the time in just like a professional football team or baseball team. They have wagering and betting on that, but that never changes the outcome of the game from anybody's

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standpoint. For ours, it's going to be the same thing. We're going to race hard, but I think the betting and wagering is going to bring more excitement to the fanbase, where they can feel more involved and have some stakes in the game."

GAME OR VICE?

The potential downsides to normalized betting in motorsports aren't hard to imagine. Whenever big money is at stake, there can be temptation to throw a race. Team orders can suddenly be viewed with suspicion, or big money interests could start to exert pressure on a series or team. Shady operators could take the money from fans and run. "I think any time there's a possibility for some unknown to happen, it could," McCoy said.

"The sponsors we work with are very connected to younger people," said Castro. "They want to do things right. And betting is something that I don't think is right for young



Betting among fans in the stands may never go away, but the trend toward legalizing sports betting will give fans more opportunities to get in on the action, both in-person and online. Many view the trend as good for motorsports, as it could increase engagement and potentially draw more fans to race venues. Others are concerned about its downsides.

people."

Policing the real or perceived corruption that legal gambling could generate is crucial for Long. "If I knew that it wouldn't change the outcome, okay," he said. "There's always somebody trying to make some side hustle, and that's what concerns me. I wouldn't want it to change the integrity of the sport."

Brown believes an educational initiative would be a good plan to introduce alongside any sports betting partnerships in racing. "The downfalls would be the same that you would have with any other type of gambling," he said. "You see people out there gamble more than what they have, that people get in over their head. It's just like anything else where moderation is important. You need to put some awareness out there and make people aware of the effects of getting addicted to gambling. Besides that, I think it will make it fun, it will raise the stakes, it will bring a lot more interest and eyeballs on our sport."

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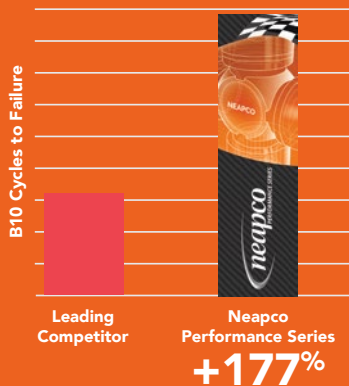
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Simmermaker at Winlight Bets has factored in the concerns about corrupting influences in sports betting while creating the app and will be using all the tools of technology to neutralize it. "Utilizing tech that simply wasn't around five to 10 years ago, we can notice trends in how people bet," he explained. "For instance, if a guy who typically bet \$20 on a race and did that every other weekend, and then walked in and put down \$10,000 on a race, that would be a flaggable event and we may not let that bet go down. Similarly, we can look at the handle and we can limit it to, say, we're only going to allow 50% of the handle to be bet. And any bet above that is going to be flagged or disallowed. There are great compliance groups in the major sportsbooks that really have this stuff down."

One aspect of legalized sports betting that might reassure the industry is that not all of the push is coming from giant

casino interests. Some of the movement is coming from people with deep ties to racing culture. "What's really important to me, the reason I started Winlight Bets, is to grow the sport and to help and enhance the sport. I worry about all of motorsports in the sense of 'death by a thousand paper cuts,'" Simmermaker said. "Nothing we do at Winlight Bets will risk the reputation of drag racing or any other motorsport."

Ultimately, betting on competitions seems to be an almost natural impulse for the human race, and will continue, legally or not. Whether sports wagering can vault motorsports to the next level of fan popularity will be decided in the next few years. "I've never really seen attitudes change; it's always been there, especially from a standpoint of a fan where they might do their own little wagers in the stands, a dollar here or a dollar there," Brown said. "But it's always brought excitement, it's always been part of sport

even since I was at an early age watching it as a little kid." **FRI**

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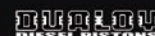
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By Linda Mansfield

This year's edition of the Performance Racing Industry (PRI) Trade Show is a can't-miss event for anyone in the business of motorsports. Slated for December 8–10 at the Indiana Convention Center (ICC) and Lucas Oil Stadium in downtown Indianapolis, this mega-event is where more than 1,000 companies will showcase their latest products, services, machinery, technology, vehicles, and trailers to attendees from all 50 states and around the world.

Moving through the Trade Show aisles are members of professional race teams, retailers, warehouse distributors, engine builders, fabricators, dealers, installers, jobbers, and media members—all on the lookout for what's innovative and new to market. Because Indianapolis is centrally located, the Show's travel costs are mitigated for thousands of attendees and exhibitors who are within a few hours' drive. And, since most racing series aren't in action in December, it's also the perfect time to network and learn new tricks of the trade that will help attendees go faster, work smarter, or make more money in the new year.

All forms of motorsports are represented at PRI, including drag racing, short track, road racing, stock car, off-road, endurance, karting, truck and tractor pulling, performance marine, and more.



Plus, a slate of high-level conferences and a broad-based education program encompassing three separate learning tracks provide further value for buyers, media, and others who descend on Indianapolis each December for the PRI Show.

NEW, EXPANDED FEATURES

One big change in 2022 is that all PRI Trade Show attendees must now be members of PRI. Costs range from \$40 (Pro Member) to \$250 (Champion Member) annually for individuals. And each level comes with different benefits. PRI Membership is open to everyone, including racers, service providers, and now even fans. However, all PRI Trade Show attendees still must qualify to be admitted into the Show.

Why is this necessary? Racing is a very fragmented sport, and we live in an increasingly complex society. New environmental regulations pose significant challenges to the sport. And PRI as an organization that unites the industry, helping it adapt to change and advocating on its behalf. It provides support for race tracks to prevent them from closing; it lobbies for the racing community's interests against legal threats; and its educational programs help racing businesses and racers succeed.

The Show's membership requirement is a direct reaction to threats facing the racing industry. And under the PRI Membership brand, the organization is working to build, protect, and promote the racing community.

In addition, PRI Members are eligible to join the Performance Racing Political Action Committee (PAC). This is the industry's central location to lobby lawmakers and work to protect motorsports at the local, state, and federal levels.

A group of enthusiasts banding together to advocate for its interests is not new. The National Hot Rod Association (NHRA), for example, when founded in 1951, was not a drag racing organization, but rather one devoted to supporting hot rod hobbyists and clubs. It also sought to burnish the reputation of hot rodders who were being unfairly treated in the press.

"Race tracks, race teams, and motorsports businesses are facing unprecedented challenges," said Jules Bush, PRI Membership marketing and communications manager. "PRI Membership was created in 2021 to unite the racing community and help build, promote, and protect the industry. Membership allows PRI to support race tracks, sponsor race events, help businesses, and contribute to legislators that support those issues that matter most to our industry."





Indiana Governor Eric Holcomb, at left, visited the 2021 PRI Trade Show and became a PRI Member while at the Show. This year, all attendees must be Members, and membership fees will be applied to the support of racing on various fronts. "Membership allows PRI to support race tracks, sponsor race events, help businesses, and contribute to legislators who support motorsports issues," said Jules Bush, PRI Membership marketing and communications manager.

Among PRI Membership's recent activities:

- Educating and hosting lawmakers at race-related businesses
- Promoting the RPM Act and Save Our Racecars initiative at race events
- Participating in motorsports industry events in key states
- Creating tools that have generated more than 1.5 million letters supporting the RPM Act in Congress
- Developing and sharing captivating content featuring race-related businesses with millions of fans throughout the world
- Opening the PRI Membership headquarters to provide members with a central hub to gather in the racing capital of the world, Indianapolis

In the future, PRI's membership headquarters will also host automotive events on a regular basis and further amplify the fun and excitement of the racing industry by generating additional innovative content.

To become a PRI Member, visit performanceracing.com/membership.

Another platform the PRI Trade Show will showcase in 2022 is the growing electric vehicles (EVs) market. Resist it or embrace it, EVs are in our future, and the PRI Show and its partners aim to help educate and inform racers on the opportunities that exist in this emerging space.

"It's coming, and it's going to create some interesting scenarios," said Chet Christner, who compiled a video on EVs he saw at last year's PRI Show for FloRacing. His video included some action footage of a prototype electric midjet. Like other EVs it was extremely quiet, which would drastically cut down noise complaints from residents who live near race tracks.

"Think about it," Christner said in the video. "It's a vehicle that has maximum torque from a dead stop, doesn't need to be push-started, has an engine life expectancy of more than 20 years with no maintenance, and it burns no fuel so there are no fumes to contend with at an indoor event.... We are already running crate engines in sprints, Late Models, and modifieds, so how big of a stretch is it to go from a crate engine to a crate motor?"

The PRI Show's EV Zone, which debuted in 2021, will occupy more space in 2022 to showcase the role of EVs in the sport today and going forward. In addition, at press time six seminars on the EV movement are planned as part of the PRI Education lineup, which also offers sessions on business and tech topics.

Seminars relating to EVs include an all-star panel featuring record-breaking EV drag racer Steve Huff of Huff Motorsports, John Metric of Lonestar EV Performance, Farmtruck and AZN from Street Outlaws, and others examining advances in EV performance and engineering, and how EV trailblazers are pushing the envelope and

breaking records.

Other sessions in the EV space will cover computer modeling tools that are readily available to simulate hybrid or full-electric race cars and hot rods; the business opportunities and profit potential within the EV conversion and motorsports markets; the basics of getting the wheels spinning on an EV system, what to look for in an EV powertrain, and how the main systems in an EV get connected in order to transfer power to the wheels; emerging capabilities in electrification, and considerations for everyone from builders and integrators all the way through to safety crews; and the skills necessary for the next generation of racing professionals to succeed as a team today and in the future.

Another area that debuted in 2021 and will expand in 2022 is the Content Creation Zone. It features cutting-edge AV gear and software, plus information from skilled content creators and influencers on strategies for creating an impact online.

Returning for 2022 and better than ever, the Featured Products Showcase is a high-traffic display in Lucas Oil Stadium that gives exhibitors and attendees access to the hottest products in racing and performance. Also in Lucas Oil Stadium, the Show's trailer exhibit area enables attendees to make side-by-side comparisons of the latest race trailers, motorcoaches, haulers, and toterhomes.

The Show's EV Performance Zone, dedicated to the role of electric vehicles in motorsports, will be bigger this year, reflecting the increase in EVs on track. Seminars on the EV movement also will be part of the PRI Education lineup.





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The Indiana Convention Center itself will be filled with aisles upon aisles of exhibitors and displays. One large section in the Yellow Hall is occupied by Machinery Row, where dozens of exhibitors showcase tools, fixtures, fabricating gear, and more, and stage all type of precision machining equipment wired for live demonstrations.

The Hot Rodders of Tomorrow, a nationwide engine-building competition for high-school students, will remain prominent at PRI, as the organization will determine its dual national champions at the SEMA Show in Las Vegas, Nevada, November 1-4, followed by the PRI Show in Indianapolis.

PRI also will host the 11th annual Race Track Business Conference, which is held on Wednesday, December 7, leading up to the Show opening, and carries a separate registration fee. The gathering focuses on cutting-edge presentations on the current status of motorsports. It includes individual sessions and a keynote speaker during a full day of activities. Details can be found at rtbc.speedwaysonline.com.

Returning in person this year after going virtual in 2020-2021 due to COVID-19 is the International Council of Motorsport Sciences

The Featured Products Showcase will once again be set up in Lucas Oil Stadium. Think of it as a quick reference guide to the hottest new products at the Show. Once attendees acquaint themselves with the products here, they can visit the exhibitors' booths for more information about those products that most interest them.

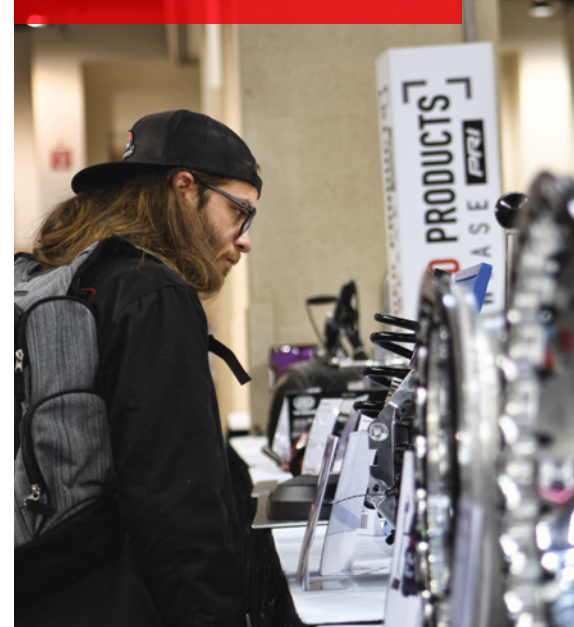
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(ICMS) Annual Congress. The ICMS is a 501(c) not-for-profit corporation that strives to inform the industry on the latest innovations and initiatives in motorsports safety. The Congress is offered through a separate fee from the organization; more info is available at icmsmotorsportsafety.org.

Networking is a vital component of the PRI Show, with ample opportunities throughout. There's an exhibitor reception on Wednesday night at Lucas Oil Stadium. The show's famous Grand Opening Breakfast, which is free to attendees and exhibitors alike, takes place Thursday morning in the ICC's Sagamore Ballroom before the Show opens. Once again the program will be hosted by Speed Sport's Ralph Sheheen, and special guests will be announced in the coming weeks. Later Thursday is the PRI Happy Hour and the Save Your Race Car Rally at Lucas Oil Stadium; the latter will be focused on support for the RPM Act.

The bottom line is that PRI is the singular event where professionals across all forms of motorsports meet to learn and swap ideas on how to go faster, work smarter, and enhance their businesses and operations for the upcoming race season and beyond.

Don O'Neal of Streetway Marketing & Media in Evansville, Indiana, told us his group attends PRI each year "because it is where our business is impacted. [If the show] would go to Florida, Indy, or Vegas, we would be attending. Business is relationships, and PRI is what we like."

NEW EXHIBITORS

New exhibitors are a hallmark of every year's PRI Trade Show—it's part of what makes the Show a must-attend event.

Dozens of companies will exhibit for the first time in 2022. So, what are they hoping to accomplish? What products or services are they showcasing? And why should attendees make it a point to visit their booths?

According to Todd Crutcher of Spring Mountain Motor Resort and Country Club in Pahrump, Nevada, "We have been making major strides in developing our facility and race track, so this was the perfect time for us to showcase what's new at Spring Mountain. We now officially have more than nine miles of race track due to the addition of our 3.2-mile premier racing circuit named Charleston Peak, which makes us still the longest road course in North America.



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Maxxsonics is once again heading down to the Las Vegas Convention Center for SEMA 2022.

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An important element of the PRI Show is the opportunity to make person-to-person contact with people who can help your business or race team. Networking opportunities are plentiful throughout the Show, from organized activities like the Exhibitor Reception on Wednesday evening and the Grand Opening Breakfast on Thursday morning, to spontaneous conversations that go on all week.

"PRI is the best show to promote directly to the racing community," he continued. "Specifically, our membership and track rentals have given even the most seasoned drivers the chance to challenge themselves on our race track. Our focus is to launch our Radical Racing School and increase track rental and membership awareness. Today, with the expansion of our road course, Charleston Peak is the ideal track for testing, training, and best of all, racing.

"We're excited to show off our new and improved club member atmosphere with our new track and soon-to-be upgraded clubhouse," he added. "We are also offering several new driving programs, currently in the new C8 Corvette and Cadillac V-Series

Blackwings, with Radical Sportscars to come soon. Next year we will also launch our very own karting facility. We'll be displaying a Radical SR3XX in our booth, as well as video content showcasing our track's development and future plans."

Kevin Hein of PMAS Technologies in Eaton Rapids, Michigan, said his company has been an exhibitor at the SEMA Show in the past, but he realized the PRI attendee is more closely aligned with many of the products his company offers.

He believes exhibiting at PRI will help his company "grow its business and help identify market opportunities in which our airflow measurement and optimization expertise can excel." He's looking



In addition to returning Show veterans, the PRI Show attracts dozens of new exhibitors with exciting new products and innovative services. These first-time exhibitors help make the PRI Show a must-attend event each year.

specifically for sales growth and expanding PMAS's dealer network.

"In addition to our high-performance MAFs and cold-air intakes, we are launching a high-flow Modular Inlet System (MIS)," Hein said. "While testing a turbo inlet application, restriction was reduced as compared to an open inlet. We offer an inlet as a stand-alone or with a rock screen, wire-mesh filter, or paper filters in many different sizes. These filter options create the ultimate performance flexibility at the track."

PMAS's booth will have video and graphics demonstrating the improved airflow achieved by adding its new MIS system, as well as product samples.

Why should attendees visit the PMAS booth? "PMAS Technologies not only possesses unrivaled airflow measurement expertise, but we also have the equipment and know-how to test and optimize our products for optimum performance," he said. "We also offer benchmarking and R&D airflow services for manifold, exhaust, and intake tract components, for example."

Representing new exhibitor Maven Performance Products of Hebron, Kentucky, Jared McCombs said the Show provides "opportunities to network with people and companies in the industry unlike any other event. As a small, growing company, we value the platform and opportunity the PRI Show gives us to showcase our products and get them in front of the right people."

"Many of our customers attend the Show, and more often than not we only know them through social media, phone calls, etc.," he continued. "Exhibiting at the Show gives us a chance to meet them face to face, network with others in the industry, and display our products for those who are unfamiliar. Our product development ideas come from listening to the needs and wants of the people in the industry. What better opportunity is there than PRI?"

"We will have all of our products on display, including turbo mounts, ignition coil mounts, wiring components, and our new tube clamp switch panel mount," McCombs added. "Make sure to stop by the booth. We will have a special show offer for PRI attendees."

Click Bond of Carson City, Nevada, has been manufacturing adhesive-bonded products in the United States for more than 35 years, but 2022 will mark its first time exhibiting at the PRI Trade Show.



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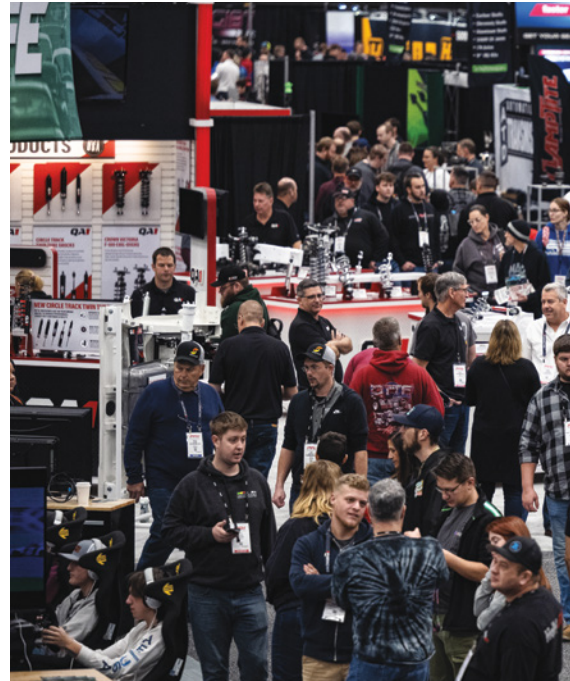
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“After our success exhibiting at SEMA in 2021 in the Racing and Performance hall, consumer feedback consistently indicated that our products were well suited for applications displayed at PRI, too,” said TJ Stoltz. “Our adhesive-bonded product line is perfect for composite materials found in today’s automotive designs. We’re excited to connect with as many of those applications as possible to provide unique solutions that

“OUR DESIGN ENGINEERS WILL BE AVAILABLE TO CHAT THROUGH SHOW-GOERS’ CURRENT CHALLENGES AND HELP FIND THE SOLUTION THEY ARE LOOKING FOR.”

will help reduce weight and installation time, and preserve structural integrity.”

What does Click Bond hope to accomplish at PRI? “Our strategic objective for the event is centered around educating future customers about our industry-changing benefits, and how we can support each phase of their programs’ lifecycles, from design to production, through sustainment,” Stoltz said.



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With more than 1,000 companies showcasing their latest products and services, and thousands of attendees representing the full spectrum of the racing community, the PRI Trade Show is the place to be December 8–10 to help you go faster, work smarter, or make more money in the coming year.

“We’re very excited to display our adhesive with our series of adhesive-bonded nut plates, studs, standoffs, and mounts currently used in today’s top racing programs.”

He added that Click Bond is bringing two of its most popular activities to its PRI booth. “Attendees will have the opportunity to experience both hands-on product demonstrations and extended reality demonstrations using our adhesive-bonded fasteners,” he said. “Companies can receive free, onsite training from our field application engineers.”

Show special product offers for Click Bond can be found at the SRI Performance booth (SRI is Click Bond’s distribution partner).

“We were pleased to discover during our visit last year to the SEMA Show how many types of applications attendees found for our adhesive-bonded fasteners,” Stoltz noted. “Our design engineers will be available to chat through show-goers’ current challenges and help find the solutions they are looking for.” **PRI**

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As the ultimate marketplace for go-fast parts and solutions, PRI provides attendees and media with unparalleled access to over 1,000 of the industry's leading manufacturers and service providers. Among the Trade Show's aisles of innovative products, tools, machinery and gear, buyers will also find dozens of first-time exhibitors showcasing a bevy of never-before-seen offerings, from transmissions to motor oils, parts washers, stud kits, engine stands, and so much more.

* List and booth numbers current as of August 31



ACME Trading

Booth 4448

acmediecast.com

Diecast Replicas of Sprint Cars & Race Car

Aero Exhaust

Booth 4451

aeroexhaust.com

Performance Mufflers & Exhaust Systems

Affordable Fuel Injection Inc

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affordable-fuel-injection.com

LS & Ecotec Harnesses, TBI EFI Superchargers

Allstate Carburetor

Booth 2010

allcarbs.com

Carburetor, Carburetor Parts, Fuel Pump

American Flat Track

Booth 7009

americanflatrack.com

Race Motorcycles, Lounge Area & Giveaways

Autotuner

Booth 2605

autotuner-tool.com

ECU Reading/Writing Tool

Black Belt Racing

Booth 1837

blackbeltracing.com

Plastic Wheel Covers, Washers RR Breakaway

Boss One Media LLC

Booth 7192

boss1media.com

Media Production & Live Events

Carr Lane Manufacturing

Booth 3728

carrlane.com

Toggle Clamps, Ball Lock Pins, Hand Knobs



Carter Bearings

Booth 7049

carterbearings.co.uk

Monoball Bearings, Rod Ends & Bearing Tools

Click Bond

Booth 2108

clickbond.com

Adhesive-Bonded Assembly Fasteners

Defiant Metal

Booth 5438

defiantmetal.com

Welding Glove, Sleeves, Welding Kits

Dirtwrap

Booth 1241

dirtwrap.com

Race Car Decals, Wraps

Ecoroll Corporation Tool Technology

Booth 5614

ecoroll.com

Roller Burnishing Tools

EcuFast

Booth 3426

ecufastusa.com

ECU Tuning Company

Eddie Motorsports

Booth 2241

eddiemotorsports.com

Pulley Kits, Hood Hingers, Billet Accessories

Exergy Performance

Booth 7178

exergyengineering.com

Diesel Fuel Injectors & Pumps

First Brands Group

Booth 3557

firstbrandsgroup.com

Brakes, Rotors, Spark Plugs, Oil Filters

FMB Machine

Booth 5059

fmbmachine.com

CNC Tooling Racks for Engine Builder's Shop

Foggit

Booth 2038

foggit.com

Fogging Oil, Protects Against Rust Formation

Fuel Factory

Booth 2943

fuelfactoryusa.com

Race & Performance Fuel

Full Race Motorsports

Booth 2033

full-race.com

Turbochargers, Exhaust Manifolds, Engines

Gladiator Parts Washers

Booth 5311

arnoldmachine.com

Gladiator FRT + Gladiator TRT Parts Washers

Grannas Racing

Booth 3327

grannasracing.com

Bellhousings, IRS Rear Ends, Transmissions

GreX Airbrush

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grexairbrush.com

Airbrush, Spray Gun, Orbital Tools

Heritage-Crystal Clean

Booth 5555

crystal-clean.com

Parts Washer

ICT Billet

Booth 2704

ictbillet.com

LS Engine Swap Components, Etc.

