Perfecting Motion: Tribology and the Quest for Sustainability
Episode 5 – Improving the Sustainability of the Internal Combustion Engine
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Neil Canter:
For those of you who have been joining us through the podcasts, Welcome Back! It's January 2022. We hope you've had a good holiday season and wish you a happy and healthy New Year. And we have looked in the first four podcasts of this series, we have looked ahead with some of the newer technologies that may help us in our quest for perfecting motion, the drive to sustainability. These are things like tribochemistry and additive manufacturing and nanotribology to name three of them that we have study here, but for this one as we move into podcast five, we're going to look a little backwards because one of the issues that I think we need to look at and address is frankly what's going on with the internal combustion engine. This is, of course, the locomotion that powers our vehicles. If you get into your vehicle, you're going to work in the morning, you turn the car on—the internal combustion engine starts up and moves on, as most of us have those type of cars.

The thing to keep in mind here is that in the move by the global automotive industry to electric vehicles, whether it be hybrid or full battery-powered electric vehicles, the source of the move has frankly been the internal combustion engine, which is the source of all the emissions. But the thing that we have to recognize is this move—the internal combustion engine—it's not going to happen overnight. People are going to be driving internal combustion engines, at least for the next generation for the next 25 years. So, here we are, it's the beginning of 2022 and this is going to happen for the next 25 years. What, if anything, can be done to help make the internal combustion engine more sustainable, because that's going to help in the, excuse the pun, the drive to sustainability, if you will. So, at this point, to answer this and other questions that we're going to pose here, we're fortunate to have Lake Speed, Jr., from Total Seal Piston Rings available to speak with us. Lake has been working in the automotive industry for over 25 years and has worked in the past with Joe Gibbs Racing NASCAR team. So, Lake, thank you very much. Welcome and appreciate your time.

Lake Speed:
Thank you, Neil. As you know, I love the internal combustion engine and love tribology, so this is a great opportunity to talk about the future of something that I've spent my whole life being around and the dovetail here obviously is efficiency, and while racing may not, on the surface, bring up thoughts of efficiency to the unindoctrinated if you will, but in reality racing really is at the cutting edge of efficiency. The way to make an engine go faster is to make it more efficient.

Neil Canter:
So, if I can interrupt you here, at least for those of us saying it and so, as an analogy, I think many people know and remember the space program, which is still going on because a lot of technology, a lot of developments come from the space program, the same thing could be said for the conventional car we have in our driveways. A lot of the innovations there have come from racing.

Lake Speed:
Oh 100 percent. If you think just one thing, diamond-like coatings, the DLC coatings that are now in modern production engines that are allowing the use of lower additive levels, you know less ZDDP things like that to help with emissions, to help with engine durability, all that technology was first deployed into internal combustion engines in racing. Formula One has been the platform of motor sport that has done the most to advance the science of efficiency, if you will, for internal combustion engines by bringing in different material technology, coding technology, the bespoke lubricants that have been developed for racing. What was used 20 years ago in a racing engine oil looks remarkably like today's GF-6 oils. So, I think it's the chemistry that the tribology of motor sports is leading the way and I think that it, as you said, we still have to deal with all the internal combustion engines that are still going to exist for probably decades to come. That's a question that still needs to be answered, how do we deal with that—and so look forward to talking with you today and maybe sharing some ideas about that.

Neil Canter:
Right. So, let me back up a little bit. Diamond-like coating for those not familiar with it, we're not talking about diamonds, as in diamonds and jewels. I think maybe we wish we were, but we're talking diamonds made of carbon, as I think many of you know out there. We're talking about carbon type coatings that help to reduce friction and wear that apply to the surfaces of automobiles such as engines and pistons primarily, which is where the source of a lot of the frictions are. So, while we wish it were diamonds, it's not. One other thing to say is ZDDP is a chemical additive used in motor oil, which has been used in many years for reducing wear. It has come under some scrutiny, but it's certainly an additive that has been used for the last 70 or 80 years. And then one more concept from Lake was GF-6, which is the last passenger car engine oil specification that is existing currently in the United States, and they go through specifications periodically with a lot of testing involved, but that's what's called GF-6, so with that addition, Lake, let's start here. What is the challenge in developing a competitive race car and what technology improvements have come about from this effort that have been used in passenger car vehicles?