Ignite Industrial Technologies

Booth 5536

ignitecleaners.com

Parts Washers & Degreasers

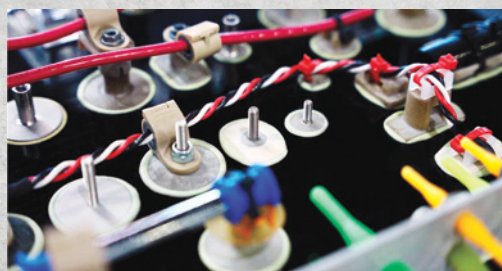
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Kaizen Shadow Foam for Tool Organization

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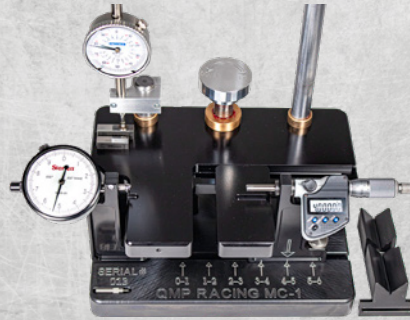
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CONVERSION FACTOR

As electrification sees greater adoption on the street and on the race track, interest in ICE to EV changeovers continues to grow. Although the technology still has its limitations, the advantages it offers in certain racing disciplines are undeniable, and it's only going to get better from here.

By Bradley Iger

With automakers continuing to pour billions of dollars into the development and manufacture of electric vehicle platforms, public interest in EV technology continues to grow in turn. The tech's increased visibility has also brought increasing awareness to EV conversions, a fledgling industry that has greatly benefited from those OEM-backed development efforts. Once a niche populated by a small group of tech-savvy DIY hot rodders, EV conversions are becoming more sophisticated and capable by the day, and they're convincing an increasing number of competitors to ditch ICE powertrains in their mothballed race cars for electric motivation.

As EVs become a greater presence in brand portfolios and top-tier models continue to tout increasingly impressive performance figures, the inherent benefits of the technology are becoming more widely understood as well. Yet EVs remain a topic of heated debate in the realm of motorsport. While it'll likely be some time before we see a grid powered solely by electricity at the 24 Hours of Le Mans, it's important to note that there are formats where the tech is ready for prime time right now. Perhaps even more important, there's plenty of evidence that indicates that the early adopters of today could become the front-runners of tomorrow.

"We can't put our head in the sand and just ignore this," explained Lawson Mollica of AEM EV, Hawthorne, California. "The public certainly isn't—the Ford F-150 Lightning and Hummer EV are sold out for their introductory years, and dozens of new electrified models with performance intent are coming over the next few years. I think we kind of have to look at this like the early LS swap market. It really wasn't that easy to do early on, and you had to solve a lot of problems along the way. But over time, the market matured and the problems were solved. That's how we see the progression of this segment going as well."

Although the majority of the focus in the ICE to EV conversion market is currently aimed at street applications, more and more teams are starting to take notice of what the tech is capable of.

"I think you have to approach this from the requirements of the discipline," said Michael Bream of EV West, San Marcos, California. "There are situations where an electric isn't going to stand up against its gasoline counterpart right now. But you also have to consider the fact that the record at Pikes Peak is currently held by an electric vehicle."

Photo courtesy of Legacy EV



Excess heat is the enemy of EV performance, and managing it still remains a challenge today, said Michael Bream of EV West. For racing that requires sustained power output for long amounts of time, he suggests over-engineering the powertrain and dialing it back is likely the best solution.

TARGETED ADVANTAGES

While the earliest EV conversions were about technical curiosity and experimentation more than anything else, Mavrick Knoles of Legacy EV in Tempe, Arizona, told us that performance is the biggest driver in today's market.

"We've heard countless stories about people being hesitant about the technology and then going for their first spin in a Tesla in Ludicrous Mode. I think that EVs feel like the future for many folks, and they want to embrace the next wave of technology. We've spent so much time perfecting the gas engine, and now we're kind of starting fresh with EVs. A lot of people are saying to themselves, 'Okay, now how can I further optimize the performance of this?' That's where people start to get really excited."

The current limitations of the technology may keep battery-powered vehicles out of endurance racing and other motorsports disciplines that require long periods of



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sustained output for the foreseeable future, but EVs can shine in other competitive disciplines right now. “You don’t need a massive battery and tons of cooling to do formats like drag racing and autocross,” said Adam Roe of Zero Labs, Gardena, California. “There are EVs out there with 14 kWh batteries and a thousand horsepower. There’s a lot of things that you get from an EV powertrain that you can’t replicate with a gas vehicle, and the main one is efficiency. You have 85% or more of the energy in an electric vehicle being converted to usable power, whereas you might see 15% with an internal combustion engine. Although gasoline has great energy density, a lot of it is lost to noise and heat.”

Bream also cited another potential advantage of EVs that may not be obvious at first glance. “A race, for all intents and purposes, is a moving auto show. If you want people to look at your car and the sponsors that are on it, electric is currently

the best choice for that,” he explained. “I think what’s driving this current trend of ICE to EV conversions is an overall excitement around electrification. So if you’re trying to get a million views on your video, there’s so much interest in electric that you’re going to have a better chance of getting that kind of attention with an EV build.”

GETTING RACE-READY

Today’s street-car EV conversions often showcase the ‘wow factor’ of instant torque delivery and scratch the itch of general curiosity about the technology. That allows those conversions to focus on drivability and achieving an agreeable combination of range, performance, and cost. But as in the ICE world, EVs built for racing tend to balance priorities differently.

“Torque management is key,” said Mollica. “Electric motors provide prodigious amounts of torque. And while that sounds really cool from a performance standpoint,

it doesn’t equate to fast on the track if you can’t make it stick. That’s where we really focus our efforts—the software that allows you to manage that.”

AEM EV’s VCUs, or vehicle control units, essentially serve as a bridge between the EVs’ various powertrain systems. Integrating everything together into one interface makes tuning much more straightforward than it has been in the past. “You have a lot of different systems that aren’t really talking to each other, and that’s where the VCU is a game-changer,” Mollica said. “For instance, our battery management system monitors the batteries and does all of the features that a battery management system should do, but it’s programmed through our VCUs. The same goes for our power distribution units. So not only is the VCU controlling what’s going out based on the data it’s bringing in, but it’s also seeing everything that’s coming across the bus. It can do passive



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AEM EV's vehicle control units (VCUs) integrate the EV's various powertrain systems into one interface, making tuning much more straightforward than it has been. "You have a lot of different systems that aren't really talking to each other, and that's where the VCU is a game-changer," said a company source.

balancing, it can tell you if you have a bad cell, it can tell you what your temperatures are, and on and on. So if you give it the beans, the VCU can, for instance, take that information and determine if it needs to de-rate the power output to prevent you from damaging something."

As with internal combustion powertrains, excess heat is the enemy of EV performance, and managing it still remains a challenge today. "The problem isn't the size of the radiator, or the water pump, or the fan," said Bream. "We know how to dissipate heat. The problem is that the current drive components that people are using weren't engineered to wick the heat out of them at those higher power levels. You could have the best cooling device in the world on a Tesla motor, but if you run that motor hard for about two to three minutes, you're going to start going into thermal cutback. The internal water passages and the surface area aren't big

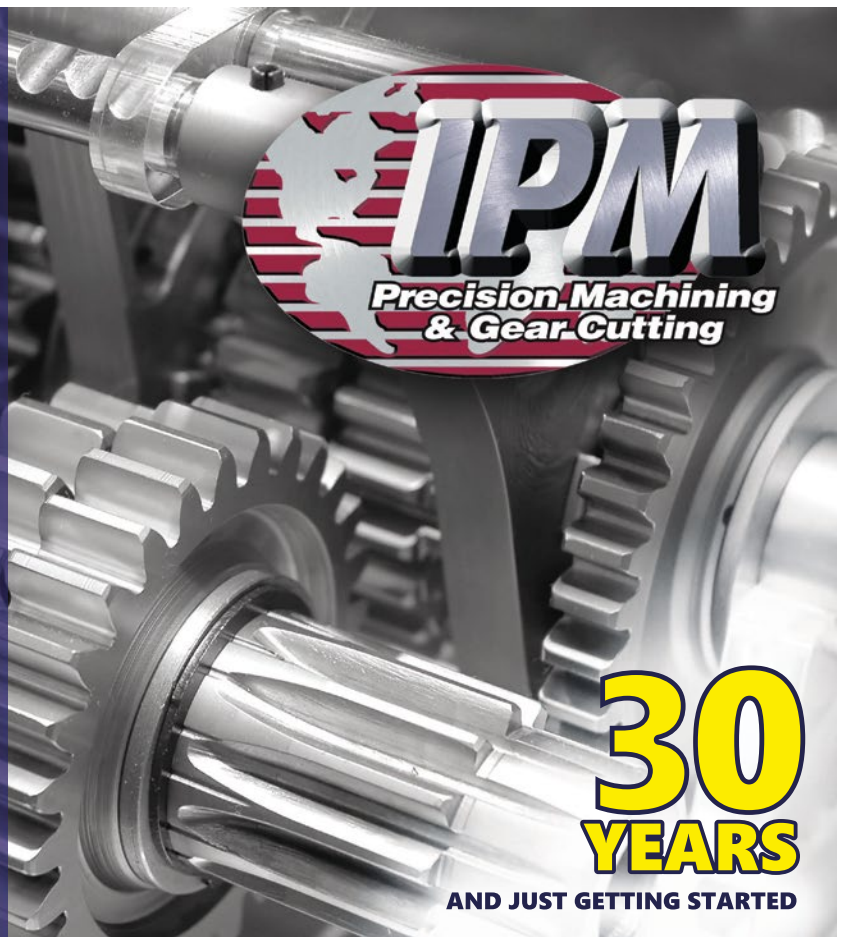
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enough to dissipate heat like that.”

Bream noted that with his team’s Bonneville EV land speed car, they pre-chill the motor with ice for 20 minutes before every run to maximize its potential. For racing that requires sustained power output for long amounts of time, he suggests that over-engineering the powertrain and dialing it back is likely the best solution for the time being.

“Inherently, I think the engineering has to take an approach that maximizes getting heat out of the internals in these components, and racing just isn’t a big enough niche yet,” he explained. “The systems that are doing these high continuous loads are commercial systems that you’d find in things like electric buses. So they exist, but you’re not going to use a bus motor in a race car because it weighs a thousand pounds or something like that. If you wanted to build an EV race car for a road racing

application right now, the recipe is to get an extremely lightweight car that’s very aerodynamic, put in an electric motor that’s rated for, say, four times as much power as you need, and dial the output back electronically so it doesn’t have to work as

“THE RECORD AT PIKES PEAK IS CURRENTLY HELD BY AN ELECTRIC VEHICLE.”

hard. That’s the only way to do this type of performance continuously right now.”

Meanwhile, others continue to look for ways to adapt more traditional cooling systems to these powertrains to help mitigate heat issues. Roe noted that while the batteries are the main concern, there are other components that need to be taken

into account as well. “Thermal management needs to be focused on your inverter and the motor, too. We use two radiators on our vehicles, and we have two connected systems for cooling so those systems can focus on different jobs. I’ve seen layouts where people have the batteries, the motors, and the inverter all on the same circuit, and the problem with that is that your cooling reservoir will just cook because in that setup you are going from hot, to hotter, to hottest. In order to maximize efficiency you need as short of a run as possible and cycle it as much as possible. And it’s a good idea to have a backup pump in the system—pumping capability is not something you want to suddenly be without,” he said.

Knoles also pointed out that the cooling requirements of powertrain components can differ. “You need to know what the operating specs are for the battery you’re using,” he said. “It’s something that tends

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“What’s driving this current trend of ICE to EV conversions is an overall excitement around electrification,” EV West’s Michael Bream said. “If you’re trying to get a million views on your video, there’s so much interest in electric that you’re going to have a better chance of getting that kind attention with an EV build.”

to get overlooked in the industry, and some chemistries are much stouter than others. Some batteries run at peak efficiency at 120 degrees Fahrenheit, so the cooling system might not have to work as hard as you’re expecting to keep those batteries where they want to be. Meanwhile, with the inverter you’re converting DC current to AC current, so the more power you’re sending to the motor, the hotter that inverter is going to get. Those differing system demands typically need to be regulated independently.”

The specifics of EV race car safety components are usually going to be dictated by the rule set of the sanctioning body a racer is competing with, but expect a kill switch to be part of the mix regardless. “You basically need isolation management; your high-voltage battery needs to remain isolated from the metal in your 12-volt chassis system,” said Bream. “You see this in Formula 1 and Formula E—you have a

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component that looks for voltage isolation within the chassis, and that system will give you a visual cue, like a bright green or bright red light, which indicates whether or not the high-voltage system is still properly isolated after an incident. In terms of controlling that kind of thing, it's a hundred times easier to turn off electricity than it is to shut down a fuel line or to stop a liquid that's not containable. An inertia switch can turn off a fuel pump, but you still have all the fuel in the lines that can drain out. An EV's version of that inertia switch is called a contactor, and it's an electromechanical device, so it literally operates at the speed of light."

COST BENEFITS

EV conversions can cost anywhere from about \$40,000 in parts and labor for a basic powertrain swap to well into six-figure territory for a bespoke solution that's designed for hardcore competition. While

that's a sizable chunk of change to initially drop, there are cost benefits to be had once the job is completed.

"There's a bigger up-front investment with EV development, but as with an electric vehicle on the street, the operating costs go way down," said Mollica. "You don't have multiple fluids to change, multiple gear sets to service, and all of these different types of things that can break. It's also easier on the braking system. As long as you're not destroying components, the biggest concern is the batteries at that point. If you maintain them properly, they're going to last quite a while."

Looking into the future, Bream posits that the racers who choose to adopt this technology while it's still in its infancy will likely have an advantage in the long term. "You have to be cognizant of current events," he said. "The winds are starting to shift, and a lot of businesses that are interested in sponsorships are becoming

more aware of the footprint. I don't think it's a stretch to say that some of these large companies that are throwing around sizable amounts of money want to align themselves with future technologies, cleaner technologies. Because they're the ones that are going to survive." **PRI**

SOURCES

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THE COMPONENTS ARE DIFFERENT AND SO IS THE FUEL, BUT EV PERFORMANCE COMPANIES SHARE THE SPIRIT OF INNOVATION—AND SOME OF THE SAME TECHNIQUES—THAT THEIR GAS-ENGINE PREDECESSORS PIONEERED.

By Drew Hardin

They are practices rooted in automotive history: Want to make a car go faster? Swap in a more powerful motor from a heavier car. If that motor isn't making enough power, innovate. Build the parts needed to increase its performance, test those parts, and if that doesn't work, try again. That's how hot rodding began in the years before and after World War II, when men like Vic Edelbrock Sr., Ed Iskenderian, Stuart Hilborn, and many more used ingenuity and their own two hands to make speed parts, and in the process gave birth to the performance aftermarket.

"We get a lot of flak from the hardcore gasoline world for being electric," said Eddy Borysewicz of reVolt Systems, Oceanside, California, which offers electric conversion systems using refurbished Tesla motors. "But the real hot rod guys say, 'That's exactly what we did in the 1950s. There's no difference with what you're doing to what we were doing, ripping motors out of high-powered sedans and putting them in lighter cars.' So we coined the phrase, 'Hot Rodding 2.0,' as our shop motto. We're dedicated to the art of preserving hot rodding." That dedication includes testing at the Bonneville Salt Flats, where the Team Vesco streamliner, with a twin-motor reVolt system on board, set the EV speed record in 2021 at 353.870 mph.

We recently spoke with Borysewicz and several other performance EV pioneers to learn about what's new in this growing segment of motorsports and opportunities there may be for aftermarket businesses to participate.

BATTERIES NOT INCLUDED

"Our system was designed to be as minimally invasive on the vehicle as possible," said Borysewicz about the reVolt conversion. "Four bolts hold the motor system in, two for the front and a TH400 standard mount for the tailshaft." The systems are based on 400kW Tesla S motors that produce approximately 533 horsepower and 800 lbs.-ft. of torque at the yoke. They are salvaged from wrecked cars and re-machined, as reVolt mounts the motor longitudinally rather than in the factory transverse orientation. The drive system mounts in the vehicle's transmission tunnel and connects to a driveshaft that powers the rear wheels.

"We do the whole batteries-not-included thing," Borysewicz said about the package. It comes with "the entire control system, the inverters, the motor, the reduction boxes, and the 1350-style output yoke. It comes pre-wired with a generic wiring harness. You can put your throttle pedal in, mount your controllers under the dash, and it's basically turnkey ready for batteries. Once you put a 400-volt system on top of it, you literally turn the key on and go."



Photo courtesy of AEM EV



Revolt Systems' Tesla conversion was designed to be "as minimally invasive on the vehicle as possible," said Eddy Borysewicz. "Four bolts hold the motor system in, two for the front and a TH400 standard mount for the tailshaft." This photo shows the Tesla motor going into Borysewicz's personal 1965 Mustang.

The weight of the system is a non-issue for most vehicles. Borysewicz said, "A typical old-school cast-iron block with the transmission weighs around 700 pounds. With the radiator, fuel, fuel tanks, and all the other stuff that goes in there you're at around 1,000 pounds. We just did a conversion on a 1980 GMC pickup for the Holley High Voltage Experience that we called the Hillbill-e Deluxe. The motor weighed 300 pounds, the battery 700, so it was a dead even swap. And the best part was, we could choose where to put the batteries and shift the weight backwards. That truck was extremely nose-heavy when stock, but after we put the batteries in, we were at a 49/51 split. It's nice to choose where to put the batteries, spread them out evenly between the axles, so you don't have all this weight in one spot."

As for sourcing the batteries, "no one on an aftermarket level is making a pre-built battery pack that's brand new," Borysewicz explained. "It's still a custom thing. People are going to junkyards, pulling Teslas apart, and using all these different types of lithium-based chemistry to get their EVs working, so it's still kind of the Wild West. We are starting to see new products that are designed just for aftermarket EVs, but the battery pack is the hardest part of this whole equation."

"For the PRI companies, there's such an untapped market here," Borysewicz continued. "EVs are not going away. As we evolve this, there are going to be more and more people interested in souping up their motors, and there's a huge void with batteries in the aftermarket. No one's cornered that yet. There's a whole, brand new market here, untouched, fresh, just ready to be taken."

EXCITING CLASSES

One of the prominent companies involved in EV conversions is AEM EV in Hawthorne, California. AEM's specialty is making the componentry that enables and simplifies a conversion, from vehicle control units (VCUs) to digital dashboard displays. "Our system is fully integrated and uses the VCU as a central point of control for the battery management system, power distribution unit, combined charging unit, and more, to optimize a vehicle for exactly the type of racing you want to do," said Lawson Mollica. "While plenty of people will take their OE EVs to the track and be competitive [see below], we see conversions as taking over to create the most exciting classes of EV racing."

"THERE'S A WHOLE, BRAND NEW MARKET HERE, UNTOUCHED, FRESH, JUST READY TO BE TAKEN."

AEM was instrumental in Steve Huff's quest to be the first to run 200 mph in an electric dragster. When Huff started building the car in 2017, "we had motors, batteries, and controllers, but there really wasn't anything that would let those things talk to one another, no center piece where all the inputs and all the outputs go," Huff recalled. In 2019, AEM came aboard "with a great computer, a VCU that would allow us to control not just two motors, but four. Once we put four motors in the car, we went 200 mph in May 2020."

The custom-wound axial dual-stack motors from Phi-Power utilize Cascadia controllers and inverters and are powered by a custom-built lithium-cobalt-polymer battery from High Tech Systems. The 5P/192S battery produces 800 volts, 2,000 amps, and an estimated 2,400 horsepower and 2,000 lbs.-ft. of torque. Huff Motorsports' e-Spec Racecars built the custom, 240-inch-wheelbase chassis, which is NHRA certified to 6 seconds.

"When Steve realized he needed to double the motors, with the electronics he was using he would have needed two independent electronic systems to run the two sets of motors," Mollica explained. "Neither would talk to one another." The system AEM created "eliminated all that redundancy and removed a ton of potential weight that would have been added to the car just in wiring alone."

John Romero, AEM's director of product development, nicknamed that VCU "the adult in the room," Mollica said. "Not only is it doing the torque management and all the things needed to get down the track, but his batteries, which are not cheap, are integrated with the battery management system. If they aren't up to temperature or don't have the voltage he needs, it will de-rate to protect the batteries so they won't burn up. So in addition to not only helping him achieve his record—which he broke at the Holley High Voltage Experience and broke again at NHRA Seattle—the system is protecting his investment as well and keeping him safe."

Mollica sees potential at the sportsman levels as well. "Once you build an EV conversion, the cost of maintenance is a fraction of what it takes to maintain a high-performance ICE vehicle, which means more money for travel and events." As a proof-of-concept, AEM has a development vehicle it calls the Testang, an S197 Mustang GT powered by a Tesla motor. "It clicks off mid-11-second passes at around 120 mph on street tires, rips through a long autocross at a respectable clip, and has about 80 miles of range for commuting, more if we add more battery. It's also registered as an EV in California and is street legal. We couldn't do that with a blown S197 with all the trimmings

it would require to achieve that same performance. With EV, the everyman and everywoman enthusiast can have their cake and eat it, too."

THE OPEN WHEEL EXPERIENCE

"This is not just a hobby," Dave Evans said of the Formula Mazda that he and his son, Broch, both of Broch Evans Motorsport in Austin, Texas, have converted to electric power. "We wanted to build an entry-level, meaning crossover, car. If you're a good karter, or you're a good automobile racer and you want to move into open wheel, and electric is attractive to you, this would provide you with that open wheel experience." Since the car doesn't require shifting, "it simplifies things," he added. "Broch is a professional coach. He can teach a student how to right-foot throttle/left-

foot brake and steer this car, and learn to drive the racing line, very quickly. That can be challenging when you're trying to shift and do everything else when first learning."

The Formula Mazda is powered by a Gen 2 Nissan Leaf motor, partly because "it's a very well understood motor," Evans said, and also because they're available from a wrecked Leaf for \$1,000-\$1,500. The motor, controllers, and batteries are tucked into the Formula Mazda chassis with the heavy-duty suspension.

The electric components add about 200 pounds to the car, Evans estimated. "I think we can get it down a little bit. In the prototyping we have steel battery trays that we'll replace with aluminum." But the weight is within the design spec of the chassis, he said, and also the brakes, which are made for the Miata.



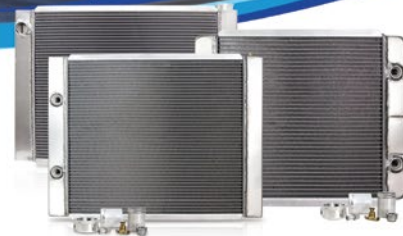
A turning point in Steve Huff's quest to be the first to 200 mph in an EV dragster came when AEM EV provided a vehicle control unit (VCU) for the rail. "That VCU would allow us to control not just two motors but four," Huff explained. "Once we put four motors in the car, we went 200 mph."



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“WE SEE CONVERSIONS AS TAKING OVER TO CREATE THE MOST EXCITING CLASSES OF EV RACING.”

The pair faced multiple challenges incorporating the electric powertrain into the Formula Mazda, not the least of which was packaging. “In an open wheel car, there’s literally no room on the car for anything,” Evans said. “Everything on the chassis has already been designed to go there.” What helped was Broch Evans’ skill in CAD and the availability of a 3D printer.

“3D printing of componentry turned out to be important for two reasons,” Dave Evans explained. “It allowed us to prototype quickly, to see what fit and what didn’t, and then build what fit, and to be able to do that

in-house for a few bucks instead of sending things out.”

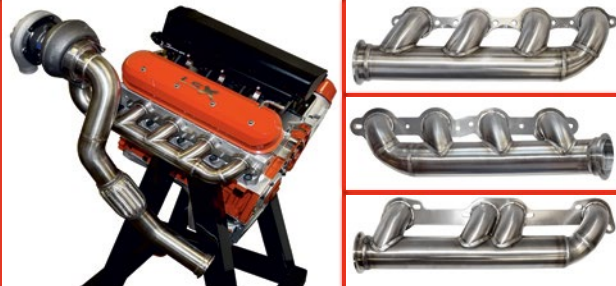
The only Nissan component in the car is the motor. The Leaf VCU is from Thunderstruck, while Electric GT supplied the battery management and high-voltage systems. (Many of the BMS components were made by the Australian manufacturer

Zeva, which is now out of business; Evans said similar components are available from Thunderstruck and Orion.) Power comes from four 5.5-kWh lithium-ion Electric GT OX battery modules. EV West provided the maintenance switch for the main high-voltage circuit and the auxiliary contactors for battery safety, and Dave and Broch



The Testang is a Tesla-converted S197 Mustang that AEM EV built as a development vehicle. It’s an 11-second drag strip car, a respectable autocrosser, and has about 80 miles of range for commuting. “It’s also registered as an EV in California and is street legal,” said a company source. “We couldn’t do that with a blown S197 with all the trimmings it would require to achieve that same performance.”

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Broch Evans Motorsport is bringing electrification to open wheel racing with its Nissan Leaf-powered Formula Mazda. After making some exhibition runs at SCCA events in 2022, the plan is to “have this ready for next year and a set of cars on track,” said Dave Evans. The SCCA was “writing rules for it as soon as they saw it.”

said. “There’s also a specific exit protocol from the car. The driver literally hops out. You don’t step out while holding things.”

The electric Formula Mazda drives with “a different feeling altogether,” Broch Evans said. “The throttle response is dead smooth, and you can go from 0 to above 100 mph with no clutch. When you put your foot down on the throttle, it keeps you pressed back the entire time, one constant feeling of acceleration.” The extra weight isn’t a detriment; in fact, because it sits low in the car it lowers its center of gravity, “so it holds itself in the corners.”

Both Broch and Dave race with the SCCA through the US Majors series (Broch won the 2020 US Majors Tour Southern Conference championship in an ICE-powered Formula Mazda), and when they showed the sanctioning body the electric prototype, “they said, ‘Wow, we didn’t think anybody was going to build open wheel,’” Dave Evans recalled. “They were out writing rules for it as

designed a proprietary pre-chilling system to control battery pack temperatures. All the CAN control systems—the heads-up display with GPS and data logger, the power distribution unit, and analog transducers—came from AEM EV.

Safety equipment onboard includes a fire

suppression system from SPA Technique specific to the lithium-ion batteries, and LED indicators that alert the driver and course workers to problems with the electrical system. “Any faults that trigger engine shutdown or isolation shutdown result in those lights being illuminated,” Dave Evans



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MLE Racing and Cascadia Motion worked with Ford Performance on the build of the Mustang Cobra Jet 1400. The companies collaborated with AEM EV to develop a data and control system for the two dual-stack Cascadia motors. "That car runs 8.12 at 171.97," an AEM EV spokesman said. "It's a beast."

soon as they saw it. They now have a full rule set, and we will be participating in the Solo Nationals as a first exhibition and then we'll exhibit at the SCCA National Championship Runoffs at Virginia International Raceway."

The goal, he said, "is to have this ready for next year and a set of cars on track." The battery packs should provide "a very intensive 15-minute open wheel experience followed by a 90-minute to 2.5-hour recharge, which fits really well within the SCCA's daily race schedule."

They estimate the price for a turnkey car at around \$75,000. Overall operating costs will likely be lower than for an ICE Formula Mazda, not only because of the lack of fuel bills but also because a replacement motor will be a fraction of the cost of an engine rebuild, Dave Evans said.

"With battery technology always improving, one of the things we're going to see in the near future with EV technology is a huge increase in quality with a decrease in pricing," Broch Evans predicted. "We may start at \$75,000, but it is something you could be able to do with much less with better technology."

"With the work that Nissan is doing with their solid-state batteries, the weight comes down, the temperature requirements start to go away, the charging times are faster, and cost comes down," Dave Evans added. "And while we can talk about how everything in the future is going to be amazing, we are building this car for EV fans who want to race today."

RACING OE EVs

Setting up an EV street car for racing is "fairly straightforward," Mollica said, largely because there's little that can be done to modify the factory powertrain. "The way the CAN bus networks are integrated, typically if you try to introduce something over that network and it doesn't readily identify it, it just bricks the car. I'm sure the code will get cracked one day, but when it gets cracked, how do you keep the over-the-air updates from undoing that?"

The powertrain may be off-limits, but "if you know how to set up a car, you can set up an EV," Mollica said. "Use corner weights, figure out where the weight is, figure out where your load points are. Get the right wheel and tire combination, the right suspension, so you make the right adjustments. Put the right aero on it. Take as much weight out of it as you can. Do all the stuff racers do and go have a good time."

Bracket racer Todd Payne runs his daily-driven 2014 Tesla S P85D in the IHRA Summit SuperSeries at tracks near his Yadkinville, North Carolina, home, and went all the way to the World Finals in Memphis in 2021. Other than "taking any knick-knack stuff out of the car to lighten it up just a little," the only modification he has made is to match the size of the Tesla's tires front and rear. The AWD car came with staggered wheels and tires; Payne replaced the narrower, 245/20 front tires with 265/20s spec'd for the rear. That helped eliminate

wheel spin, and he has experimented with tire pressure to slow down his launch to keep him from red-lighting.

"The tire pressures are really weird, almost backwards from what you would have to do for a rear-wheel-drive car," Payne said. "I add tire pressure to slow down my reaction. Now I'm running almost the stock pressure. That's strange, but it is four-wheel drive, and you have to think if you flatten the tires, you're adding grip, and it could make it launch faster because it hits so hard."

Payne considered running slicks on the Tesla, "but then I'd have to change all four tires every time I drove the car to work." As it is, he drives the Tesla fully stickered, with the dial-in still written on the window. **PRI**

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facebook.com/todd.payne.583

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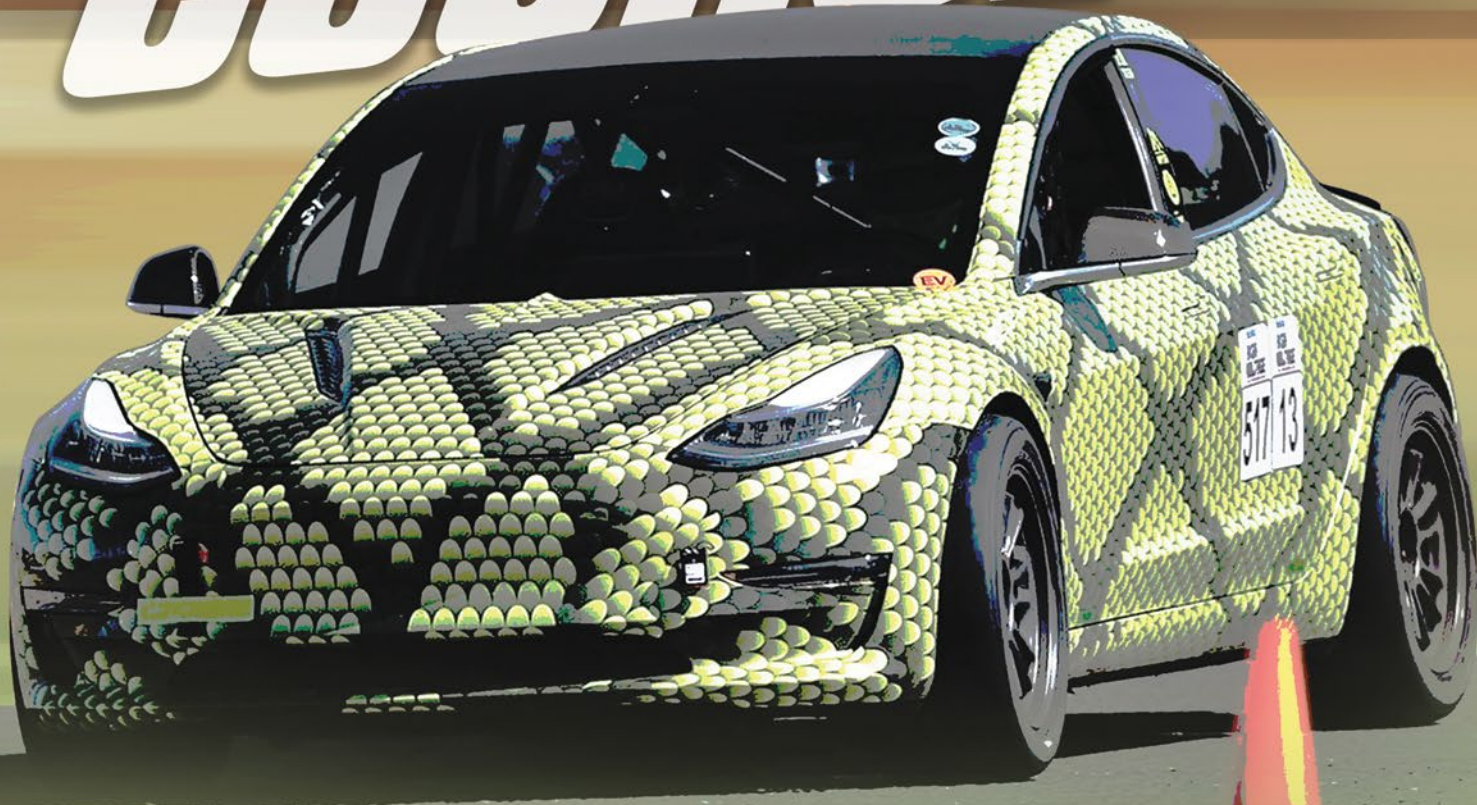
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Electric vehicles could become the next big thing in racing, yet barriers to their success persist. So we asked racers, sanctioning bodies, track operators, and others about where EV racing is working, where it's not, and why.



By Drew Hardin

There is no simple way to characterize the state of EV racing in the US.

On one hand, EV race vehicles have achieved some notable benchmarks. The overall record up the Pikes Peak International Hill Climb, 7:57.148, was set by an electric-powered Volkswagen I.D. R in 2018. Steve Huff, the first to break the 200-mph mark in an electric dragster, continues to go faster and quicker...and ran nearly 203 mph this summer. Holley's High Voltage Experience, a multi-discipline event with drag racing, autocross, and road-course hot lapping, had "incredible" turnout this year, said Lawson Mollica of AEM EV, Hawthorne, California, a Holley brand with a diverse array of products in the EV performance space.

Then there are areas where progress in the EV racing segment is anywhere from slow-moving to practically nonexistent. For example, drag strips that have opened their bracket programs to EVs have had few, if any, entrants.

"From what I see talking to other guys out here on the East Coast, it's not doing good at any tracks out this way, with little or no participation whatsoever," said Wayne Delmonte of Lebanon Valley Dragway, West Lebanon, New York.

John Bisci Jr. of World Wide Technology Raceway in Madison, Illinois, noted, "We do have some Tesla owners who come to our street-legal racing nights and make one or two 'fun' passes down the track, then park in the car show/display area. But the actual organized racing class has had no takers."

Todd Payne, a longtime bracket racer from Yadkinville, North Carolina, said his daily-driven 2014 Tesla Model S P85D has almost always been the only EV entered at the NHRA and IHRA Summit Series programs at his local tracks. What's more, he told us,

his fortunes have swung wildly. He went to the 2021 IHRA Summit SuperSeries World Finals in Memphis and made it to the final four in eliminations thanks to his quick reaction times and the Tesla's remarkable consistency. Yet he was outright banned from an independent drag race because the organizers "didn't understand the car."

The Mint 400 opened to EV participants in 2021 but so far no one has entered, despite "really aggressive outreach," said Matt Martelli of the Terranaut Media Group, Vista, California, which puts on the desert race outside of Las Vegas, Nevada. He acknowledged that "there are a lot of challenges specific to off-road that are unique," from range-taxing race distances to lack of infrastructure in remote areas. But, he added, "we want to be very proactive in helping new technology. If it requires us to modify our race, our race course, whatever, we're open to that. We want to get the conversation going to all the different EV manufacturers and product manufacturers to let them know we are amenable and interested in working with them."

The reluctance to accept EVs as legitimate race vehicles seems to be a US-only phenomenon. When asked for examples of where EV racing is strong, Mollica mentioned several series, from Formula E to FIA Rallycross and the Dakar Rally, that take place in Europe and South America. "Here in the US, people are trying to figure out rules and safety. EV adoption abroad happened faster than it has here, and they have a head start on the racing. A lot can be learned by studying what they are doing right. But if you consider the hockey-stick trajectory of EV racing elsewhere in the world, combined with the mass adoption and rollout of EVs at the OE level, it is not going to be long before EV racing takes a foothold here."



The acceptance of EV racing in the US has been slow, “but if you consider the hockey-stick trajectory of EV racing elsewhere in the world, combined with the mass adoption and rollout of EVs at the OE level, it is not going to be long before EV racing takes a foothold here,” said our source from AEM EV.

To his point, in some respects the state of EV racing in the US can be attributed to it is still in its early days. But there are factors that need to be addressed before EVs can be fully accepted into the racing fold.

SAFETY CONCERNS

In its 2022 Summit Racing Series rules, the NHRA allows 2014–current EVs with unaltered frames, unibodies, and safety systems to run the quarter-mile no quicker than 9.00 seconds and no faster than 150 mph. “A normal race car,” Delmonte pointed out, “can only go 9.99 at 135 before it has to get into chassis certifications and a license for the driver.”

The rule makes it easier for street-driven EVs to race, and as Payne pointed out, “I’ve got 10 airbags and antilock brakes going for me. They say if you don’t modify the car, you can run it because you’re safer than half of them out there.”

That’s not what concerns Delmonte, however. “Most of the guys who are coming in with Teslas are not racers, they’re just guys who can afford a Tesla and want to see how fast it can go. They have no experience on the race track. It doesn’t matter if you’re in a 15-second car or a 9-second car, you still need experience to know what you’re doing and where you’re at.

“I get that these cars have airbags in them, but it’s not only that car you have to worry about, it’s the car going down track with them,” Delmonte added. “That could be an 11-second car that’s not required to have all the fancy safety gear, and now a car just hit them doing 150 mph with electric batteries and stuff in it. I think it is a very unsafe racing atmosphere.”

Delmonte said his Lebanon Valley safety crew “is trained in electric cars, but not every track has that luxury. An accident with an electric car is not like a normal accident. There are protocols that have to be taken. Where to cut the wires is different with every car, so you have to find out where to cut,

“YOU NEED TO KEEP PEOPLE COMING TO THE TRACK, TO TRY NEW RACING OPPORTUNITIES.”

what to touch, and what not to touch.”

When asked if he would continue to participate in the EV racing program, Delmonte said, “As a track operator, I have the option of not competing in the EV class. We don’t have to do it, but we want it to grow, to get more people to come to the race track. The younger community isn’t going to buy a muscle car or a dragster and come racing. A lot of them are buying electric cars these days. It’s just a change of times, and you need to keep people coming to the track, to try new racing opportunities. But as far as safety goes with these really fast cars right now, I don’t feel we are there yet.”

Mollica agreed that “educating track safety teams on how to respond to various scenarios when they occur in EV classes will further speed up adoption. It is not uncharted territory, which is great. There are lots of case studies and existing, proven protocol for these things. Further, if good rules are enforced, the cars are very safe, despite the high-voltage systems that are

used to propel them.”

In the road racing segment, Brett Becker of National Auto Sport Association (NASA) in Las Vegas, Nevada, said most of the EVs—largely Tesla Model 3s—at NASA events are in the HPDE or Time Trial run groups, which do not have the same safety equipment regulations as cars doing wheel-to-wheel racing. “One of the developments in our Time Trial classes over the years is that they’re mostly full-cage race cars now in almost all the classes, whereas 10 years ago there were a lot of street cars in that class.” Mounting a roll cage in a Tesla “presents a challenge,” he said, “of welding in a car with all that juice in them. I don’t know how it’s done, but I know it’s not easy.”

When asked if EVs were competing in NASA’s sprint races, Becker said, “I know of

EVs face challenges in off-road racing that are specific to the discipline, admitted Matt Martelli, whose Terranaut Media Group puts on the Mint 400 desert race. But, he added, “we want to be very proactive in helping new technology.”



none.” There was a notable EV entry in the 2021 25 Hours of Thunderhill, an electric-powered Sports Racing car built by Entropy Racing of Sacramento, Pennsylvania. The EVSR could compete in a long-distance event because its lithium ferrous phosphate batteries were designed to be hot-swapped during a pit stop, a two-minute task that had to be repeated about every 30 minutes. Those batteries are “heavier and cheaper” than lithium ion, Becker said, and they’re also “easier to extinguish in a fire, because they’re still extinguishable with water.” (The EVSR team finished the race in 29th place overall. Turn to page 104 for a profile of Entropy Racing.)

ACCEPTANCE

Cutting a new path is never easy for a pioneer, and some of the EV racers we spoke with have experienced their share of trials. Payne said he and his Tesla have been met with much distrust, from fellow racers and even race organizers who think the Tesla has electronic devices that allow him to cheat. The organizer who banned the car told Payne, “it’s a different animal, and we don’t understand it,” he recalled. “They



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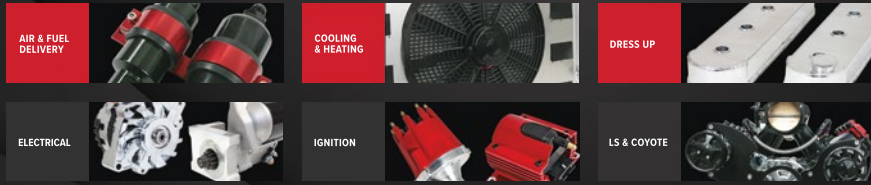
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EV OBSTACLES

“EDUCATING TRACK SAFETY TEAMS ON HOW TO RESPOND TO VARIOUS SCENARIOS WHEN THEY OCCUR IN EV CLASSES WILL FURTHER SPEED UP ADOPTION.”

talked about the traction control and the launch mode, and how there's no way to police the computer in the car. My response was, 'do you really think I'm going to tamper with my car?' It's just like your smartphone. You can't go tampering with it or you're going to get blocked or bricked. Same thing with a Tesla. You can't go in and mess with stuff and mess up your warranty."

He also recalled one track owner "giving me the stink-eye" when he tried to plug in between rounds. "They think I'm robbing them of power, that their power bill is going to be \$300 if I plug in for one race," he said. Payne now takes a generator for power top-ups, but he pointed out, "if we could get

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50-amp chargers at the tracks, that would help us. And we need to tell the track owners that these things can only suck so much power. You might be talking \$5 charging all day long."

Steve Huff's quest for 200 mph began when he debuted the dragster at the 2017 SEMA Show, "and the struggle started then. We were wondering, 'Is anybody going to care when we go 200? Is it going to be a unique thing that happens once? When is the industry going to catch up with us? When are the recognized names in the performance industry going to get involved?'"

Some of those questions have been answered. Competing against Don Garlits to be the first EV dragster to 200 drew national attention, and AEM provided much-needed technical assistance starting in 2019. "With their products, we finally had the data acquisition that we needed," Huff said.

When he felt the car was ready, Huff purposely timed his record attempt for May

Response to the Holley High Voltage Experience "has been incredible from a participant and vendor standpoint," said a company source at AEM EV. Car count in 2022 was "significant for a new series, and we had a big increase in custom EV conversions over the inaugural event."



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EV OBSTACLES

2020, since "there was no motorsports news going on" during those early months of the COVID-19 pandemic. Even so, hitting the number "made international news in Asia and Europe much more than it did in the US," he said. To this day, even when "Big Daddy" Don Garlits himself is lining him up for exhibition passes, reaction is mixed.

"Garlits and I were at the Gatornationals this year, and on the line we could hear the crowd boo. Yes, we also heard a lot of applause, but there's also that other factor. I don't know that the two are going to mix really well."

By "the two," Huff was referring to the pro- and anti-EV camps he encountered while shooting for 200 mph.

"Most of the interest in the electric car comes from people 30 years old and younger," he explained. "They have a lot of interest, but they've never been to a race before. They're new racing fans."

Huff has created educational programs about EVs, from K-8 STEM classes to hosting University of Wyoming engineering students who work on a Formula SAE team. "For the second time in three years they're flying 15 of their students up here (Huff Motorsports is based in SeaTac, Washington) for a four-hour lecture, Q&A, and a tour of my



Pictured here, from left, are Don Garlits, the first dragster driver to reach 200 mph (in 1964) and Steve Huff, the first EV dragster driver to hit 200 mph (in 2020), at the NHRA Gatornationals. Garlits' notoriety has helped draw attention to the quest for a 200 mph EV pass—and EV racing in general.

shop. That never happened with my Top Fuel Harleys, hydroplane, land speed bikes, or any car I've ever raced or owned."

On the other side are race fans who are anti-EV for reasons that range from a lack of understanding of the technology, to a fear that EV racing will somehow replace traditional ICE-powered vehicles, to hating the fact that EVs "don't make noise."

"That's the challenge now, that we don't make noise," Huff admitted. "Crowds don't like that. I'm a little surprised that today's racing audience is less impressed with the technology and more impressed with the noise. I would have thought there would be more interest in the development story, in how to do this." To try to appease fans, "I give them huge burnouts since I can't give them noise."

"THE QUIETER PART OF EV RACING IS NOT A DETRIMENT, IT'S AN ADVANTAGE."

"This is not a political thing for me," he added. "People want to turn it into something political, but it has nothing to do with that. I did not do this to save gas. This was done because there was a race, and I wanted to win that race. It was a quest to see who could put their name in the history books. If it was a noise contest, I would have done everything I could to win the noise contest."

Noise, in fact, is hurting race tracks, a fact that both Huff and Mollica emphasized.

"There's a reason there are only two races a year at Pomona right now, a reason tracks are being shut down all over the place, and that's noise," Mollica said. "Since these are quieter, it eliminates the argument of, 'You can't race here because it's too loud.' How much more opportunity does that open to legally race in an urban environment? We all know what happens if you can't race in a legal environment now. It all goes to the streets. Which is what we don't want. Now, the quieter part of EV racing is not a detriment, it's an advantage."

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Todd Payne's gray Tesla is pictured above at the 2021 IHRA Summit SuperSeries World Finals in Memphis. Payne's skill at the tree and the Tesla's remarkable consistency make them a formidable team in bracket race competition.

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noise, they care about the performance," Huff said. "I have a 200-mph car that I drive to the starting line, I drive back from the finish line, and drive it into the trailer. It's a hot rod, a 2,000-horsepower dragster. It won't shock you; it'll blow you up. It's dangerous, it's fast, it's expensive, it has everything we look for in a challenge and race car. It's super cool, and it's made racing fun again."

"IT'S HOT RODDING, JUST A NEW TYPE."

When asked if traditional race fans could ever embrace EV racing, Mollica was optimistic. "I've made the analogy that the flathead Ford guys shunned the small blocks, and carbureted guys shunned EFI, and small block and big block guys shunned the LS and Mod motors, and the domestic guys shunned the imports, and so on. That's part of car culture. What I do believe is that over time, a level of respect was attained regardless of the camp you are in. You have to remember that people who shout the loudest are usually most resistant to change,

but that doesn't mean that they speak for an entire niche."

Mollica himself speaks from experience. His own roots were in traditional American V8s, and he was skeptical of the performance potential of import cars until he learned more about them. Likewise, "I didn't like EVs when they came out. Then I got a ride in a Tesla, and it changed my mind. Now, we make electronics so that enthusiasts can take a chassis they are passionate about, electrify it, and race it, drive it all the time, or both. That's really what this is all about. It's hot rodding, just a new type. If you don't believe me, rent a Tesla or Mach-E, mash the pedal, and then envision that performance in your passion project and tell me if I am wrong." **PR**



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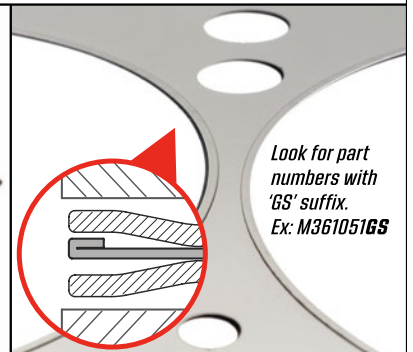
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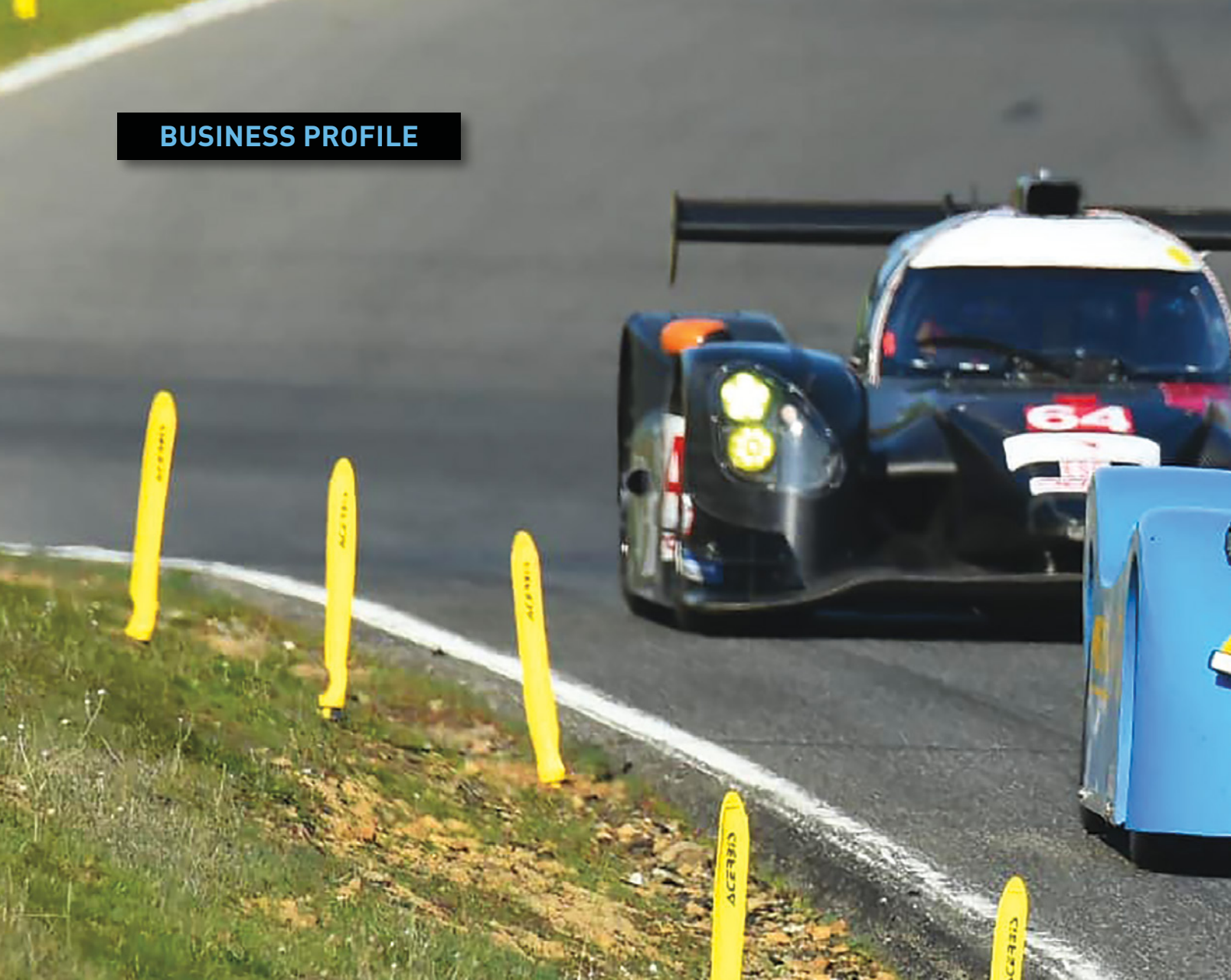
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ENTROPY RACING

Using safer batteries and off-the-shelf parts—and defying nearly every assumption about electric vehicles—this team is “plugging in and kicking gas” on internal combustion’s home turf while demonstrating a viable alternative for grassroots road racing.