Lake Speed:
Sure, so the goal of automobile racing is to be able to go faster than your competition to reach the finish of the race first. No different than a marathon or a 5K that almost everybody understands that concept. You know very similar to running, running a race car race, the harder you run, the faster you run initially, the more quickly you're going to get tired as you consume oxygen and blood sugar and things like that. So, if I run too fast, I may have to stop and wait. In racing, we call that a pit stop. You consume all your fuel and tires, and you got to stop at a pit stop to refuel, put on fresh tires and you can run again. But just like a smart, astute experienced runner knows how to pace themselves, how do I train to be able to run at a higher rate of speed for a longer distance—that efficiency in my motion. Am I carrying any extra weight? How efficient is my stride? Things like that can also be found in motor sports. In the realm that I deal with, which is piston rings, which, by the way, is my favorite tribological device within an internal combustion engine because you know there are three stages of lubrication. We all know that we put oil in engines or put oil in machines that function as a lubricant to be able to reduce friction and to reduce wear. But the way that manifests itself in any piece of equipment is what we call the three stages of

lubrication, which has been defined through the Stribeck curve as your full film lubrication, your mixed film lubrication and boundary lubrication, and one of my favorite analogies for describing that is water skiing. If the boat is not moving, the water skier is submerged in the water and that's the boundary condition, essentially, there is no hydrodynamic wedge, there's no fluid film to support the skier, he sunk in the water. At that point, we're dependent upon the additives to prevent wear, so maybe in that case, the skier's life jacket, we can think of that as maybe the additives, it's doing all the work to keep the skier from sinking. But then as the boat begins to pull the skier out of the water, so you're somewhat dependent upon the velocity of the boat lifting that ski—that skiers gear, the water ski and the life jacket are still supporting some of that load. But then once the boat reaches enough speed, now it's the full film. It's the fluid effect of that relative motion between the ski and the water that's supporting the load of the skier. We call that full film lubrication, so engine bearings pretty much live while the engine is operating in that full film condition, and there's that mixed film that's in between, so a piston ring, because a piston has to change directions every cycle, twice per cycle in a typical four-cycle engine, which is what most internal combustion engines are four- cycle engines, that piston ring goes from full film lubrication at mid-stroke of the piston in the mixed film, as the piston begins to slow down as it reaches top dead center or bottom dead center and then at that ring reversal with that moment that piston stops, it's in boundary condition. So, it's exposed to everything that's happening in the engine, so the piston ring is the number one source of friction in the engine, followed by the rest of the valvetrain components. So, as you mentioned about the diamond-like carbon, the different coatings we can put on these parts to try to reduce friction that's a key thing, and that's where motor sports, as in our quest for going the furthest we can, the fastest we can for every drop of fuel that we can put in that fuel tank, is of utmost importance.

I remember several years ago, we attended an SAE training session on improving fuel economy and I showed up there as a member of Joe Gibbs Racing and they were very confused as to why a race team was attending an SAE session on fuel economy and I said, oh well, you consider fuel economy, we call that horsepower. You're just trying to gain efficiency—and we're trying to gain efficiency, so we want to learn what you're working on and maybe we could pick up a few ideas on how we can do that. So really, though, that's the goal of racing is to become more efficient.

Neil Canter:
For those who don't know who SAE is, it's the Society of Automotive Engineers, which is a major society involved with all aspects of automobiles, whether it be racing, non-racing and helping to set specifications for automobiles.

Lake Speed:
So, let's take Formula One for example, because obviously this past season was a global phenomenon that came down to the very last lap and was a tremendous finish. In Formula One, they have a rule where they are only allowed a limited amount of gallons, in their case liters of fuel per race, and in fact that fuel is limited to the amount of fuel flow the engine can see at any one time, so they cannot just use all the fuel up and then maybe try to coast to the end. They have to maybe ration on the amount of fuel that engine consumed during the course of a race. So, to go faster, they have to make the most use of every drop of that fuel, which means more complete combustion and as we know chemistry wise, if we have 100 percent complete combustion, there's very little emissions when you have 100 percent complete combustion. Most of the bad stuff that we don't like about internal combustion engines is the unburnt fuel, the partially burnt fuel.

Neil Canter:
If I may interrupt, let me also argue with this point with you that complete combustion is carbon dioxide and water if you are talking about a hydrocarbon, completely combusted, and, of course, one of the issues there, Lake, any way is carbon dioxide, which is a sort of global warming. So, yes, I agree that incomplete combustion is probably worse because you have got all these hydrocarbons and these other incomplete type issues, but you still have carbon dioxide coming off when it is complete combustion.

Lake Speed
That is true. I do not know the worst stuff, right, is carbon dioxide. It is the nitric oxides, the carbon monoxide things like that, or the incomplete combustion element.

Neil Canter:
Well, yeah, and certainly hydrocarbons like methane, which are there too. Yeah, I agree.