By John F. Katz

About 40 minutes into the annual 25 Hours of Thunderhill, a sleek blue sports racer glides into pit lane, its unruffled silence signaling its electric power. As five crew members jack the chassis and lift the one-piece body, two others

slide bright yellow dollies under the spent battery packs on either side of the cage. At 40 seconds, the old batteries have been disconnected and rolled away. New batteries are wheeled into place; the body is lowered and fastened, and at 1 minute 57 seconds the Entropy EVSR rejoins the race.

A full day and 35 pit-stop battery swaps later, Entropy Racing of Sacramento,

Pennsylvania, has done what has never been done before: “Run a significant endurance race at pace,” beamed owner Charlie Greenhaus, “with live stops in pit lane to change batteries.” The team finished 29th out of 37 starters in last year’s endurance race, despite a half-hour layover caused by motor-cooling issues, which the team has since resolved.



Entropy Racing's EVSR, an electric-powered sports racer based on a Sport Renault, successfully competed at the 25 Hours of Thunderhill in 2021, the first EV to "run a significant endurance race at pace, with live stops in pit lane to change batteries," said Entropy's Charlie Greenhaus.

It was a big accomplishment for a little company, one that Greenhaus described as "the very small end of small business." Entropy Racing has never employed more than five people, and currently consists of Greenhaus, a mechanic, and a part-time marketing manager. Yet this tiny power pack has not only pioneered electric vehicles for endurance racing, but proven, absolutely, their viability in hill climbs, autocross, and shorter road-course events as well.

KEEPING THINGS TOGETHER

A provider of racing services since 1989, Greenhaus chose the name Entropy because "it's how everything falls apart and stops moving—and my job was to counteract that." Road racing "was always our primary focus, with a large part of our business being racing rentals"—in the beginning mostly small imports—"transitioning into sports





While Entropy Racing has built three EVSRs and has two rollers in its Pennsylvania shop, owner Charlie Greenhaus hesitates to characterize the business as a manufacturer. “We’re more like a prototype developer.”

racers over the winter of 1996–1997.” That’s when SCCA discontinued the Sport Renault series, and Greenhaus “started buying them off the walls and out of the ditches.” By 2000, Entropy owned 16 Sport Renaults and promoted its own race series while continuing to campaign its own team.

suspension as the Gen 1 car but has a redesigned safety cage that relocates the driver, as well as a completely redesigned body and”—most significantly—“a battery support structure that allows the rapid replacement of the battery packs.” At 1,850 pounds, it’s about 150 pounds lighter than

“YOU HEAR THE TIRES MORE, YOU CAN HEAR THEM TALK AT THE LIMIT, IN A WAY THAT YOU MAY OR MAY NOT BE ABLE TO HEAR IN A GAS-POWERED CAR.”

All that changed in 2013 when a customer requested a high-performance electric road car. Greenhaus ultimately vetoed the idea, “due to weight-vs.-range limitations at the performance level desired.” However, “upon further discussion, we decided to partner on an electric sports racer,” based on the readily available Sport Renault chassis.

Off-the-shelf parts controlled costs, as did a very targeted approach to development. “We knew range and motor temperature were going to be our first big challenges,” Greenhaus explained, and so the team didn’t spend a lot on, say, the Renault’s existing brakes. “Of course, those priorities changed constantly as we solved one problem, only to find another.”

By mid-2015, Entropy had built three Electric Vehicle Sports Racers, or EVSRs. A second-generation model followed in 2020. Greenhaus described it as “evolutionary rather than revolutionary. It retains the same

the Gen 1 model. When we spoke in July, Entropy had built three examples, “and we have two more rollers in the shop.

“It would probably be a stretch to call us a manufacturer,” Greenhaus continued. “We’re more like a prototype developer. We have the platform and design to do a larger run, but we haven’t expanded to that level of production.”

DISSUADING THE DOUBTERS

Beyond the small size of the Entropy enterprise, “the biggest challenge” to scaled-up production has been “hurdles with the sanctioning bodies: Who are you going to race with? Early in our development we ran into a lot of skeptics and some negative comments,” Greenhaus explained. “We had a client out on the West Coast whose region flat-out said, ‘No, we’re not interested. We won’t allow it. We don’t want any part of it.’”

Todd Reid is Entropy’s lead driver; he

recalled a regional event in New Jersey where the other drivers were so convinced the EVSR would block traffic that, to appease them, he agreed to start at the back of the pack. “Out of 25 cars, I went from last to seventh,” he said. Reid qualified for position in the next two races and won both of them. “Then there was no more, ‘Boo-hoo, you’re going to hold us up. You better stay out of the way.’”

Gradually, the closed minds started to open. “In the beginning,” Greenhaus recalled, “we did a lot with the New Jersey Region of the SCCA, which was instrumental in obtaining national approval for safety and regional competition. In the last two years we’ve run a tremendous amount with the DC Region, which created the classes Electric Modified 1 and 2, depending on power output, and grouped the cars with Spec Racer Ford.”

EVSRs have also competed in the DC Region’s Sprint Bracket Series, “which is structured somewhat like bracket drag racing: You hit your target time, or you get bumped to the next class.” Greenhaus himself drove an EVSR to the series championship in 2021, defeating 68 other cars, and the Entropy team was solidly in third place for the 2022 series at print time.

“We’ve also run with NASA Mid-Atlantic and Northeast, and obviously with NorCal for the 25 Hours, and with the New Hampshire Sports Car Club for the Mt. Washington Hillclimb,” Greenhaus continued. “We’ve run the Pikes Peak International Hill Climb twice. We’ve run hundreds of sprint races, and we have a 95%-plus finishing record. As we’ve finished more races—and won a good number against gas cars—we have become accepted as another car on the grid. That was always the mantra of our team: ‘a good race car that happens to be electric.’ These cars are not built for any specific surface, series, or venue. Unlike Formula E, we race against ICE cars on an even playing field, and we don’t make any changes to the course or race to do so.”

NUTS AND VOLTS

Greenhaus readily admits that Entropy did not invent the battery-swap concept. The idea dates back at least to 1968, when

Batronic delivery vans (built in Boyertown, Pennsylvania) promised a battery exchange in five minutes. Greenhaus acknowledged a “24 Hours of Lemons” team that had modified a Nissan Leaf so that they could swap batteries in the paddock and be back on the track in 30 minutes. “I don’t discredit that effort within context, but that isn’t racing.”

Entropy configured its dual 350-pound battery packs using off-the-shelf lithium ferrous phosphate (LFP) cells. “They are safer and more stable than lithium-ion cells,” said Greenhaus, which can burn so hot on impact that most tracks “don’t have the fire-suppression equipment for them.” When overtaxed LFP cells did catch fire during testing, Greenhaus calmly extinguished the flames with less than three gallons of water.

Furthermore, while LFP batteries weigh 30–40% more than equivalent lithium-ion units, they cost less, and do not require a battery management system. And their



Prior to competing in the 25 Hours of Thunderhill, the Entropy Racing team practiced their pit stops at Summit Point Motorsports Park, seen here. Hot-swapping the batteries during the race took about 2 minutes; now, the team has it down to 1:30–1:45.

discharge characteristics are especially good for racing. “Your first lap will be your fastest, because they start at 3.2 to 3.3 volts and drop almost immediately to 3.0 volts; but then they stay at 3.0 volts until they are 80–85% discharged.”

Each of the two battery packs on an

EVSR consists of 25 cells and can deliver a maximum of 29 kWh, “or 25 or 26 at full chat,” Greenhaus added. Motors and controllers are cataloged items from EV West, albeit modified to improve cooling and “tweaked” in other ways Greenhaus would rather not share.

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The EVSR uses off-the-shelf lithium ferrous phosphate (LFP) battery cells and motor controllers from EV West. The LFP batteries are heavier than lithium-ion but cost less, and a battery fire can be extinguished using water.

With batteries accounting for 700 of the EVSR's 1,850 pounds, the car is "exceedingly well balanced. We can put the weight wherever we want, and we usually run about 53% rear weight bias. Also, with the batteries on either side of the car and just 3 inches off the ground, the roll center is low, and we get a lot of grip with our inside wheels."

"The three heaviest components," Reid added, "the batteries, the driver, and the motor," are at or below hub level, with the batteries below the axles and outboard. "The first time I took an EVSR into a high-speed corner—turn 9–10 at Summit Point—I thought, 'Damn, I could have gone faster.' And the next time I went through, I thought, 'Damn, I could have gone faster.'" When

racing against ICE cars, "you just have to believe that you can go 5 mph faster, or 7 mph faster, and it's going to stick."

Reid met Greenhaus some 30 years ago, when Entropy was providing trackside service for NASA Northeast. In 2011, Reid's vintage Lotus 7 suffered a devastating rear-end collision, so bad that Reid feared the car would need a new chassis. But Greenhaus cut and welded the damaged frame, and, afterward, Reid took the car to Summit Point and shaved half a second off of his best previous time.

Similarly, Steve Hanford met Greenhaus when his racing Miata needed mending: In the mid-1980s, Entropy sorted out a badly botched suspension installation, then rebuilt a blown engine, and has maintained Hanford's race cars ever since.

Hanford described the EVSR as "a momentum car. The chassis is terrific. If you pedal hard and don't hit the brakes a lot, you can keep up with much bigger, higher-

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Even on a wet track, the EVSR remains exceptionally stable. “The power delivery is linear,” said Greenhaus. “There’s no shifting, so you don’t have those transitions and shock loads.” Furthermore, “rain makes cooling a non-issue.”

Hanford sees another advantage in the EVSR’s relatively quiet operation. “You can definitely hear it, but it’s quieter than a gas car. You hear the tires more, you can hear them talk at the limit, in a way that you may or may not be able to hear in a gas-powered car. You are also more conscious of the cars around you: You can hear them accelerating and decelerating; you hear their tires reacting. So if you are trying to beat someone into a corner, you know if they are struggling or not.”

Reid added that the EVSR’s relative silence could be “a big deal” at tracks where the surrounding population has complained about noise.



“The future of motorsport is going to be more electric,” Entropy Racing’s Charlie Greenhaus predicted. “At hill climbs and drag races, EVs are already dominant.”

EXTENDING THE RANGE

Since Thunderhill last year, Entropy has replaced its hydraulic jacks with faster-acting air jacks. The crew has gained experience, too, dropping battery change times down to 1:30, or 1:45 at most. “That’s faster than most cars can refuel,” noted Reid, reminding us that most amateur racing bans pressurized

fuel feeds and NASCAR-style dump cans. “If you’re doing a driver change, it’s conceivable that the battery swap could be finished before you are done getting into the car, plugging in your helmet, closing all your belts, and putting on your arm restraints.”

Despite this, the need for more frequent pit stops still adds up to a net disadvantage. “When we ran enduros in gas-powered cars,” Hanford recalled, “our fuel window was about an hour to an hour and 15 minutes. In June, when we ran the EVSR in a 100-minute event at New Jersey Motorsports Park, we had three pit stops, so that’s 35 minutes, give-or-take. I finished sixth or seventh, and the guy right in front of me ran slower average lap times, but had fewer pit stops—and that gave him a couple more laps. We need a jump in battery technology to where we can run an hour, the same as a gas-powered car. That would make all the difference.”

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Entropy has accomplished: “Nobody but nobody else is campaigning an electric endurance race car. No one else can run a 25-hour race without being given anything special—or without having two or three cars to cycle through. We are it.”

“We have the only viable EV in the world that has been run continuously, at a competitive pace, in an endurance race,” Greenhaus added. “There are some really good [electric] cars out there, and some really quick cars, but I haven’t heard of any of them running more than one or two races a year. And no EV, beside ours, has ever run an endurance race in any meaningful way.”

FUTURE SHOCK?

Still, Greenhaus believes that Entropy Racing has taken the EVSR project about as far as it can. “We’ve done everything we’ve set out to achieve,” he claimed. “We don’t have any more performance goals to meet. We’re at the point where we we’re hoping

to partner with somebody, or to pass the program along to someone who has the marketing and promotional capability to take it to another level.”

Greenhaus clearly believes that “the future of motorsport is going to be more electric. At hill climbs and drag races, EVs are already dominant. I’d be surprised if we ever see an IC engine beat the Volkswagen I.D. R’s time at Pikes Peak. And the I.D. R’s record on the Goodwood hill was just bested by the new electric racer from McMurtry Spéirling.”

But Greenhaus does question how million-dollar, 700–1,000-hp exotics can bring electric power to grassroots road racing. “If a major manufacturer comes in and spends untold amounts of money, who is going to race against them? Look at Trans Am: The TA1 fields are tiny, while the TA2 fields are full. The reasons for that are finance and accessibility.”

Then again, there’s the matter of range vs. weight. “We’re running anywhere from 150–200 hp, and at 150 hp we can get

a 25–30-minute run on a 29 kW battery pack,” Greenhaus added. The first full field of electric road racers, he predicted, will consist of cars rated 250 hp or less.

Ultimately, however, the EVSR program has been less about converting motorsports to electric power than it is about building an electrically powered, relatively affordable race car that can run with—and win against—combustion-engined competitors with little or no special accommodation. “It’s a race car that happens to be electric,” Greenhaus said. “While it would be nice to see a full field of electric cars, I’m more proud of the fact that our cars don’t have to be set aside. The proof of the EVSR as a viable race car is that we don’t have to have our own private playground with our own little race track. We go to Summit Point or Lime Rock or Watkins Glen, and we line up and grid and we race like every other car, electric or diesel or whatever. It’s just another race car. And we’re going racing.” **PRI**

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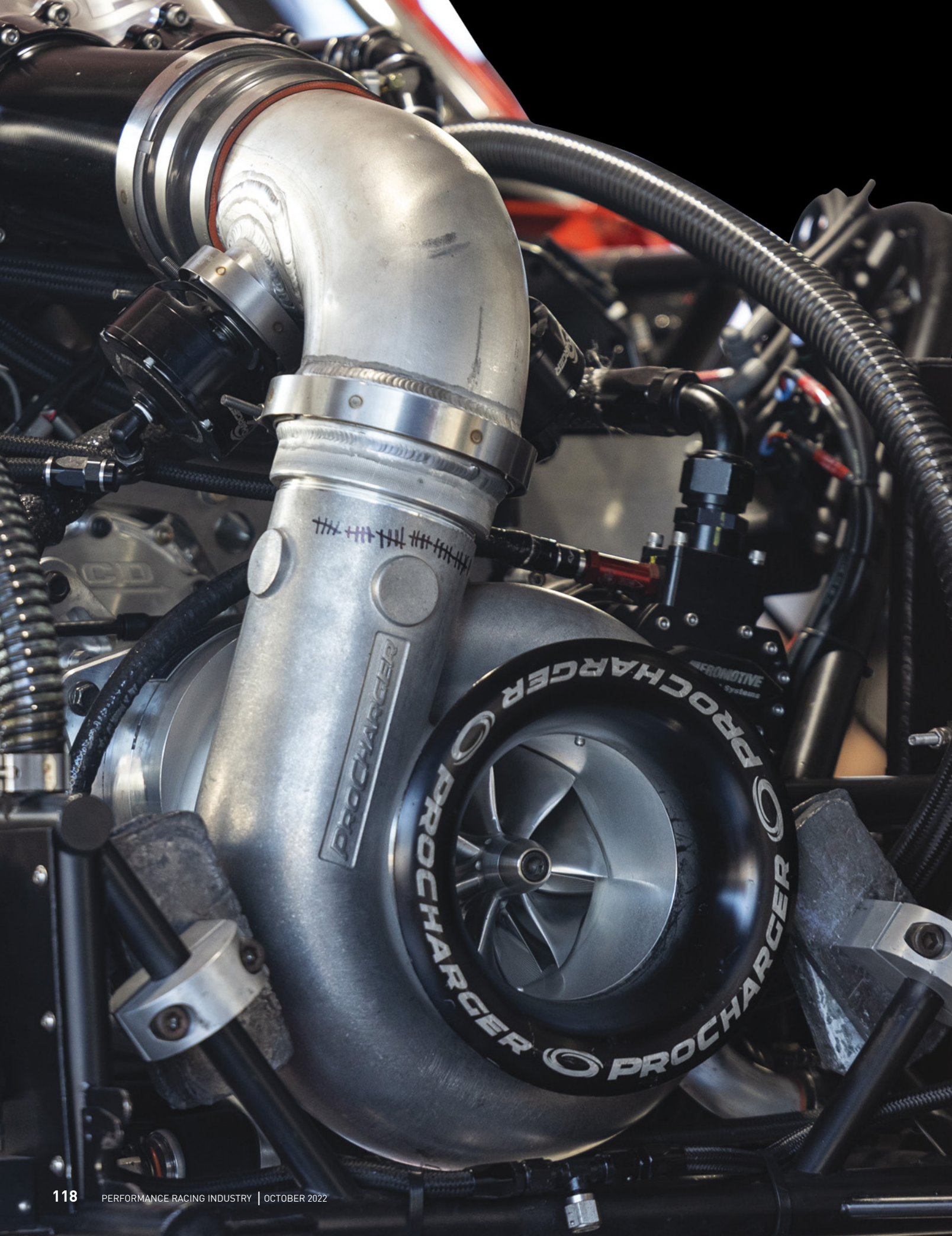
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POWER PUSHERS

With recent advancements in design and production, superchargers are more capable and efficient than ever before. And while that's allowed the horsepower potential to reach new heights, maximum output isn't always the primary target.

By Bradley Iger

Blowers have been an object of desire for speed freaks since the dawn of hot rodding, and roughly a century after the first supercharged automobiles started competing in organized motorsports, they're still sought-after commodities today. It's no secret that forced induction is the key to big horsepower numbers, and today's supercharger designs offer capability that eclipses what was possible even just a few years ago.

"Right now, our largest impeller is 131 mm, and no one has maxed out the capability of that unit yet," said Brian Cox of Vortech Engineering, Oxnard, California. "We've seen a few racers making as much as 3,600 horsepower at the wheels with it. But we know that they'll find the ceiling soon enough, so we're already working on the next iteration."

These strides in supercharger performance come from a variety of different improvements in design, construction, and production, but each manufacturer has its own strategy for success. We spoke with some of the companies that are driving innovation in the segment to get a better sense of how they're pushing the performance envelope today, and what they have planned for the future.

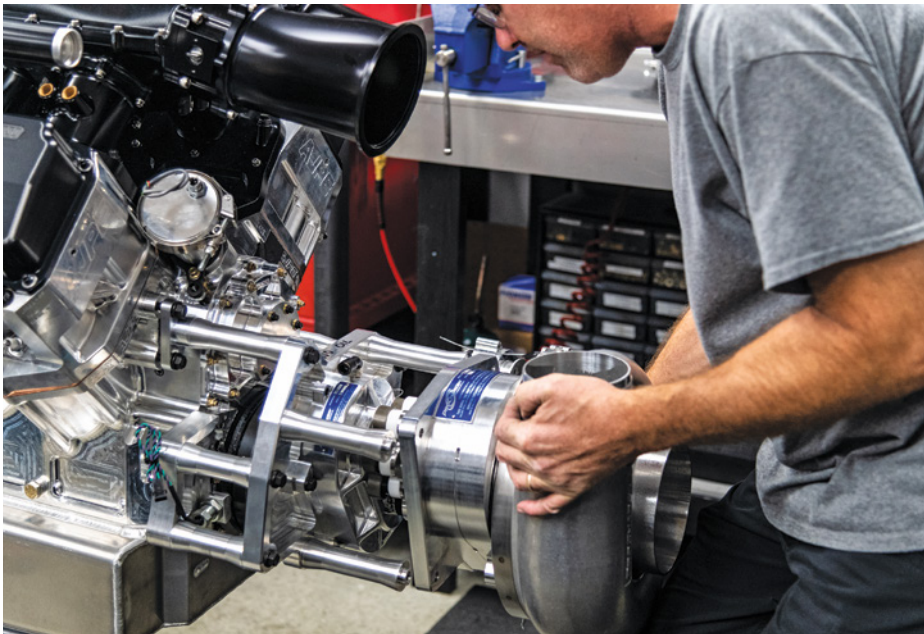
PROCHARGER

While improvements in simulation software have helped ProCharger of Lenexa, Kansas, in some aspects of design, Erik Radzins told us that data collection has been the real key to design improvements in recent

years. "The computer programs help to point you in the right direction, so that saves some time, and it allows us to determine if a theoretical design is feasible—whether our machines can produce it or if they're going to smash the bit halfway through the run," he said. "But at the end of the day it's real-world testing, working with engine builders, and sharing data that has really made the difference. Ten years ago, data sharing between companies was virtually non-existent. But these days everyone really wants to push the sport of drag racing forward, and the engine builders have realized that we're not going to start building engines."

Radzins said that most of ProCharger's motorsports-spec blowers are designed independently from those intended for street applications and are largely built around sanctioning bodies' class rule sets. That allows ProCharger to focus on refining specific elements of the blower to give racers the capability that they're looking for. "We took a clean-sheet approach when designing the gearbox for the Pro Mod blower, the F4X," he explained. "That blower makes so much horsepower, and those guys are running them so often that they needed a really, really durable gearbox."

ProCharger's Cliff Hall explained that, in the realm of motorsports, peak performance and durability tend to go hand-in-hand. "When someone comes to us and asks us to build a blower capable of more than 3,500 horsepower, it makes us go back to the design board on the gearbox side of things."



ProCharger has improved its machining tolerances in recent years, according to Erik Radzins, who explained, “Each race blower gets fully inspected by a coordinate measuring machine before it goes out the door, and if it doesn’t meet our production standards, it gets tossed in the trash.”

“RIGHT NOW, OUR LARGEST IMPELLER IS 131 MM, AND NO ONE HAS MAXED OUT THE CAPABILITY OF THAT UNIT YET.”

ProCharger’s current focus is on fine-tuning and filling in the power level gaps where they exist in the company’s product portfolio rather than focusing on making as much horsepower as possible. “Nobody is calling us asking for 500 more horsepower at this stage, so there really isn’t a need for a bigger blower right now,” he explained. “A lot of folks realize that they don’t need 5,000 horsepower—especially in the no-prep scene. The track can’t hold it. Having a repeatable, durable, deadly consistent combination is more important.”

A few years ago, ProCharger also introduced the CrankDrive gear-drive system for all of its F-series superchargers. “We took the same concepts we were using with our gearbox technology and applied that to the CrankDrive,” said Radzins. “When we went to design it, we listened to what the racers and the engine builders wanted out of it. The idea was to provide these racers with a better solution for a gear-drive system. They didn’t have to call anybody else, worry about delays or problems with someone else’s manufacturing tolerances, etc. They could just get the entire supercharger system that we designed and built as a holistic solution.”

Radzins said the company has also improved its machining tolerances in recent years. “Each race blower gets fully inspected by a coordinate measuring machine before it goes out the door, and if it doesn’t meet our production standards, it gets tossed in the trash.”

Part of the improvement comes from these strict quality assurance measures, but Radzins noted that the machining process

itself has changed as well. “With a lot of our race products, the two halves of the blower case are made next to each other on the same machine on the same run, then they’re assembled and re-machined as a torqued assembly to ensure that everything is aligned perfectly.”

Going forward, Radzins said that

WHIPPLE SUPERCHARGERS

As automakers continue to dish out increasingly robust engine combinations and drivetrain components, the line between street and race applications is blurrier than ever. Those improvements at the OE level have allowed Whipple Superchargers in Fresno, California, to



While CAD and simulation software has helped with the design of ProCharger’s superchargers, “at the end of the day it’s real-world testing, working with engine builders, and sharing data that has really made the difference,” said Erik Radzins. “These days everyone really wants to push the sport of drag racing forward.”



“Development never really stops,” said Dustin Whipple of Whipple Superchargers. “We’re constantly investigating new ideas and testing new things that can make the product better. The use of computational fluid dynamics modeling has really helped things advance at a much faster rate than ever before.”

focus on making more power with less boost, an effort that Dustin Whipple said has been significantly aided by simulation software.

“The use of computational fluid dynamics (CFD) modeling has really helped things advance at a much faster rate than ever before,” Whipple explained. “Before CFD, making superchargers and testing them for different applications took forever, and it was extremely expensive. With the simulation work we do now, we can run multiple versions of a design idea simultaneously and determine which of those should move on to the prototyping phase. That was a significant shift in our approach to design, and it allowed us to take paths that we hadn’t taken before.”

Whipple’s earlier development efforts saw the manufacturer adapting products initially designed for street applications for use in motorsports, a strategy that was due in part to some of the race classes that the company was involved with at the time. These days it’s the other way around.

“The great thing about the racing side right now is that it’s going into uncharted territory,” Whipple said. “The Gen 5 was where we moved in a new direction, and now we have the Gen 5x, which was

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developed based around what we learned in competition. And then there's the Gen 6 that's on the way, which is also derived from the racing side."

That motorsports-based development approach allowed Whipple to find ways to improve efficiencies across the board. "Compared to where we were five or seven years ago, we're making more power with smaller superchargers," Whipple said. "Back then we couldn't spin the compressor at the levels we're using today—efficiency fell off and the temperatures went off the charts. Back then we might've been able to reach some of the performance metrics we're at today, but we would have had to make some sacrifices to get there. It is sort of like a turbo application: If you wanted to chase one part of the curve, you had to give up everything else. That's not the case anymore. We don't have to give up power down low to make power at the top."

The aforementioned CFD work has played an important role in component design for Whipple as well. "Matching components in the inlet system, the discharge system, and the intercooler is definitely far more important now than ever before," he said. "As the compressor flow went up, we had to make sure that the rest of the system was capable of handling that higher volume. And what works well for one application might not be ideal for another."

While the Gen 5 unit introduced a brand new rotor design, and the Gen 5x ushered in new shaft and inlet designs—along with some changes to the intercooler and a number of smaller refinements—the Gen 6 showcases the next iteration of Whipple's rotor design, which focuses on delivering more low-end torque as well as more power at the top end. "The gains are very noticeable, especially as the boost levels go up," Whipple added. "Development never

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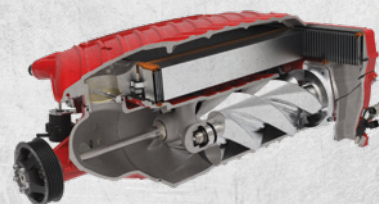
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really stops. We're constantly investigating new ideas and testing new things that can make the product better."

VORTECH ENGINEERING

When it comes to developing superchargers for motorsports use,

manufacturers are always on the lookout for upcoming rule set changes. When a sanctioning body decides to make a tweak, it sends companies like Vortech back to the design lab to see how they can meet that new criteria while providing competitors with the most capable design possible.

"We might have a blower out there with, say, a 123-mm inducer, and it'll make a ton of power, but a sanctioning body might decide that they want to slow the class down," said Cox. "They usually do that by changing the inducer size to limit the power that the blower can make. When that happens, you're actually putting the blower in a bad spot—it's really the wrong

"WHEN SOMEONE COMES TO US AND ASKS US TO BUILD A BLOWER CAPABLE OF MORE THAN 3,500 HORSEPOWER, IT MAKES US GO BACK TO THE DESIGN BOARD ON THE GEARBOX SIDE OF THINGS."

way to slow things down. But the motor's already built, and a racer might have a hundred grand in that motor already. They're looking for another, less costly way to slow it down, so we have to design around those circumstances. It's something that supercharger companies spend a lot of time chasing."

It's another situation where software has become a crucial component of the design process, a tool that now allows Vortech to run extensive simulations and vet a number of potential solutions before the company ever builds any physical parts. "There are certain aspects of an impeller that you want to focus on—the rpm where it creates power, the efficiency of it, things like that," he said. "All of that can now be calculated before a part is built."

That, in turn, has helped to push supercharger design into truly purpose-built territory.

"For instance, we were working with a Pro Mod driver, and we were using our largest supercharger—the 131—but his motor was actually too large for it," Cox recalled. "It was putting the blower in a bad spot, so we went back and made changes to the impeller to dial that system in for his combination. The software allows us to design for a boost number, or a pressure ratio, or a pound-per-minute measurement of how much air it needs to move. It allows us to design around the specifics of an engine combination."

After finding the limits of conventional materials like 6061 and 7075 aluminum, the company also decided to move to a proprietary forging process to manufacture its impellers in order to address the high loads and temperatures they're subjected to. Meanwhile, Vortech's modular gear case design has allowed racers to alter the configuration in order to, for instance, make changes as needed based on two different sanctioning body rule sets.

Although the company is actively considering what competitors will be looking for down the road, Cox said that predicting exactly what form that will take can be tricky. "We're making a ton of power now, but we have to anticipate what the next step for this racer is going to be. We're

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Computer software and simulations are critical elements of the design process at Vortech Engineering, said Brian Cox. “The software allows us to design for a boost number, or a pressure ratio, or a pound-per-minute measurement of how much air it needs to move. It allows us to design around the specifics of an engine combination.”

doing that R&D now—the design stuff is on the table. But any time you make things larger you’re adding mass, so if you make a larger impeller, you lose the stiffness of the shaft and add extra loads when it’s spinning that fast. A lot of things need to be re-designed to make it work. So saying, ‘Yes, we do need a 150-mm inducer blower for the guy who needs 4,000 or 5,000 horsepower’ is a leap of faith, to a degree.”

MAGNUSON SUPERCHARGERS

Racers are always on the lookout for the latest and greatest—the “best” option available. But in the realm of motorsports, that can be a moving target. “The reality is that every supercharger manufacturer has a criteria that they’re trying to achieve,” said Kim Pendergast of Magnuson Superchargers, Ventura, California. “Are you designing for quarter-mile drag racing, or an endurance format? Do you need torque, or do you need horsepower? Are you willing to risk a failure to get every last ounce of performance out of it? It all really comes down to what you’re trying to do with the supercharger.”

Over the past few years, Magnuson has sharpened its focus on its testing methods in order to find the balance between competitive performance and rock-solid reliability. “There are some customers who don’t really care about reliability—they just want power,” Pendergast said. “Sometimes that’s our blower, sometimes it’s not. Making a single supercharger with a lot more

power is not very interesting to us. What is interesting to us is being able to replicate performance consistently. That’s hard to do at a price point that more than two people out there can afford.”

To help facilitate those efforts, Magnuson brought in testing equipment from Arrington Engines, a company that was building powerplants for NASCAR when Pendergast was at the helm. The idea was to find any potential weak links in the system, address them, and continue running the testing processes until the design was bulletproof.

“Bringing over the airflow bench allowed us to optimize parts, but optimizing a part doesn’t necessarily optimize it for the whole system,” she said. “The next step was to run the system with the intercooler cores on a supercharger test stand. To really properly test something like the TVS2650 it required a larger test stand, so we just finished building one to handle the higher horsepower. From there the system goes to an engine stand before it gets installed in a vehicle.” Once a design has been given the nod, Magnuson puts that system through the ringer by handing it over to engine manufacturers that are supplying racers in order to get additional feedback from the race track.

Pendergast likens Magnuson’s old design approach to a Lego set—a modular solution that allowed one template to be easily adapted to a number of different



Over the past few years, Magnuson Superchargers has put a greater emphasis on in-house testing to find the balance between all-out performance and reliability, said Kim Pendergast. Once the supercharger passes those tests, it goes out to engine builders for additional feedback from their customers at the track.

“MAKING A SINGLE SUPERCHARGER WITH A LOT MORE POWER IS NOT VERY INTERESTING TO US. WHAT IS INTERESTING TO US IS BEING ABLE TO REPLICATE PERFORMANCE CONSISTENTLY.”

vehicles. These days it's more about an integrated design that tailors the system more specifically to the requirements of the platform. "Some of it is because of packaging, but it also just allows you to produce a better system overall. It gives you more flexibility to achieve the targets that are set for a given application."

Changes in the company's design philosophy also led Magnuson to broaden its supplier network, a move that allowed it to implement a patented porting technique to squeeze more efficiency out of its systems.

Looking ahead, Pendergast said that folks should expect to see a stronger presence from Magnuson in the Mopar world over the next few years, along with larger supercharger options aimed at the high end of the market. **PRI**

SOURCES

Magnuson Superchargers
magnusonsuperchargers.com

ProCharger
procharger.com

Vortech Engineering
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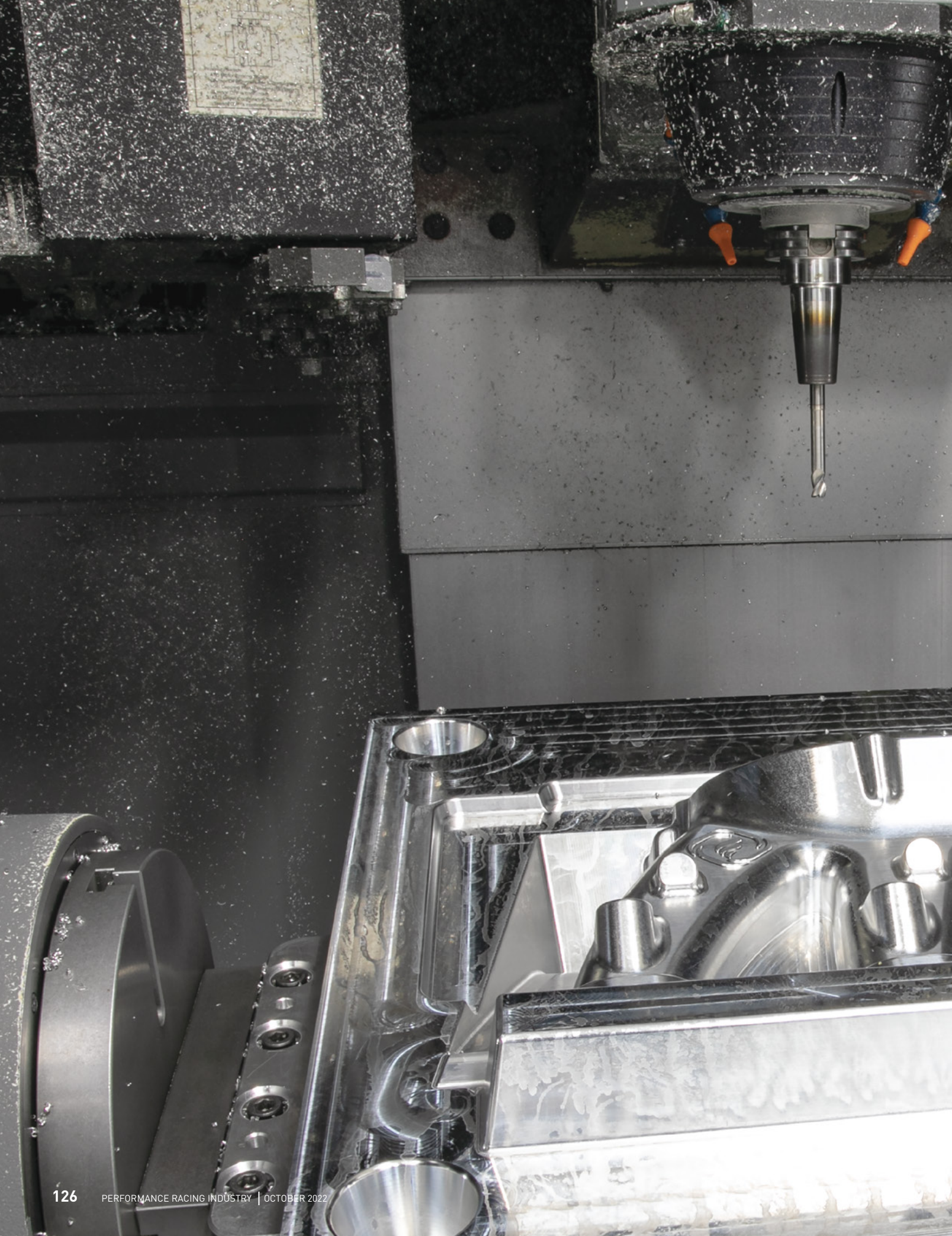
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GIVE IN-TAKE

In the realm of custom manifolds, a good compromise may just be the best power solution.

By Mike Magda

“There’s a lot of power in the intake manifold, and that is why we build custom intakes,” said Tony Bischoff of BES Racing Engines, Guilford, Indiana. “The intake itself—with runner length, taper, plenum design, and such—is very critical to making the engine operate in the power band that you want it to run. It’s almost more critical than the camshaft selection.”

Race engines are becoming more ‘one-of-a-kind’ these days, even those built from a popular and common engine platform. As engine builders modify cylinder heads, experiment with deck heights, and become more daring with power adders, a custom intake may be required to complete the game plan. Intake design has become both a science and an art for some shops, and there’s no shortage of information exchange when building one for a specific race application.

“We have a four-page data sheet that every manifold customer has to fill out,” said Keith Wilson of Wilson Manifolds, Ft. Lauderdale, Florida. “We build the manifold to their combination. We can narrow down every spec to what we need to build.”

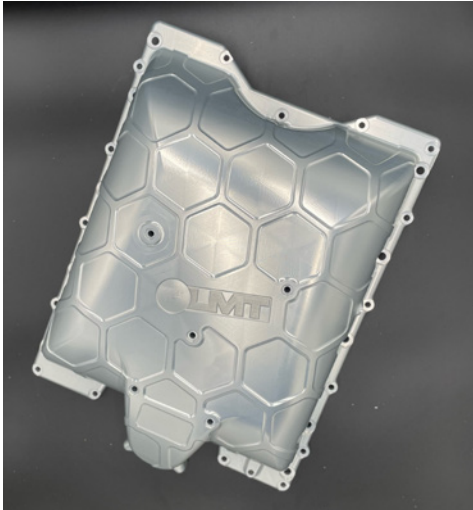
“Everybody seems to want something different,” added Taylor Lastor of TRE Racing Engines, Cleveland, Texas, a shop that advertises that every one of its sheetmetal intake manifolds is custom made for each application. “We’ve done them for just about anything you can think of.”

The majority of custom intake builds are for popular domestic V8 platforms, although a few of the import straight-six engines—such as those from BMW and Toyota—are gaining strong support in the market. Even late-model supercharged V8 engines are drawing interest from custom designers to increase power and improve the looks of the induction system.

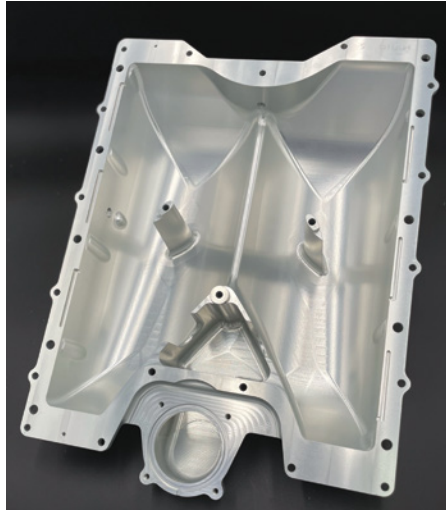
Jeff Smith of Late Model Throttle in Waukesha, Wisconsin, specializes in designing unique billet-aluminum products. He understands that there is a small but willing clientele who will spend \$7,000-plus on a full-billet intake with an intercooler, but he also wants to take advantage of off-the-shelf components to bring the price down and still deliver improved performance.

“There’s not a lot of nice-looking intercoolers for the Hemi,” noted Smith. “So, my plan is to make the lower piece to fit the Hemi and then have a LS Holley Hi-Ram bolt pattern on top. My friend Ron at Sheer Fabrication makes a billet air-to-water intercooler for turbo applications that fits the Hi-Ram. I’ve seen stuff fabricated for the Hemi world, so I’m sure the owners would love to see a billet one instead.”

Smith has a Hemi engine in the shop that he’ll measure using a laser scan and a CMM (coordinate measuring machine) to confirm the dimensions. One objective is to keep the profile as low as possible to allow the largest intercooler to fit under the hood. The Hi-Ram top would also fit on the intercooler to keep the cost in check.



Late Model Throttle specializes in designing unique billet-aluminum products, including custom air boxes to fit on supercharged late-model engines.



"I could also do a custom lid with an elbow, or whatever was needed," added Smith, noting that many of the custom intakes with integrated intercoolers for the Hemi haven't been very attractive for a \$50,000 engine. "People like things to look nice when they open the hood. It's not just all dyno numbers."

New designs don't always make power. Smith designed a new billet lid for the supercharged Hellcat Hemi engine with a beautiful CNC-machined honeycomb pattern. All the dimensions and design cues looked like it would improve power. He had already designed a billet lid for the Ford Mustang GT500 that picked up 35 horsepower on a chassis dyno, and he leveraged many of those ideas.

"I had a friend test the Hellcat lid and he lost horsepower," he said. "I plan to test it again in my shop. You do spend a lot of time, money, and engineering on something that looks good on the computer but doesn't always come out right in the real world. Still, it's a cool project, and some people will want it whether or not it makes horsepower. But for me personally, as a performance shop and as a CNC enthusiast, I have a hard time selling something that loses horsepower."

A post-test diagnosis revealed a couple of areas where Smith can make design changes to reduce turbulence

and increase the air speed, so more development will follow.

EXPERIENCE VS. NEW TECHNOLOGY

Testing, changes, and more testing seem to be the foundation of most intake manifold development. Advances in computer programming have led to computational fluid dynamics (CFD) software that is designed

to help engineers analyze airflow and experiment with designs before committing to a CNC program.

The majority of racing intakes, however, are designed based on experience.

"We have a basic CFD program, but to really do CFD at a Formula 1 level you need programs, engineers, and computers that are quite expensive," said Wilson. "Plus, it takes so much data input to get a real answer that it's not feasible for every job. We do a little CFD, but most of the design is from experience and formulas that we've proven."

"There's probably a mathematical formula, but for us it's experience over the years," said Tim Linder of M&M Competition Engines, Franklin, Indiana.

"I use experience, although we do use CFD occasionally," said Bischoff. "My cylinder head guys know more about that than I do. I have a simple chart, and for the most part it holds true."

Three of the leading key factors in manifold design—especially tunnel-ram-style intakes—are runner length, runner shape, and plenum volume. Conventional wisdom said a longer runner will help with low-end torque while a shorter runner improves high-rpm performance. Optimum runner shapes tend to start as a round throat in the plenum and transition to the shape of the intake-port



Note the precise transformation from the round throat in the plenum to the oval at the cylinder head port designed into this custom sheet-metal intake from M&M Competition Engines. CAD and computational fluid dynamics help some manifold manufacturers with their designs, but M&M relies on its years of experience to help customers make power, said Tim Linder.

“THE INTAKE ITSELF— WITH RUNNER LENGTH, TAPER, PLENUM DESIGN, AND SUCH—IS VERY CRITICAL TO MAKING THE ENGINE OPERATE IN THE POWER BAND THAT YOU WANT IT TO RUN.”

opening at the base plate. Plenum volume is usually tied to engine displacement in a naturally aspirated (NA) engine, while boosted engines have their own formula.

Overall, these dimensions have to work with each other to achieve ideal power for the intended rpm range, and there will be compromises that the engine builder must choose between.

“I think the biggest thing to emphasize is there are often trade-offs based on the application. We always want to utilize pulse tuning, ram-effect, and optimize plenum size, but the manifold also needs to fit,” said David Visner of Visner Engine Development, Kentwood, Michigan. “For example, if you have a small-tire boosted car, the better trade off may be to have a larger plenum and runners that are technically too short. The development of these manifolds is a work in progress. We are just trying to learn more and build better stuff all the time.”

“On a nitrous motor, we tend to make the plenums somewhat smaller because they usually come up against a real tight converter on the brake,” said Linder. “And if you make the plenum as big as you would for an NA motor, a lot of times, they would sneeze and cough up against the brake and not leave clean. So sometimes it’s things like that, that we have learned over the years. For us, everything is more about notes from feedback and stuff that’s worked in the past versus a mathematical formula.”

Conducting A-B tests on intake manifold design can get expensive if a new one is built with only a slight variance in the

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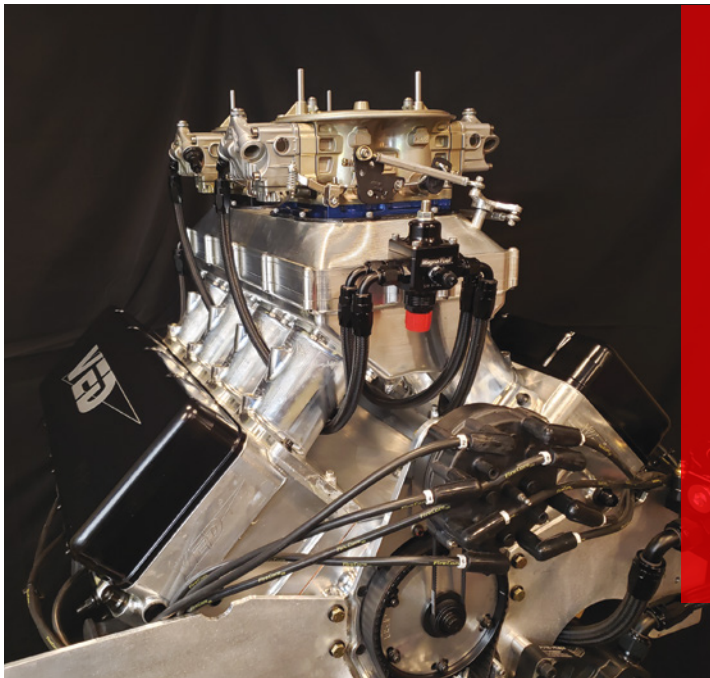


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Visner Engine Development builds more than 100 intake manifolds a year and will leverage previous designs in coming up with the correct intake for a specific application. The shop may need the engine long-block to measure critical dimensions before entering the project into CAD.

dimensions. It's certainly more difficult than changing camshafts. Yet, lessons can be learned. BES worked with a 410-cubic-inch NA engine used in truck pulling, and the customer wanted more rpm.

"We shortened the runners a quarter-inch and gave it another 200 rpm more usable power without sacrificing any peak torque," recalled Bischoff. "Below peak torque it dropped, but an engine really operates efficiently at no more than a 1,500-rpm range. That was a LS engine, and it's more critical in a NA engine. But a quarter of an inch can make a difference."

Drag racers are driving much of the innovation in the intake market with increasing use of boost and freedom to use nitrous oxide when rules permit. They also have a choice between EFI or carburetors in chasing quicker times.

"Drag racers have gone to a lot more boost and fuel injection," noted Wilson. "You can be a little more creative, but you still have to worry about puddling fuel and getting fuel vaporized into the cylinder. But we've also worked with NASCAR and IndyCar teams, so we have a very good understanding of where and how fuel enters the combustion chamber."