Lake Speed:
Yeah, so trying to make it as clean as possible. We know it will never be as clean as a battery electric, but there is no argument there at all, and so the real goal, though, Formula One has been able to pioneer is taking an internal combustion engine that would normally be maybe about 35 percent thermal efficiency, so the idea that we have got you know this many liters of fuel how far can we go or how much power can we extract from that fuel? They have gone to a hybridization model that is allowing them to be over 50 percent thermally efficient and then looking into the future to your last point, they are looking at can we change the fuel in the future to have a drop in fuel that is one, bio sustainable and number two, comes closer to complete combustion so that it is a more environmentally friendly fuel and that is their goal and I believe based on their track record, we will see that take place in the next few years.

Neil Canter:
All right, so let's back up in terms of hybridization model. This is not a hybrid vehicle we are talking about. The racing cars are not becoming a hybrid vehicle. What do you mean by hybridization model? What's going on? What are they changing over to go from internal combustion engines or hybridization model?

Lake Speed:
So, the modern Formula One engine today is a hybrid. It is not just a petrol engine.

Neil Canter:
It is a hybrid?

Lake Speed:
No.

Neil Canter:
Okay. And do they have a battery in there?

Lake Speed:
They do have batteries in there. In fact, I believe the new Mercedes all-electric vehicle from the reports that I have heard, the battery package that's in the new Mercedes production EV is based on the battery

technology that Mercedes developed for their Formula One team. And the efficiency of that, the energy density of that battery pack, is three times their leading competitor that's in the market right now. And because of that, back to racing you want that car to be as light as you possibly can to be more efficient and the other thing they have done with the use of electrification of the car, they had a very unique approach to it. We all probably know about turbochargers. A turbocharger is a device we add to an internal combustion engine that harnesses the exhaust heat that exhausts energy and then uses it to supercharge the engine, where we can push more air into the engine to have more power density in the engine. What Mercedes did at a stroke of brilliance, by the way, the traditional turbocharger is, what we call the turbine, which is powered by the exhaust and the impeller, which is causing the boost, right, so it's putting the air into the engine. They are in one housing. Of course, we know that the exhaust is very hot and, of course, when air gets hot it becomes less dense, so there's less oxygen per unit of area. Okay, so that decreases the efficiency of the engine when you have less density.

What Mercedes did, in brilliance, is they split the turbocharger and they put an electric motor in between so that they can use the motor generators that are attached to the wheels that under breaking they can absorb energy, they can create energy, store it in the battery package, but then when they want to accelerate the car, they can actually spin the turbocharger up independent of the engine because the turbocharger can only spin as fast as the exhaust is going, so there's this called turbo lag, which is one way where they're more efficient than a naturally aspirated engine, but they still have that area where they could increase efficiency and the turbocharger can always run at maximum speed, which you can't when the engine is at low speed because there's no exhaust speed. They solve that problem by being able to decouple those two and allow the electric unit and, of course, they can also when they're under deceleration, they can use that back pressure in the exhaust to spend the exhaust turbine and create energy. So, they're harvesting energy and releasing that energy using the computer controls to do it at a level that no engine has ever done it before. So, think about if we could take the modern existing fleet of engines and increase their thermal efficiency by 15 percent what that would do to global fuel consumption to global emissions releasing, so that's a fantastic thing. And then that same kind of technology though, Neil, has also been explored by companies like Nissan for their plug-in hybrid cars, where the internal combustion engine in the hybrid doesn't power the car, it generates electricity for the battery system. So, if you can run the engine at a fixed engine speed, you can make it more efficient. All the valving events, all that can be precise so they've explored the same opportunity and how we can make a generator, essentially, over 50 percent thermal efficient. I see opportunities as we go forward, especially in areas where the power grid is going to be harder to fill out. There's a role for hybrid electric and improved internal combustion engines to help facilitate the transition to that sustainable future that we all want.

Neil Canter:
Fair enough, and that's appreciated, particularly improvement in thermal efficiency. How long has Formula One been doing this? When did they first move into the hybrid world and what prompted them to do it?

Lake Speed:
So, seven years ago when they began using these hybrid systems, they went away from having just an internal combustion engine to now they call it a powered unit, which is a hybrid system. So that was seven years ago, and what prompted them was discussions amongst the teams and the team owners that there's a problem in the world that's related to CO_2, related to emissions. We have the best engineers in the world, in their opinion, and we have this competition that tends to bring out better solutions. Why don't we allow our pressure cooker of global competition to tackle this problem, and so

that's where they set out to the idea of okay, without getting rid of internal combustion engines, how do we go about making those engines more efficient? How can we extract the maximum efficiency from a single drop of fuel that was the focus of the regulations? And that's what they've done. Their next level of approach is how do we create a sustainable drop of fuel and then still extract the most value from it? So that's the direction they're going in and again hats off to them. I think the FIA and Formula One have done a fantastic job of allowing motor sports to do, as you said previously, lead the way in terms of technology change because they have all the resources and all the desire to find a way to become more efficient and they can show that path that then can be copied down to production vehicles and, eventually, hopefully make it a positive change for the world.