"A carbureted naturally aspirated manifold is about keeping a strong signal to the

carburetors with plenum sizing along with runner length and taper," added Visner. "EFI manifolds also rely on runner sizing but can tolerate larger plenums. Front entry manifolds have issues with the Helmholtz Effect, which creates pressure drops on the front cylinders. This makes the entry and plenum shape very important. With experience, we learn whether it's more

important to oversize the plenum a little bit to slow down the air speed to help hole-to-hole distribution issues, or to target pulse length tuning for ram effect."

"With EFI, you don't have the signal to the carburetor, which is a big difference," noted Lastor. "More guys are going to front entry on their EFI manifold, and also for nitrous. It's a different way, compared to throttle bodies on top of the plenum. Pro Stock did it, so they're thinking they want to."

Bischoff recalled a LS engine with a pair of four-barrel carbs that was in the shop for an EFI conversion. There were two manifolds to test.

"What worked for carbs isn't necessarily going to work with EFI," said Bischoff. "The shorter, larger runner made more power with a carb, and it was exactly the opposite with the fuel injection. It just shows that you're tuning waves, and the charge isn't as heavy in the plenum area and at the start of the runner with the EFI in relation to carburetion."

Another type of forced induction that may require a custom intake is a supercharger. "An unusual one is a manifold for a Roots-style blower. There's nothing crazy about them, they just require a lot more bracing," said Linder. "Trying to get a sheetmetal manifold strong enough to survive under a 14-71 blower is difficult."



The two-piece F16 intake manifold for LS7 and LS3 cylinder heads from Frankenstein Engine Dynamics is extremely flexible, as it can be shipped in one of 64 different variations to the engine shop. Shown is the dual 90-mm throttle body setup with 16 injectors—eight in the runners and eight in the plenum.

“THIS CUSTOMER PRESENTS US WITH A GREAT OPPORTUNITY TO COMBINE DIFFERENT SUCCESSES IN DIFFERENT TYPES OF ENGINE PLATFORMS AND ROLL THEM INTO ONE NEAT LITTLE PACKAGE.”

Frankenstein Engine Dynamics in Weatherford, Texas, offers billet intake manifolds, but they're designed with a cost-cutting strategy that also allows for some customization.

“We try to make all of our manifolds modular, which allows us to put together the best combination of pieces,” explained Jesse Meagher. “It becomes a semi-custom intake where we might have runners suited to a particular cylinder head and rpm range. And we may have a plenum suited to a certain displacement. That allows us to manufacture manifolds at a higher volume and keep the price down.”

The company will still work with a customer seeking a one-off intake for a specific application, although Meagher admitted, “we don't do a lot of that because the cost and time are more suited to smaller companies.”

Customers may have a few options with a Frankenstein billet intake, such as throttle body size. When Frankenstein does work on a custom intake, it will leverage the R&D into production intakes.

“We already have our cast products in production right now. We just finished developing a two-piece small block LS/LT spider-style manifold that is going to have a large variety of tops to support carburetors or different throttle bodies,” said Meagher. “We'll have billet elbows for the ProCharger guys. We've taken our modular approach to the casting realm. Now, you can get a two-piece cast base, and I have four or five

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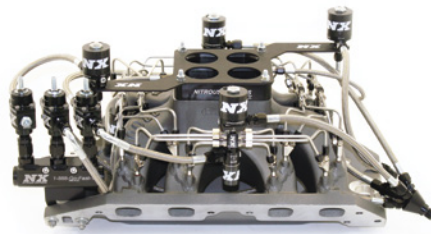
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INTAKE MANIFOLDS



Brodix doesn't offer custom work, but many of its castings are shipped to cylinder head shops for custom porting or to nitrous companies for custom plumbing. This Brodix Big Duke intake is set up with three stages of squeeze by Nitrous Express.

different cast-top options that allow me to mix and match to give the best of both worlds."

Right now, Frankenstein is developing a proprietary cylinder head/intake manifold package that will fit the rules of an unspecified NHRA class. "We're defined by the rules of the class, and it's up to us to explore all of the gray areas and loopholes that we can," said Meagher. "They've made some recent changes to the class, so it's opened up quite a bit. It allows us to take aspects of many different projects over the years and combine them into something that was previously very restrictive in terms of things like valve angle and general engine layout. This customer presents us with a great opportunity to combine different successes in different types of engine platforms and roll them into one neat little package."

CUSTOMER MODS

There are other major players in the cylinder-head business that manufacture

intakes but don't have a custom shop to develop billet or sheetmetal intakes for specific one-off applications. They offer production cast intake manifolds designed to complement unique features on their cylinder heads and will leave additional modifications up to customers.

"We're struggling just to keep up with current orders," said Mark Fretz of Brodix, Mena, Arkansas, adding that shortages in the intake market increased the demand at his plant by up to four-fold in some applications. "Most of the product that leaves us will go to a head-porting shop where they cut them in half, port them and weld them back together. We also supply manifolds to the nitrous companies so they can plumb them."

Michael Green at Pro-Filer Performance Products in New Carlisle, Ohio, said some of the company's cast-aluminum intake manifolds were engineered with custom design cues. "With our big block Chevy tunnel-ram manifolds we're able to provide a manifold that will make the power of a custom sheetmetal intake for a fraction of the price," said Green, noting that versions are available that cover standard and spread-port heads along with different deck heights. Pro-Filer and Wilson even collaborated on a small block Chevy single-plane intake for conventional 23-degree heads. "We make it, Wilson designed it."

Companies will leverage other types of teamwork to improve their products. Wilson's engineers are in contact with racers and often compare notes and test results.

"We're not under the illusion that teams will bolt on an intake and be happy with it," said Wilson Manifolds engineer Robbie Mansfield.

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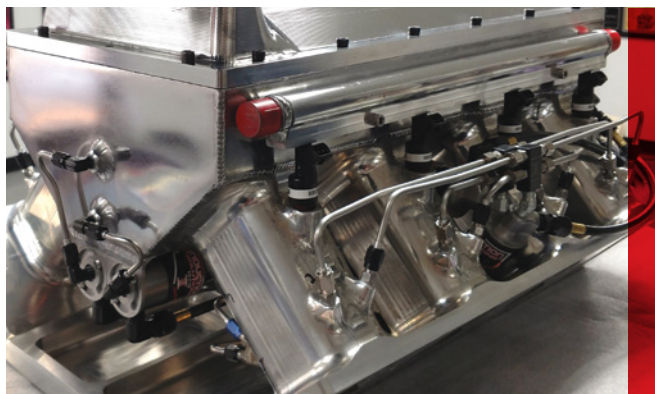


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This fully customized intake manifold from BES is equipped with EFI and six stages of nitrous. "There's a lot of power in the intake manifold, and that is why we build custom intakes," said Tony Bischoff.

"They're going to compare it against everything they've ever run."

Some shops are scaling back their custom intake business. According to Bischoff, BES is building custom intakes only for customer engines built in the shop. Lastor noted that TRE's turnaround time is now six to eight weeks for a custom intake but may take longer for unusual applications.

"Some of the older engines, like the Ford FE, they're harder to do," said Lastor, adding that sourcing raw materials at the right price remains inconsistent.

In the end, the definition of a custom intake manifold in today's race market can be as glamorous as a full billet piece that shines like a diamond and has precise dimensions that were calculated by an expensive CFD program. Or it could be as blue-collar as an off-the-shelf cast intake found at a swap meet but is now in the hands of an experienced head porter. Yet, the objective is the same for both.

"Some people just don't realize the power they've left on the table with the wrong intake manifold," concluded Wilson. **PRI**

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COLLABORATIVE EFFORT

Producing customized exhaust solutions requires a team-oriented approach between component manufacturers and their customers that begins with just the right questions about where—and how—each pipe is going to fit.

By Jim Donnelly

Left by themselves, the pieces that go into exhaust systems for racing or other high-performance applications are both basic and esoteric. Most everybody starts with pretty basic pieces of flat or tubular steel. To the uninitiated, the process of getting the perfect exhaust system is a little like trying to make spaghetti out of wheat grains.

For a visually simple component, creating a custom performance exhaust system is first an exercise of making it fit into a precisely measured location, squeezing into a frame that could be a short-track Late Model, a dragster, or even a pro-level pulling tractor. The packaging consideration will determine which tubes, bends, and flanges that exhaust supplier presses into service for the project.

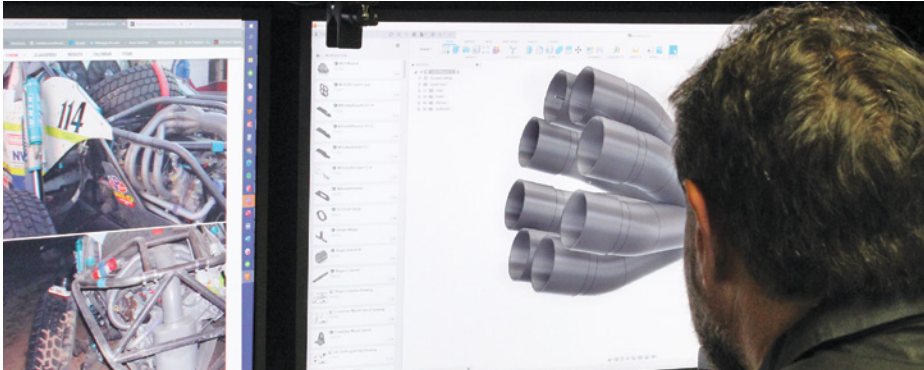
That's not all. The operative word in this idea is "performance," which means that the supplier—and the end customer—must have a firm idea of what the custom installation needs to help the muscle engine scream with power. Exhaust system design demands close collaboration between supplier and customer, and a built-in evaluation process that helps determine whether the combination of parts is really going to work. For that to happen, the end customer, who could be a race engineer or a serious hot rodder, has to somehow convey the space on the vehicle where the exhaust is going to fit.

That packaging decision, and its effect on end performance, is what the testing process for these components is all about. At one time, it was largely limited to eyeball engineering and pure guesswork. Smart suppliers in today's aftermarket industry work hand-in-glove with their customers to create intelligent exhaust solutions, even on a chassis-by-chassis or car-by-car basis. It's all about process, starting with the critical questions about which pipe's going to fit where, and how.

At Burns Stainless in Costa Mesa, California, Vince Roman has a technology-driven technique for assuring that a custom exhaust design proposal is viable, also relying significantly on input from the intended end customer.







To design its exhaust systems, Burns Stainless uses a program called X-Design, which evaluates engine parameters—bore, stroke, compression ratio, cam specs, and more—to determine tube length, tube size, and collector and exhaust size. “We talk with the customer to make sure we have the proper data, and then design the header,” said Vince Roman.

“Our customers are very unique,” Roman said. “We sell to customers who have custom engines installed in custom chassis, including some things from the Harley-Davidson market. Our components have to work on their unique, one-off system. There’s no dyno testing for that. But what we have done is put together a program called X-Design, which is a parametric design model. We’re looking at bore, stroke, compression ratio, camshaft specs, port sizes, power, and rpm targets. The program specifies primary tube length, tube size, whether or not to run a step header, along with collector and exhaust size. Usually, we talk with the customer to make sure we have the proper data, and then design the header.

“Our predominant customers are drag racers, Pro Stock to Top Sportsman, but we also have boat racing, tractor pulling, road racing, and so forth,” Roman continued. “Usually, the customer or fabricator deals with packaging issues. We determine tube size, tube length, collector size, and exhaust size, and then we put together a kit with flanges, collectors, and bends that builds to their particular packaging constraints.”

MODELING SUCCESS

The onrush of technology has taken most of the guesswork out of the evaluation process. In many cases, it has also eliminated or limited the onetime standard need of dyno-testing the engine with a variety of exhaust pieces hanging from it.

Current engineering software allows the evaluation and testing procedure to take place even if the customer and supplier are divided by a continent. That’s how Ultimate Headers of Berea, Ohio, handles the challenge.

“In many cases—and I’ll use Art Morrison Enterprises as an example—they will create a model of a chassis with an engine and steering components installed,” Jim Browning Jr. said. “They send that to us, and we then design a header in SolidWorks. I’ll send them a solid model back, see if everything works, then build the first one. It’s done in engineering software that has the complete header designed and packaged, which they can fit back into their model



Burns Stainless customers “are very unique,” Vince Roman said. “We sell to customers who have custom engines installed in custom chassis. Our components have to work on their unique, one-off system.”

to see if it works. We’ve done this with customers including Art Morrison, Roadster Works, and Speedtech Performance.

“From start to finish, the process usually takes about two days when I have all the data,” Browning continued. “I don’t flow bench test everything. Quite frankly, they’re all very similar in the overall package. There’s not that much of a variation in them. We’re usually looking at 1 7/8-inch primaries, 3/8-inch collector, and it’s got to fit. We’re not building race car parts where we’re looking for 1–2 more horsepower. Our customer base is pro touring, autocross, so we never get complaints from those customers about horsepower.”

One ongoing project at Ultimate Headers is the development of a long-tube header for a Fox-body Mustang, using the new Ford 7.3 Godzilla engine. It’s a performance version of Ford’s existing Super Duty truck engine being designed by Willis Performance Enterprises, where the final Ultimate Headers long-tube design will eventually be tested on a dyno.

MANUFACTURING TO CUSTOMER DESIGNS

“Our business is mainly the processing type,” explained Gavin Lau of Jiawen Performance Industries in Shanghai, China. “In other words, it is processed and manufactured according to the requirements of the customer’s drawings or samples. That’s even true for the OEM customers that we have now.

“The general operation process is that they send us the designed drawings or hand-designed samples, and we produce new samples according to their drawings or their samples,” Lau continued. “They test all samples by themselves, and after passing the test, then tell us that we can produce the order. If the test fails, they will tell us what needs to be modified, and then we will remake the sample and send it to the customer until the sample is ultimately confirmed and approved. In the whole process, product design and development, testing, and after-sales service are the responsibility of the customers themselves. We just process and produce their own designed products for them.”

Utilizing a supplier’s customer base as

the foundation for testing new components is the strategy of Specialty Products Design (SPD) in Rancho Cordova, California, which started out building specialized systems for Late Model oval racers before adding components for NASCAR's then Busch and Winston Cup applications. Now primarily focused on drag racing, but with other specialties including exhausts for air racing, SPD practices exhaust building across broad disciplines, always with an eye on maximizing performance.

"In real time, most of us are not inventing anything new anymore," Chris Hill said. "They're projects now that establish the performance difference between running a four-into-one collector and a tri-Y collector. In most cases, we're utilizing customers as the basis of our testing—trying different setups on our existing customers. Oftentimes, it's changing from four-into-one to four tubes into two tubes into one collector. There are benefits for each, but each changes because of mechanical changes inside the engine, such as cam and valve timing. It becomes a collaboration between us and the engine builders. We've already developed relationships with our customers in terms of buying products.

"We've been here at SPD since the early 1990s," Hill added. "There was a time when everyone started running crate motors. We worked with two or three engine builders for Late Models in the Midwest to come up with a system for them that worked very



Much of the design—and even testing—of today's performance exhaust systems is done by computer. At Ultimate Headers, design is done in SolidWorks. "I'll send [the customer] a solid model back, see if everything works, then build the first one," said Jim Browning Jr.

well. Eventually, they made the headers that we were building for the vehicles running because there was that much benefit in them based on the time that we'd put in with the engine builders. They had 25 to 30 horsepower extra with these exhausts."

MONEY-SAVER

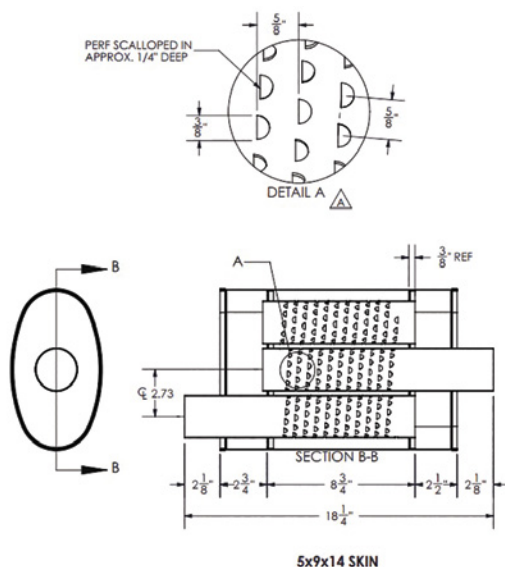
The business model at Performance Tube Bending (PTB) of Irwindale, California, is a little bit different because the company no longer produces its own brand of exhaust components for the aftermarket, which it once did by selling a Lexus-specific exhaust system under the PTS brand. At PTB, components are

now produced to match the packaging and performance parameters that the customer has determined on his or her own.

"We have very limited product. We private-label and make whatever the customer has designed and tested," Jim Renella said. "We don't make or sell an aftermarket exhaust system. We had the Lexus system we designed under the brand of PTS.

"We're old school. We do it here the trial-and-error way," Renella continued. "We don't stray too far from OEM. Obviously, the mandrel bending process helps the performance because it doesn't limit airflow. OEMs can have crush bending, which also interferes with airflow, so we can help by creating an exhaust system for the customer that's mandrel bent instead.

"I prefer to work with prototypes that I fixture and duplicate from beginning to end," he said. "I try to provide the components in the sense of providing a merged collector versus two-tubed. I always try to help every customer in the least costly manner to manufacture their exhaust or eliminate compound bends, so they won't have to deburr and weld. That will help the customer save money. We're a one-stop shop for the fabricator, who can buy exhaust sensors and flanges from us. If a guy's building a hot rod, he can buy our bends. We have street rod builders and fabricators, plus local race teams. We've got a lot of hot rod shops that come here and purchase from us." **PRI**



Jiawen Performance Industries manufactures exhaust components "according to the requirements of the customer's drawings or samples," said Gavin Lau. The system's design and development, testing, after-sales service, and so on, are the responsibility of the customers.

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WHEN VIRTUAL BECOMES REALITY

From training rigs to engineering studies, simulators have become commonplace in racing. As more motorsports organizations look to leverage the increasingly sophisticated technology, it's poised to become an integral development tool for a variety of applications in the real world.

By Bradley Iger

Simulators have long been used by teams in the top tiers of auto racing to help drivers hone their skills when they're not on-track, but recent advances have opened up their potential use to a much wider range of possibilities.

NASCAR has been one of the technology's most ardent proponents, not only creating the eNASCAR platform for esports competitors—some of whom have used their online racing success as a pathway into racing careers in the real world—but also for uses that have changed the organization's approach to development challenges faced outside of the virtual space. For instance, the track used at the Busch Light Clash at the LA Coliseum earlier this year was developed and tested in simulation to prove its feasibility long before construction began. Likewise, the 12-turn, 2.2-mile street course that will see racers from the NASCAR and IMSA series blasting through the streets of downtown Chicago in

2023 was actually originally designed for the eNASCAR Pro Invitational Series.

These advances in simulation technology within the motorsports realm haven't come by way of state-of-the-art military training equipment or highly bespoke software, but from a subscription-based online racing simulator for Windows PCs called iRacing.

"When we started the company back in 2004, the goal was to create a racing simulation that was truly authentic," explained Steve Myers of iRacing, Chelmsford, Massachusetts. "The person who was really instrumental in taking it to that next level was [NASCAR's] Ben Kennedy. He's the guy who was willing to take chances and look at things through a different lens to see how that could benefit him and his company. He looked at it from a driver's perspective first, as a way to learn tracks. I remember him telling a story about how he was going to a race at Five Flags Speedway,

and he was using a spray-painted mark on the track as a reference point in the simulator, and then he went to the real track and ended up using that exact same mark as a reference point in the real world. I think that really resonated with him."

Over the years, iRacing's modeling capabilities have reached a level of sophistication that has allowed engineers to use the service as a test bed of sorts. "When NASCAR was working on the Next Gen car, its R&D department used iRacing as a way to help make decisions about the development of the car," Myers added. "That naturally progressed into the realization that they could use iRacing to prototype ideas for changes to tracks, and that they could have a design completed before they ever moved a shovel-full of dirt."

Mike Burch of Speedway Motorsports in Concord, North Carolina, noted that the granularity of iRacing's modeling data



Image courtesy of iRacing

has moved simulations from a general approximation of a vehicle in an environment to a faithful virtual representation that can be relied on when the rubber actually meets the pavement.

"It's not just simulating the traction of the asphalt and all of the physical properties of the track," he explained. "The cars' dynamics have become much more accurately simulated, and it's also able to simulate things like atmospheric conditions. It gives you a very accurate idea of how all of these pieces are going to interact on track. We just finished a project in Atlanta with the team at iRacing where we put some ideas into the virtual world and had drivers compete on that layout to see how it raced. We learned a lot and made a number of changes to real-world courses as a result—some subtle, some not so subtle. After a few races there it's clear that we've hit on something. The racing has been really

exciting. A lot of the credit goes to the fact that we were able to go in and test it out before we spent the time and money to start moving the dirt."

Both Myers and Burch see this approach as a model for future track development, but the potential doesn't stop there. "Another project we're working on is something that actually started out as a tool for our vehicle dynamics engineers to use," Myers said. "We've been developing this as a way for them to take measurements of the cars and plug them into the tool to generate these car models for the simulator. What I realized as we were building this was that it has a practical real-world use for race teams and manufacturers who might want to build their own cars within iRacing and test various concepts privately within the simulation. This will allow the teams to literally build out the entire car. All of it can be custom built by them to match the specifications of their

equipment. So it is not about just having to rely on what we have already built; it provides them with the tools they need to build it themselves."

FUTURE IMPACT

Meanwhile, Burch pointed out that these new abilities could have a profound effect on motorsports development down the road. "It really comes down to the accuracy of the data," he said. "When we started licensing our facilities with iRacing for the sim, it used to be a matter of inches. Now it's a matter of millimeters, and it's only going to get better. At this point we can virtually build the cars, and it's not like, 'OK—let's scan the outside and give it these characteristics.' It's, 'Let's build a virtual engine out of virtual parts.' It's not a 'mass' of a car anymore, it's actually made up of thousands of individually simulated components, and you change the individual aspects of those components to see how it affects the behavior of the car, and how multiple cars of that configuration race together."

He added that the ability to develop both the track and the car in simulation offers many new possibilities. "It's something where you could also kind of reverse-engineer it," Burch continued. "We could say, 'OK—we've got this track, but what's the optimum car to race on this physical layout? What other types of racing might be interesting on the Roval at Charlotte, or at Sonoma, or on the half-mile at Bristol?'"

As the technology continues to mature and becomes more accessible over time, Burch expects it to find its way into increasingly affordable levels of motorsports. "Eventually this stuff will get down to the hobbyist racer." **PRI**

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MEMBER CHECK-IN

FIFTH THIRD BANK

This institution's commitment to racing ranges from backing several teams to providing a suite of services that benefit motorsports businesses, all enhanced by its newly acquired status as a PRI Founding Member.

By Jim Donnelly

Business—any kind of business—is all about building alliances with prospective partners and securing the resources to meet laid-out goals. Nothing happens in racing, or anything else, without a proper foundation of financial strength. More than most lending and financial institutions, Fifth Third Bank, headquartered in Cincinnati, Ohio, has a deep grounding in providing fiscal guidance not only to business partners in motorsports, but also to everyday customers who just happen to really like racing. At this bank, motorsports is more than just a marketing tool.

"Because of the nature of our business, originating in the Midwest and being more than 160 years old, we've been assisting automotive or racing businesses for a long time, starting in Ohio and now in the Carolinas where a lot of NASCAR is rooted," Fifth Third Senior Vice President David Morton said. "But we didn't have a real focus around it with a motorsport practice like we do today

until about 2010, when we started a banking relationship with what was then Roush Fenway. They ultimately moved their banking to us."

It was the first step in a process that led to Fifth Third Bank becoming a lead sponsor on the No. 17 Ford Mustang driven by Chris Buescher of Roush Fenway Keselowski Racing in the NASCAR Cup series. Fifth Third is now in its 11th year as a partner of RFK Racing. Based on that success, Fifth Third has since landed as a sponsor of Rahal Letterman Lanigan's IndyCar program, and also backs the NHRA Top Fuel dragsters of Doug Kalitta and Shawn Langdon at Kalitta Motorsports. "It's a business-development platform that's unlike any I've seen," said Morton. "It accelerates the sales cycle, and it makes us an authentic part of the motorsports community."

Gaining that level of credibility and public acceptance in the racing world is what compelled Fifth Third—the name comes from the two predecessor banks that merged in 1871 to form it—to join forces with PRI and achieve Founding Member status.

"We've been involved with PRI for at least eight years now, and as far as being a Founding

Member, it provides a meaningful platform for building meaningful relationships with key companies and decisionmakers outside of the PRI Show, including drivers, because the best way to help the industry is by building these relationships," Morton explained. "Beyond that, we view it as a badge of relevancy and authenticity, which we've stepped up by being a Founding Member in support of racing."

Motorsports is much more than advertising to Fifth Third Bank. It offers banking services directly aimed at racers, as Morton described: "Helping companies gain access to capital with financing or other means to grow their business is an important and valuable service. We also provide a range of solutions that enable companies to improve their efficiency and cashflow through better, smarter accounts payable and accounts receivable processes, including business credit cards and automated AP/AR systems. For businesses looking to expand their business through acquisitions or perhaps sell their business, we have robust capital-markets expertise, including access to our complimentary business transition advisory team to ensure business owners maximize their personal wealth upon the sale of their business."

With a pandemic-upended global economy and the related, chronic supply issues, racing executives need partners to help them navigate the undulating fiscal landscape, something else Morton said is a Fifth Third specialty. "It all comes back to advice," he said. "Over the past several years, we certainly helped thousands and thousands of small businesses survive by helping them navigate the Paycheck Protection Plan loan process. More recently, higher interest rates, supply-chain issues, rising costs, and labor shortages have been top of mind for most businesses,



Working closely with the motorsports community, Fifth Third Bank is "helping companies gain access to capital with financing or other means to grow their business," according to David Morton. The bank also provides a range of solutions for companies to improve their efficiency and cashflow through improved accounts payable and accounts receivable processes. Fifth Third Bank recently became a PRI Founding Member because "it provides a meaningful platform for building meaningful relationships with key companies and decisionmakers outside of the PRI Show," Morton added.



What began as a banking relationship with Roush Fenway evolved into Fifth Third Bank becoming the lead sponsor on the No. 17 Ford Mustang driven by Chris Buescher of Roush Fenway Keselowski Racing in the NASCAR Cup series. The bank has since expanded its sponsorship into IndyCar and NHRA. "It's a business-development platform that's unlike any I've seen," said David Morton. "It accelerates the sales cycle, and it makes us an authentic part of the motorsports community."

including racers. We are addressing this for our clients with creative solutions from asset-based lending to offset higher inventory levels, to supply-chain financing to ease cashflow, and to interest-rate hedging to better manage risks during a rising rate environment."

Morton said that some Fifth Third customers are pulling back on borrowing, but he added that this offers opportunities in areas such as foreign exchange and commodity hedging as buffers against rising interest rates. "We also believe that now is the time to invest in ourselves to benefit our clients long term, including being well-capitalized while also making smart investments in technology to provide an even better customer experience."

Fifth Third has given back to motorsports consistently, through philanthropic giving including Speedway Children's Charities, the NASCAR Foundation, Jeff Gordon Children's Foundation, Motor Racing Outreach, and the North Carolina Motorsports Association, on whose board it has served for 10 years. Fifth

Third also regularly provides complimentary financial education courses for racers. Mergers and acquisitions are expected to remain strong as aging business owners cash out, and outsiders represent today's new infusions of capital. The trend toward electrification will benefit racers who move first to embrace it, he predicted.

All of this leads Morton to express confidence that despite some current rockiness, racing will ultimately thrive. "During COVID-19, racing thrived, bringing new fans into our sport," he said.

"NASCAR, with the Next Gen car and new tracks, has had some of its best racing ever. Fueled by Roger Penske's vision and passion, IndyCar is poised to reach a new high," Morton predicted. "New teams in NHRA are bringing excitement to the series, challenging the proven titans of the sport. And the heart and soul of motorsports, grassroots/short-track racing, has been amazing with great racing and fan enthusiasm." **PRI**

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PRI MOTORSPORTS RETAIL BUSINESS SURVEY: **GENERATING BUSINESS AT THE TRACK**

In an age of advancing technology, doing business person-to-person may be viewed as outdated. Nonetheless, it remains one of the most effective methods of activating sales, especially at the race track.

—
By Bruce Martin

In a world of Skype calls, Zoom meetings, Facebook pages, and Instagram Reels, there are more ways than ever for racing entrepreneurs to conduct business from afar.

But for many of the most successful business owners in the performance industry,

nothing beats personal relationships. That is why it's still important for them to be at the race track to improve a company's overall business strategy.

It's the personal interaction, the handshake, the looking a customer straight in the eye,

and the real-time problem solving that can't be beat in business.

"You keep in touch with your customers," said Bernie Stuebgen of Indy Race Parts, Indianapolis, Indiana. "If they have a question or a parts failure, you are able to be there



Photo courtesy of Track First

and understand what the issue is. It's easier being at the race track to diagnose and help a customer or to see what the issue is as opposed to trying to watch it on the computer, or have him try and call you, or you get hearsay. It's better to be in touch with them by being at the track."

Stuebgen understands the importance of conducting business the old-school way. "I go around and call myself the mayor," he said. "I shake hands and ask the customers how things are going and ask them if they are happy or whatnot. If they have any questions.

"We don't have a parts truck that goes to the races, but we hand deliver lots of parts to the races when we go to watch," he added.

In addition to owning and operating Indy Race Parts, Stuebgen also owns a race team and serves as the crew chief. In turn, that has helped him expand his retail business.

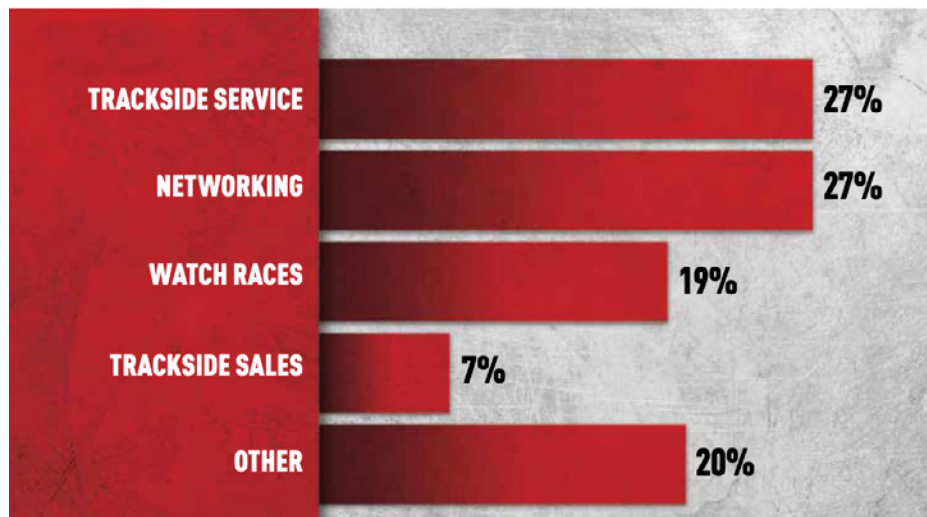
"We can try things on the car and see how they work," Stuebgen said. "I'm a pretty open book. My wife gets mad at me. Whatever we do, whatever I try or whatever parts, I share that information with the customers.

"We're really busy at the shop," continued Stuebgen, "so I don't get to race as much as the other guys, but we still race 30 times a year."

Stuebgen's job duties don't stop there. He is also the co-promoter of Terre Haute Action Track, the half-mile dirt oval in Terre Haute, Indiana, so he is at all the races at that famed track.

Stuebgen cited several examples as to

WHAT IS YOUR PRIMARY FUNCTION AT THE RACE TRACK?



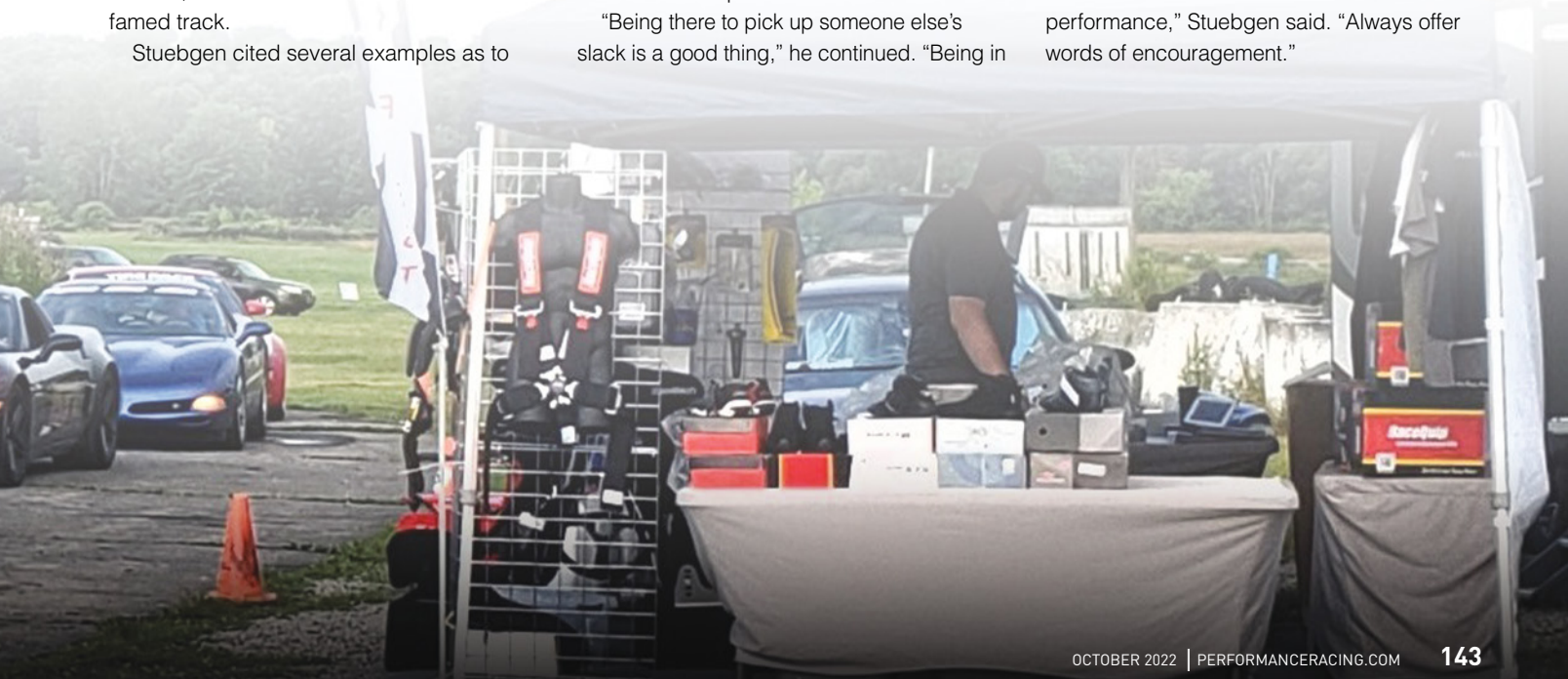
Participants in PRI's annual Motorsports Retail Business Survey cited "Trackside Service" and "Networking" as their top priorities at the race track, as noted in the accompanying graph. Other trackside functions that received multiple mentions were "Competing" and "Crew Chief," among others.

why it is important for him to be at the track as far as business is concerned. "You get to the race track and some customers might be customers of the competition, and they are not happy with their service," he said. "I've gone to the races and ended up selling someone a couple of race cars.

"Being there to pick up someone else's slack is a good thing," he continued. "Being in

the right place at the right time, that happens in everyday circumstances of living."

He is always willing to share his expertise with racers, including new entrepreneurs, about what they should and shouldn't do when conducting business at the track. "You should never criticize a customer on their performance," Stuebgen said. "Always offer words of encouragement."





Doing business at the track means more than bringing parts to customers, said Bernie Stuebgen of Indy Race Parts. He also owns a race team, which enables him to “try things on the car and see how they work. Whatever we do, whatever I try, I share that information with the customers.”

VISIBLE IN VICTORY LANE

Larger companies, such as Rocket Chassis and Mark Richards Racing, Inc. in Shinnston, West Virginia, feature an elaborate and sophisticated website. But for Steve Baker, the importance of being at the track is one of the reasons Rocket Chassis has become the most successful dirt track car in racing.

In 1986, Richards and Baker started the business with the goal of producing the fastest dirt late models in the United States. Nearly 5,000 chassis later, Rocket Chassis has become the winningest dirt late model manufacturer in the world.

Baker has five people who travel to the tracks to conduct business. The company has 22 employees. “We are racers providing services for racers,” he explained. “They are local racers going out racing that represent our company.

“That’s our advertising,” he continued. “That’s how we advertise our product, being at the race track.”

He stressed, “You have to be visible.” Nothing is more visible and validates a

product better than winning. With all the success Rocket Chassis has enjoyed since 1986, it is the best way to market its products.

PROOF IN ACTION

The main focus of Wasted Diesel of Huntington, Indiana, “is diesel repair for pickup trucks with the pursuit of performance,” said Chris Hoffman. “We are pushing the performance side of it more and more as we grow.

“Being at the track is significant because it’s a proof of concept and proof of parts, proof that we know what we are doing and the parts work really well.”

With its location in the hotbed of racing in Indiana, Wasted Diesel can focus on both racing and tractor pulling, along with its street-based clientele. “We do a lot more with the street stuff, guys who want to play with their dailies,” Hoffman said.

“I’ve been doing the diesel stuff 10 years now,” he continued. “I go to events, but it’s based on what my schedule allows me to get to. It’s been just a handful. I’m short-staffed

and so busy that it makes it hard to get there and get everything together and ready for the track.”

BUILDING AWARENESS

Track First in Richfield, Ohio, opened in 2013. The company sets up displays at Pittsburgh International Race Complex, better known as Pitt Race, the Mid-Ohio Sports Car Course, and at local drag strips, asphalt, and dirt tracks in the area.

The company is the official trackside support for the Northeast Great Lakes NASA tour. It specializes in safety apparel and other safety equipment for drivers and cars.

“It’s important to be at the track for awareness,” Sally Wadsworth said. “Our business grows through word-of-mouth from it. We’ve done Facebook and all the other social media, but being at the track, people are very grateful we are there.

“It’s not something we sell a lot of things at. It’s awareness and helping the community,” she stressed.

It’s important for Wadsworth to take enough inventory to each race, predicting what parts may be needed for racers as well as keeping helmets, fluids, and the basic trackside essentials in stock. Her son deals with electronics and shoes.

The display tent is a miniature version of their showroom. “We have samples where people come, they can get fit, and they can feel it,” Wadsworth said. “They can take it if we have it, but on the whole we dropship items.

“Woody Hyman, in the MX5 Cup, we met him at an auto interest event at Mid-Ohio about seven years ago,” she continued. “We introduced him to NASA. He has since moved into endurance racing. He still comes back to us to get all of his safety equipment, and now he races MX5 Cup.”

Wadsworth looks for events that are most useful to grow the company’s customer base, such as NASA and SCCA competition, but not pro series racing.

“My advice to other businesses is they should show they are there to help, rather than to just sell,” she said. “The motorsport community is one degree of separation, not six degrees. Everybody knows everybody.

“Most people are very loyal and have a great experience from it. Most people

return to us. We have a great return rate in our customers because they know we are authentic. We're not just trying to sell them T-shirts and helmets," Wadsworth added.

NEED TO BE SEEN

Todd Sherrer of Everything Horsepower in Abercorn, Quebec, Canada, takes the "out of sight, out of mind" approach as a reason to be at the track. He realizes it's important just to be seen at the races.

"It doesn't take long for people to forget about you," Sherrer explained. "It's great exposure, especially if you can do something good while you are there. You become irrelevant quickly if you are not participating and showing your wares."

Sherrer has been in racing since 1984 and has operated out of his current shop since 1993. His role at the track is easy to explain. "We are racers, and we end up providing service," he said. "A lot of clients bring our cars here [to the track]. We end up doing a lot of tuning and service at the track. People always need help with suspension and engine stuff.

"I'm the old-school guy. I stay with the carb stuff, and my son is the fuel-injection guy," he continued. "We cover everybody. We do full service from chassis to engine shop, fab shop. We do the whole car. If somebody comes in with a blank slate, we'll build them a car.

"We have a little bit of everything. The bulk of our work is the job somebody started and

didn't finish. That covers the gamut of people out there.

"I wouldn't say we have a majority of any one type of racing," said Sherrer. "Any door car, we are all over the place. We do a lot of the small-tire stuff. I don't think that makes us unique."

Although Everything Horsepower began as a restoration and engine shop, its focus has evolved. "If I look at the shop right now," Sherrer revealed, "it's all race cars. It's odd, but it gets us where we want to go."

Sherrer's main benefit of being at the track is picking up new work and meeting clientele. He doesn't advertise, so the track exposure is crucial.

"People come to me for parts and tires," he said. "That's all track exposure, that's the only advertising we are doing right now because we can't keep up with everything. It's 80% to 90% of what we do right now during the season.

While Sally Wadsworth (not pictured) is careful to choose the correct inventory for Track First's trackside displays, she said the display is really about building awareness of the business and helping the race community. "My advice to other businesses is they should show they are there to help, rather than to just sell," she added.



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Todd Sherrer of Everything Horsepower doesn't advertise, so being at the track is crucial to the business. "It's great exposure," he said, "especially if you can do something good while you are there. You become irrelevant quickly if you are not participating and showing your wares."

"Being at the track is very important if you want to grow your business, especially in the racing venue. It's everything."

For Sherrer, it all started out just to have some fun racing. Then it grew into helping other racers. "Our race car is 100% built here," he explained. "We always made it faster and faster because that is what we wanted to do. It has drawn a lot of attention, and we ended up building a clientele through that."

"We have a few customers that we babysit, for lack of a better word. Some of them really want you there to walk them through the weekend to get them from A to B. We've had good success with that, too. Once you win one event, they want you there every time."

"It's fun," Sherrer continued. "We like doing it. It's not all building the business, it's a personal passion thing for us, too."

Sherrer is also a strong believer in professionalism, which should be a top priority for any trackside operation. "Don't be unprofessional," he stressed. "Don't show up looking like a slob. Don't take junk leaking all over the place to the track and make yourself look like you shouldn't be there. If you are there representing yourself as a professional and a business, try to present yourself as a professional. That is the simplest piece of advice I can give anybody."

TAKE NOTES

Edward Bertram of K&E Sales in Clintonville, Wisconsin, has been in business

for 22 years. He is the trackside parts supplier for two dirt oval tracks in Wisconsin—Outagamie Speedway in Seymour on Friday nights and Shawano Speedway in Shawano on Saturday nights.

He is the epitome of doing business the old-fashioned way. "If you don't have a parts trailer and go to the race track, it's difficult to let those people know about your company," Bertram said. "Just because you have a Facebook page doesn't mean they are going to see it."

Bertram stocks tires, wheels, suspension parts, spindles, tie-rods, ball joints, tear-offs, radiators, fan belts, gaskets, as well as helmets and fire suits.

"You can't really predict what is going to sell on a given night," he said. "Anything can break, anybody can crash. A lot of times something never moves for months, but if you don't have it, you can't sell it."

Bertram has plenty of small-ticket items, but with more than 100 cars at some of his races, by the end of the night he can easily have \$3,000 or more in sales. "You could have 20 different people looking for little pieces," he said.

Bertram believes loyalty and territory are important. He does not go to any other tracks that already have a parts vendor. He expects the same in return.

He also has one key bit of advice to anyone in the parts business that conducts business at the track. "The most important

thing I think to anybody running a parts trailer is, every single item you sell goes on a notepad automatically," he explained. "Whether you have three of them hanging on a wall or 10 of them hanging on the wall, if you sell one part number, you have to write that number down so when you come back on Monday, you have enough inventory back in the trailer."

"Too many parts guys tend to forget to jot down the part number," he continued. "The next week when they go to the track and the guy wants to buy what they didn't write down, guess what? They don't have it."

"Also, pay attention to your customers. They will tell you what to put in," Bertram added.

Meeting customers, forging relationships, shaking hands, and getting to know the client base may seem "old school" by today's standards, but those business concepts have stood the test of time. **PRI**

SOURCES

Everything Horsepower

facebook.com/everythinghorsepower/

Indy Race Parts

indyraceparts.com

K&E Sales

kandesales.net

Rocket Chassis

rocketchassis.com

Track First

track-first.com

Wasted Diesel

wasteddiesel.squarespace.com

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PERFECTING THE ART OF CHASSIS SETUP

A proven system for gathering and analyzing data will help determine the best adjustments for your vehicle.

By Lynn Doughton

Like building a race-winning engine, race car handling is very complex. Teams struggle to master chassis setup week in and week out all over the world and in all types of racing applications. This is because many drivers don't even know what a good handling race car should feel like. All they know is that it's a battle. And, when teams "hit it" and find a good setup, they often can't repeat it after the car gets damaged. Setup work becomes a little like "black magic" at that point.

But setup work shouldn't be a battle. And it's not black magic. The problem is we've all been guilty of taking shortcuts. Rather than taking the time to analyze data to find the appropriate solution, we call "our guy" and ask what to do. I often ask, "What would happen if you ran your business like you run your race team?" The answer: You would go out of business (or, at the very least, make a lot less money).

Like your business, your race team needs a system—a proven approach to gathering and analyzing data with processes to implement the setup adjustments needed.

Measuring the rate of wheel load increase on a pull-down fixture is called the wheel load curve, which indicates the likelihood of grip loss.



WHERE TO BEGIN?

Chassis setup can be broken into two categories: balance and wheel positions. The crew chief's job is to set up the race car to obtain the optimum balance for the driver and the optimum wheel positions for the track and tire. Let's dive a bit deeper into these topics.

Vehicle balance: The race car's balance, which determines how the car rotates and maintains traction through turns, is driver-dependent ranging from loose (oversteer) to tight (understeer). Spoiler alert: If you put a driver with a preferred balance in an identical car with the opposite balance, the driver won't be happy (or win).

Dynamic vs. static balance: Traditional setup procedures measure the vehicle's balance on wheel scales at ride height (natural relaxed position of the suspension). This is effective, but it requires tremendous discipline. This is because you can adjust the balance statically to whatever you want it to be, but that doesn't take into account important factors such as spring rate, dynamic platform, bump stop loads, sway bar loading, droop limiters, and binds. This is why you can have two cars with the same static wheel weights and percentages in the shop but handle completely different at the track.

Another option is to measure the vehicle's balance in a loaded state, like it would be on the track. Many providers, including DRP Performance Products, do this by using a pull-down fixture to motion the chassis to a position it would see on the track at certain points, such as corner entry and apex. This allows providers to measure the vehicle's balance at that point, taking all the factors mentioned above into account. You get a picture of the true balance of the car at that point. You're measuring the results of your inputs, not just the inputs themselves.

WHAT'S MISSING?

Common feedback providers hear on dynamic scaling is: "But you can't induce all the forces that are happening on the track, so your numbers aren't right." And you're right—you can't mimic every force that's happening on the track. The good news, though, is you don't have to. Think of the pull-down fixture as an engine dyno. When you dyno your engine, you're not accelerating the car just like the driver does. The airflow is not just like it is on the track. The G loads are not there, the engine angles are not shifting as they do on the track. But what you do have is a good, consistent way to measure how much horsepower your engine is making in a controlled environment. That's what the pull-down fixture does: It allows you to measure the balance of the car, under loads very similar to the track, in a controlled, repeatable environment. Like the engine dyno, it allows you to make adjustments and see how the adjustments will affect the car—all before you get to the track.

Using a spring load machine allows the user to set the static and dynamic spring loads, expediting the setup process.





WHEEL POSITIONS

The other important set of handling inputs are the wheel positions. There's nothing more important on a race car than the tires. You can work on balance the rest of your career, but if you don't get the tires pointed in the right direction, you're not going to have a good handling race car.

Wheel positions include toe, rearend position, camber, caster, stagger, tread width, and more. Like vehicle balance, wheel positions are best measured dynamically as well. Wheel positions, however, are adjusted to what the tire needs to make the most grip. This will vary depending on the tire and track condition. Higher banking, higher grip tracks will need higher camber and air pressures. Smaller, flatter tracks will need less camber and air pressure, but more rear steer.

THE IDEAL SITUATION

With the technology available today, a short-track team can show up at the track, unload fast, and make only minimal adjustments with all the work done in the shop. Adjustments are pre-determined, and guessing is eliminated. DRP recently had a customer who had top-of-the-line equipment but had resorted to some shortcuts in the setup process. In the busyness of race season, this person failed to test changes in the shop. At the track, the changes weren't bad if the track had grip. As soon as the grip was lost, the car went from decent to junk. Back at the shop, after testing

Spring rate affects platform, which is an important component of balance and wheel positions.

the setup on a pull-down fixture, this customer found the left front was more than 500 pounds lighter than it should have been, and the rearend had negative steer. No wonder the car got tight! This racer optimized the right rear travel, added some travel to the left front, and had a completely different race car. That's to say the bad weekends could have been avoided with proper testing.

THE BOTTOM LINE

Everything on the race car works together as a system. You need the tires at optimum position and the loads balanced to the feel the driver wants. With the right measurements and the right system to interpret them, you can come really close to mastering the art of chassis setup...and do it in the comfort of your own shop. **PRI**

Lynnie Doughton is the chief steward of DRP Performance Products based in Bassett, Virginia. DRP manufactures advanced setup equipment and premium low drag hub components for the automotive racing industry. With more than 30 years of full-time racing experience, Doughton is passionate about making it easier to race competitively, growing car counts, and prospering our sport.

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ADVOCACY CORNER

Tracking legal, legislative, and regulatory developments impacting the racing and performance industry.

Edited by Laura Pitts

Performance Racing Industry's Washington, DC-based advocacy team, along with race track ambassador Tom Deery, work nonstop to protect and promote tracks, sanctioning bodies, and motorsports businesses around the nation. This month we are tracking several initiatives, including a new partnership with NHRA superstar Antron Brown to support vital legislation, a new appointment aimed at boosting PRI's political action committee (PAC) efforts, and an update on a PRI-opposed rule to phase out the sale of new diesel- or gas-powered cars in California.

NHRA TOP FUEL CHAMPION ANTRON BROWN PARTNERS WITH PRI, TESTIFIES IN SENATE HEARING

NHRA Top Fuel champion Antron Brown testified before the Senate Environment and Public Works Committee when it considered the passage of the Recognizing the Protection of Motorsports (RPM) Act on September 7, in Washington, DC.

Brown—a professional NHRA team owner and driver who has won multiple Top Fuel Championships—began his racing career about 40 years ago when he and his family modified street-legal motorcycles into dedicated race bikes. Like Brown, most of America's 100,000-plus racers begin competing in modified street vehicles as a cost-effective way to go racing.

Today, however, modifications are at risk from the Environmental Protection Agency (EPA), which maintains the position that it is not legal to convert production vehicles into race vehicles. Enter the RPM Act, designed to protect racing. (For more background information, visit saveourracecars.com.)

"The RPM Act is essential to the racing community, particularly for grassroots racers who are just getting started," said Brown. "It's imperative that we protect the ability for young men and women to be able to compete at the track. The RPM Act will give racers the assurance they need to continue this American tradition."

Brown was joined by his sons Adler and Anson, who compete in NHRA's Junior Drag Racing Series, and his wife, Billie Jo. He shared details about his family's personal journeys in motorsports, which includes four generations of Brown family



Antron Brown

members competing on the track. "I owe a lot to motorsports; there are many great lessons that come from racing," said Brown. "I'm urging Congress to help protect motorsports and ensure that it remains a viable pastime for all Americans by passing the RPM Act."

Brown's testimony follows racing legend Richard Petty's support for the RPM Act when he and SEMA CEO Mike Spagnola recently sat down with key lawmakers in DC to advocate for the legislation. PRI will continue to provide updates on the progress of passage of the RPM Act.

WADE KAWASAKI NAMED EXECUTIVE DIRECTOR OF SEMA AND PRI POLITICAL ACTION COMMITTEES

The SEMA Board of Directors has appointed industry veteran Wade Kawasaki to serve as the first Executive Director of SEMA's and PRI's respective political action committees. In this new volunteer role, Kawasaki will oversee each PAC's Board of Directors and fundraising efforts, reporting to the SEMA Board of Directors.

"The Performance Racing PAC is the first line of defense against anti-racing legislation," said Samantha Large, PRI and SEMA PAC Manager. "The more people



Wade Kawasaki

that support the PAC, the more we can get done in Washington. You may not care about politics, but politics cares about you. In other words, the racing community should pay attention to politics because there is a lot going on in Washington that will impact the future of motorsports.”

By law, PRI and SEMA may not use their funds to contribute to federal political candidates. However, each organization’s PAC allows its members to contribute personal funds that are used to help elect lawmakers who support its positions and initiatives.

Since its formation in 2021, the Performance Racing PAC has raised more than \$50,000 for the lawmakers and candidates who support racing.

For more information, visit saveourracecars.com or contact PRI and SEMA PAC Manager Samantha Large at samanthal@sema.org.

CALIFORNIA TO BAN SALES OF NEW ICE-POWERED CARS BY 2035

The California Air Resources Board (CARB) has voted to finalize a PRI- and SEMA-opposed rule to implement California Governor Gavin Newsom’s 2020 executive order to phase out the sale of new diesel- or gas-powered cars in the state by 2035. The rule requires 35% of new cars, SUVs, and small trucks sold to be zero-emissions starting in 2026, increasing to 68% in 2030, and 100% in 2035. The rule also sets durability, warranty, and other provisions for zero-emissions vehicles.

“[We] believe that Californians should not be directed toward a specific technology, but rather be allowed to choose the type of vehicle technology that best serves them,” said PRI and SEMA CEO Mike Spagnola. “While electric vehicle technology expands clean transportation options, [we] will continue to advocate on behalf of the industry that has helped make the internal-combustion engine (ICE) a reliable, affordable, and clean option for millions of consumers.”

Between 1980 and 2020, the combined emissions from the six most common air pollutants dropped 78%, thanks in large part to advancements in cleaner ICE technology, which continues to improve.

The newly adopted regulations could lead to 17 other states that have often followed all or part of California’s previous clean-car rules adopting similar proposals.

We will continue to provide updates on this story as they occur. For more information, contact Caroline Fletcher at carolinef@sema.org. **PRI**

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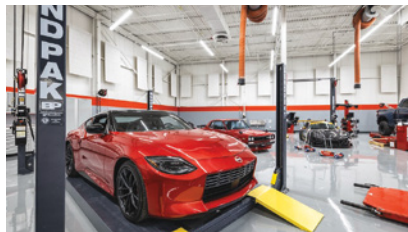
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INDUSTRY NEWS

SEMA GARAGE OPENS IN DETROIT

The SEMA Garage in Detroit, Michigan, is now open for business. The new 45,000-square-foot facility is the first-ever research facility dedicated to testing and understanding how the aftermarket is impacted and can successfully work with Advanced Driver Assistance Systems (ADAS).

Located in Plymouth, Michigan—just 30 miles from Detroit—the SEMA Garage Detroit features a large ADAS technology center, an installation



SEMA Garage Detroit

center, and will expand to include a four-wheel chassis dyno lab, and another dyno lab capable of testing diesel and gasoline tailpipe emissions. Like the high-tech SEMA Garage in Diamond Bar, California, the Detroit facility will give aftermarket parts manufacturers access to sophisticated resources that are typically accessible only to large-scale manufacturers.

“The SEMA Garage Detroit is a game-changer in helping aftermarket manufacturers develop products for today’s sophisticated automobiles,” said Ben Kaminsky, SEMA Garage Detroit General Manager. “We will be collaborating with automakers, suppliers, and key players in the industry to conduct some groundbreaking research. We are really going to be able to take product development and testing capabilities to a whole new level.”

SEMA Garage Detroit features new equipment, such as emissions and horsepower testing for all-wheel-drive and diesel vehicles, vehicle lifts, full sets of tools, fabrication equipment, an alignment rack, 3D scanning tools, and engineering software. The lab accommodates a 48-inch all-wheel-drive chassis dynamometer and includes a new emissions test bench. With equipment that meets CARB’s new 1066 testing requirement standards, SEMA Garage Detroit will be able to perform all required CARB and EPA test procedures.

Through the SEMA Garage’s resources, manufacturers are often able to develop fully functional prototypes in as little as two weeks and obtain CARB EOs in as little as 12 weeks.

ADRL CANCELS SCHEDULE, SHUTS DOWN SANCTIONING BODY

The American Drag Racing League (ADRL) based in Ennis, Texas, has canceled the remaining dates of the 2022 Extreme Racing Oil & Fuel ADRL Tour Presented by RJS Racing. ADRL as a drag racing sanctioning body is also being shuttered, effective immediately.

ADRL General Manager Andy Carter released the following statement: “Regretfully, we have made the decision not to move forward with the remaining dates of the ADRL’s 2022 season. I have taken a new role within our industry that comes with a strict no-compete clause. Trying to manage an organization like ADRL is a big endeavor and rebuilding the brand makes it even tougher. Mel Roth, who ran the day-to-day operations, and I have discussed every option out there. Between his business, the races he already promotes, and other commitments, it would be impossible for him to continue running the sanction on his own.”

LARRY JEFFERS PURCHASES IHRA FROM IRG SPORTS + ENTERTAINMENT

World championship car builder Larry Jeffers has taken over ownership of the International Hot Rod Association (IHRA) from IRG Sports + Entertainment. Jeffers is the owner of the House Springs, Missouri-based Larry Jeffers Race Cars.

Jeffers, who will serve as IHRA president and CEO, wants to grow the sanctioning body’s bracket and grassroots racing efforts with a “commitment to the IHRA Summit SuperSeries Team and World Finals.”

The IHRA is the second-largest drag racing organization in North America and home to the IHRA Summit SuperSeries, the largest national championship program in bracket drag racing. In addition, the IHRA has over 75 member tracks and thousands of member racers throughout North America.

BORGWARNER ACQUIRES EV-CHARGING SOLUTIONS COMPANY

Auburn Hills, Michigan-based BorgWarner has acquired Rhombus Energy Solutions, a provider of charging solutions headquartered in San Diego, California.

Rhombus offers vehicle-to-grid (V2G) and UL-certified charging. Rhombus supplies its patented technology to EV OEMs and charging and grid service providers.

VAN SANT DISTRIBUTING ACQUIRES ICENGINEWORKS

Van Sant Distributing—the manufacturer of US-made metal shaping equipment and more based in Pella, Iowa—has acquired Icingenetworks, also based in Pella.

Icingenetworks, founded by Victor Franco, offers custom exhaust and fabrication systems. Its products are used in the design and welding of custom headers, turbo manifolds, full exhaust systems as well as turbo downpipes and cold air intakes.

LOKAR ACQUIRES MADE-4-YOU PRODUCTS

Lokar Performance Products—the performance products manufacturer based in Knoxville, Tennessee—has announced the acquisition of the assets of Made-4-You Products (M4YP), an automotive aftermarket industry provider with worldwide sales and distribution that opened in 1985.

M4YP’s inventory, tooling, and assets have been relocated to Lokar’s location in Knoxville and the products will be manufactured, assembled and shipped from Lokar’s facility.

MATT JONES PURCHASES ART MORRISON ENTERPRISES (AME)

Matt Jones, who joined Art Morrison Enterprises (AME) in 2005, was selected by company founder Art Morrison to purchase the controlling interest in the company, which designs and manufactures chassis and components in Fife, Washington.

“Matt has played a huge role in the success of the company and has earned the trust of

our many long-term employees. It will be in good hands," Morrison said.

NEW OWNERS FOR BYRON DRAGWAY (IL)

Byron Dragway—the 1/4-mile drag strip in Byron, Illinois, home to Glory Days Vintage Drag Racing and Fall Diesel Drags—has been sold from BJ and Rhonda Vangsness to the Robertson family. As part of the announcement, Jacob Steder will now oversee the facility's day-to-day operations as the general manager.

Plans for "The Playground of Power" include increased days and hours of operation, including more evening and nighttime events, along with improvements with new scoreboards, updated and expanded bathrooms, and more.

FRIENDSHIP MOTOR SPEEDWAY (NC) ANNOUNCES CLOSURE

Friendship Motor Speedway, the 3/8-mile dirt oval in Elkin, North Carolina, has announced its closure in a social media post. Private test sessions will remain on the schedule as owners explore options for the facility's future.

The track regularly drew fans and racers from neighboring communities and states and has hosted 604 Late Models and 602 Mid East Modifieds, most recently for its Willie Harrell Memorial Race on August 13. The track also hosted Renegade, Crate Sportsman, and Street Stock divisions.

ANDRETTI GLOBAL TO BUILD RACING AND TECH HQ IN FISHERS, IN

Andretti Global, the parent company of Andretti Autosport, has announced plans for a new global motorsports headquarters in Fishers, Indiana. The team intends to build a 575,000-square-foot facility near the Indianapolis International Airport. The new global headquarters is expected to add up to 500 jobs to the local community by early 2026.

The \$200 million facility will serve as the headquarters of Andretti's global commercial functions and the base of operations for the team's current NTT IndyCar Series, Indy Lights, IMSA programs, and other future racing initiatives.

CONSTRUCTION BEGINS ON STATE-OF-THE-ART NASCAR PRODUCTIONS FACILITY

NASCAR has announced that construction has begun on a state-of-the-art production facility. The 58,000-square-foot space will be adjacent to the NASCAR R&D Center in Concord, North Carolina.

The new facility—expected to be fully operational by 2024—will house approximately 125 NASCAR Productions and Motor Racing Network (MRN) employees, with additional room to expand operations.

NASCAR NAMES JULIE GIESE AS PRESIDENT OF CHICAGO STREET COURSE

NASCAR has announced that Julie Giese—the current president of Phoenix Raceway in Avondale, Arizona—has been appointed to oversee operations for the NASCAR Cup Series' first-ever Chicago Street Course, which will take place July 1–2, 2023. Giese will continue to oversee all day-to-day operations at Phoenix Raceway through NASCAR Championship Weekend in November. After, Giese will help open a NASCAR office in Chicago and help build a "fully dedicated in-market team" ahead of the event.

TOYO TIRE U.S.A. PROMOTES ROB LOVI TO VP OF SALES

Toyo Tire U.S.A. in Cypress, California, has announced Rob Lovi has been promoted to vice president of Sales.

Previously serving as the director of Sales, national strategic accounts, Lovi has nearly 18 years of tire industry experience. He previously served in management at Michelin North America and as vice president of Sales and Marketing for Vector Fleet Management.

FIA ANNOUNCES NEW DIRECTOR OF COMMUNICATIONS AND PUBLIC AFFAIRS

Based in Paris, France, the Fédération Internationale de l'Automobile (FIA) has appointed Luke Skipper to the newly created role of director of communications and public affairs.

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Skipper will work with the Federation's leadership to "ensure the FIA is the global voice of mobility and motorsports." He will also lead a team to drive growth through social media and digital engagement and enhance the FIA's lobbying capability.

SPEEDWAY MOTORSPORTS NAMES RAMAGE, FABER TO LEADERSHIP POSITIONS

Speedway Motorsports—the Concord, North Carolina-based marketer, promoter, and sponsor of motorsports entertainment—has announced Texas Motor Speedway (TMS) General Manager Rob Ramage has been promoted to Speedway Motorsports' senior vice president of Government Relations and deputy counsel.

Replacing Ramage will be AEG veteran Mark Faber, who joins TMS after serving as senior vice president of Global Partnerships at T-Mobile Arena in Las Vegas, Nevada.

STEVE FRANCIS JOINS WORLD OF OUTLAWS LATE MODELS

Officials with the World of Outlaws CASE Construction Equipment Late Model Series have announced Steve Francis as its new director of Competition.

Francis, the 2007 World of Outlaws CASE Construction Equipment Late Model Series champion, will work directly with Series Director Casey Shuman.

Most recently, Francis served as technical director for the Lucas Oil Late Model Dirt Series.

EVAN SMITH JOINS NMRA/ NMCA EDITORIAL TEAM

ProMedia Events and Publishing, home of the Holley NMRA Ford Nationals and Red Line Oil NMCA Muscle Car Nationals, has hired veteran automotive journalist and content creator Evan Smith to join its editorial team.

Smith will be responsible for editorial content across ProMedia's web-based brands, including NMRAdigital.com, NMCAdigital.com and Race Pages Digital.

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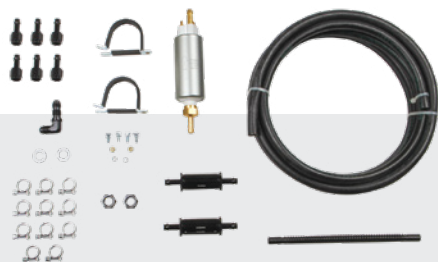


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Contact: 866-464-6553



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fitechefi.com

FiTech has released its SBC TPI wiring harness kits, offering four different TPI Retro-Fit Systems depending on a single or dual wideband O2 sensor or 4L60/80E transmission control for the application. The FiTech TPI system is based on proven, self-learning EFI technology with speed density and wideband air fuel ratio control, improving the performance, tunability and drivability of a TPI (stock or highly modified).

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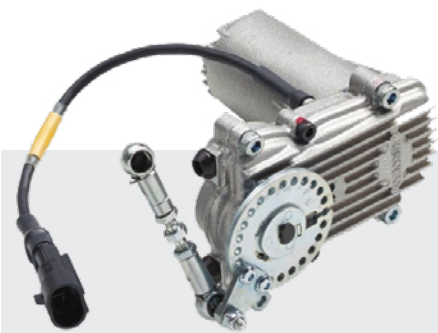


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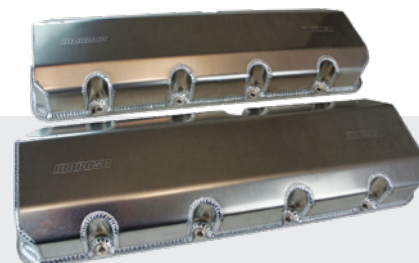


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The Jenvey ETA2 Motorsport electronic throttle actuator, designed and manufactured by Jenvey, has been created specifically for use with motorsports and high-performance engines. It will operate Jenvey individual throttle body systems as well as other applications.

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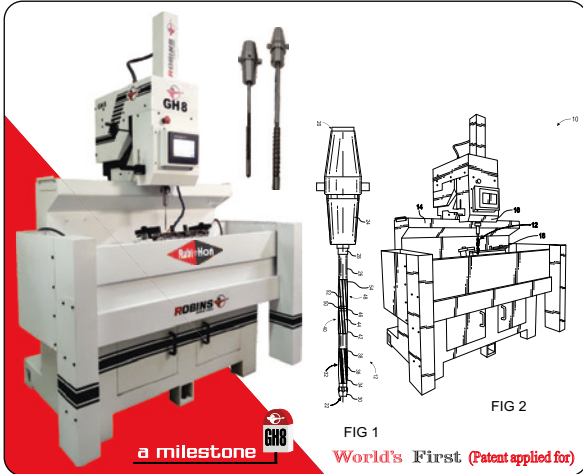
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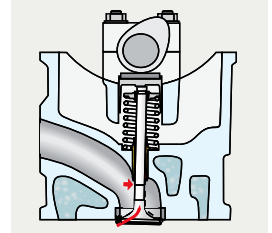
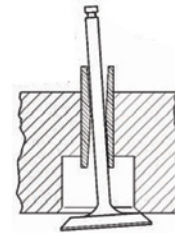
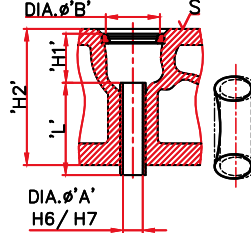
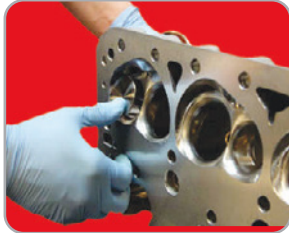
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5 - 7mm	10 - 40 μm	25 - 55 μm
>7 - 9mm	20 - 50 μm	35 - 65 μm
>9 - 12mm	40 - 70 μm	55 - 85 μm

'Valve Guide Machining Tolerances'

Dia. Ø 'A'	SURFACE FINISH	CIRCULARITY (Roundness)	CYLINDRICITY (Straightness & Roundness)
GUIDE BORE TOLERANCE (Ø 6-10mm) H6 DIA 'A' -0.000 +0.009 mm (0.00035") or H7 DIA 'A' -0.000 +0.015 mm (0.0006")	0.8 Ra μm • 32 Ra μm • 0.8 CLA • 5.7 Rz ISO • 0.9 RMS	0.006 mm (0.00025")	0.005 mm / 50 mm L (0.0002" / 2" L)

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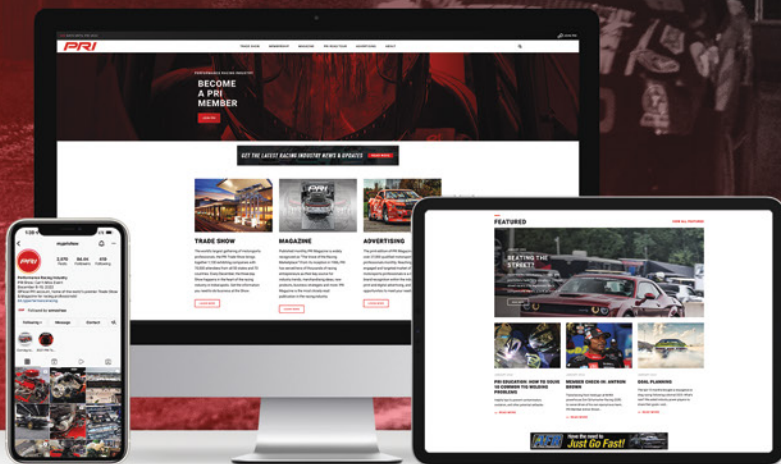
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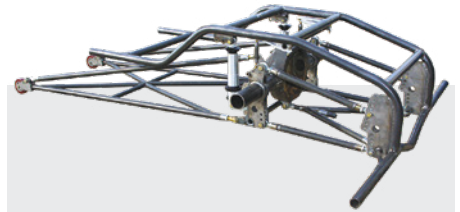
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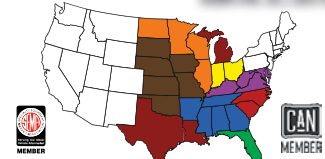
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SOCIAL STATUS

A closer look at racing and performance industry members' engagement strategies on TikTok, Instagram, Facebook, and more.

Some companies aren't especially social media savvy. Fortunately, there are businesses to help with that, such as We Design LA, which works with Formula DRIFT as well as the Acura Grand Prix of Long Beach, PRI, and others. As experts in this field, "the We Design LA team utilizes its vast resources in design, technology, and communications to create visually appealing media with effective messaging to achieve a social media campaign's projected goal," Jordan Manavian explained. "Incorporating design principles essential to audience engagement with real-time data analytics, and ultimately ensuring those tools are applied in accordance with the latest social media trends, we build our clients' campaigns optimized for high engagement."

He told us that social media is an essential part of modern business, and specifically in motorsports, as the enticing action of racing and unique visual appeal of vehicles and parts can be utilized for the promotion of business at the highest level.

Currently, short-form video is the hottest trend We Design LA sees across all social media channels. "With the quick rise of TikTok during the pandemic, other platforms such as Instagram have had to adjust their platform and algorithms to cater to the video-heavy engagement we are seeing as a result of TikTok's boom," Manavian said. "Besides short-form video content,

influencer marketing is still as popular as ever. Platforms are filled with collaborations between brands and influencers who share similar audiences."

What's the next big thing? "For those who want something simple, clean, and fast, we see platforms emerging like BeReal. This application is very simple, reminiscent of the early days of Snapchat in its constrictive premises and straightforward functionality. At some time in the day, users are prompted to take a selfie and a front-camera wide-angle image simultaneously so that all users are able to view what their friends are doing at that very moment," Manavian explained. "It's an uncurated, and, as the name suggests, real representation of daily life."

Manavian also noted that he's seeing more engaging/complex experiences growing around augmented reality (AR) based social media. While AR has seen moderate success in the past, "I believe that augmented reality will really have a 'renaissance' of sorts in these next few years.

"The days of just being on Facebook and posting everything on there are gone."

Why might it be beneficial to use an outside agency for help with social media? "It is always eye opening to have an outside perspective on your business, whether that be hiring someone to analyze your internal operations, website performance, etc., and social media is no exception," noted Manavian. "While social platforms began as

intimate ways for friends to share bits of their lives with one another, today it is something entirely different. Social media today offers immense value to businesses, which can be most successfully harnessed by experts who understand platforms' algorithms and best practices based on research and experience.

"When working with a full-service agency," he continued, "we are going to have a team of experts looking at the project, campaign details, objectives, and messaging from a wider lens as well as with experts in branding, design, content messaging, digital campaigns, social trends, data analytics, and more."

Besides hiring an outside agency to help with social media, Manavian offered some other tips to help grow your presence: "Spend time researching your competitors' platforms. Take notes of what content or design tools catch your eye, the traffic that content received, and anything else you like or dislike about their media.

"Also spend some time familiarizing yourself with platforms by spending time casually engaging with content and gaining awareness of how the algorithms affect your feeds," he added. "It's even helpful to do external research in journals, magazines, or newspapers about various trends and user experiences on each social platform to gain a better understanding of how users want to engage with your content." **PRI**



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