Neil Canter:
Any sense from you, as to any details been provided as to what Formula One is looking for in sustainable fuel? Is it going to be a bio type fuel? Is it going to come from recycling or re-refining processes? Is there any indication of the sourcing for the sustainable fuel?

Lake Speed:
I don't believe from what I've read so far that there's a single source for the fuel. They're not saying it must be bio-derived or has to be recycled, but I do know that the one thing that they've committed to is that the fuel is net carbon zero production. So that's a huge goal, by the way, to have a net carbon zero production fuel and so it must be sustainable, and it has to be net carbon zero, which those two goals right there make it pretty steep the challenge. There's a lot of major petroleum companies involved in F1, so it'll be neat to see how, again with the pretty wide range of rules, but with a single goal what kind of solutions they come up with. And in the day whoever has the most efficient solution will probably win a Formula One championship and will all know about that technology sooner or later.

Neil Canter:
Yeah, obviously that's the name of the game. So, let's take a step back in terms of the fuel. What fuel are they using today? I know in my limited racing car experience, you have a lot more than I do, methanol has been used I think in a lot of indie type cars, but what fuel is used in Formula One right now?

Lake Speed:
So, it is a gasoline. They have a specification, so there's not a spec fuel. So, it's not only one supplier for all the fuel, but it is gasoline, so it's a petroleum derived product, and there's no ethanol or anything like that. In NASCAR, for the last almost 10 years, I believe…next year will be the 10th year. 2012 will be the 10th year that they've run a 15 percent ethanol blend. So, NASCAR was the first of the major racing series to adopt a bio type fuel, so it's 15 percent ethanol, 85 percent racing gasoline, but in NASCAR's case they made the smart move of going away from leaded fuel. So up until 2012, it was still a racing leaded petroleum fuel. So, for the last 10 years they've been on an unleaded 15 percent ethanol fuel, and I believe IndyCar runs an E-98. I know they did, at least for some point, they ran a 98 percent ethanol blend. I'm not sure of that today and where they're going, but I believe you'll see that as F1 moves to a sustainable fuel, you'll see IndyCar and NASCAR also go along that same route that all the major global racing sanctioning bodies will begin to move that direction. I know Le Mans, you know which is an endurance race called the World Endurance Championship (WEC) that races you know the endurance racing around the world, they've also created some credits like if your engine platform, if your fuel has carbon reduction, if there's something about it from an ecological, environmental, sustainability standpoint, you can get some advantages by deploying that technology in terms of rules, how much the car weighs and things like that. So, I see at that hop top level, motor sports embracing the

climate change challenge and say, hey, let us help out that we're not just here trying to go fast and pollute and that we don't care. No, they're taking the challenge of what we have to face globally, seriously, and they're trying to use the resources they have to try to pioneer new technologies that can help us.

Neil Canter:
Let me back up again. A little bit on a couple of things. NASCAR, I think most people are familiar with NASCAR, in terms of racing cars that look like, I would say, passenger cars through a racing circuit in the United States. Indy refers to Indianapolis type cars from the Indianapolis 500, which is held every year in the United States at the end of May and then Le Mans refers to racing from endurance. Hopefully people know about the 24-hour Le Mans race, which is held every year where racers start at 3 o'clock in the afternoon and end at 3 o'clock in the afternoon the next day, and there are various types of cars that are raced there.

So let me ask one other thing with Formula One having taken the lead on hybrid, are some of these other organizations, Lake, maybe going to go the hybrid direction, too, at some point in the future. Is that a feasible direction for some of these guys?

Lake Speed:
Yeah, I think so. I think you'll see that making its way in. Formula One tends to be ahead of the learning curve on this and part of that is because from a cost perspective—as we know this kind of changes are not cheap—Formula One because they race on a global basis, they have more budget to be able to tackle these challenges. But you know, just like we mentioned earlier, with the diamond-like carbon, the DLC coatings, they were the first ones that pioneered that because it was cutting-edge technology at the time, but as they made it more universal, it trickled down to the NASCARS and Indy cars, no different than fuel injection. I mean, let's talk about it. So, fuel injection is something that is commonplace across the board in all internal combustion engines pretty much across the planet right now. Even like lawnmowers and stuff now could have fuel injection systems in them. While the production cars still had carburetors on them, Formula One was doing fuel injection and it trickled its way down through other racing series, eventually in automotive applications on a production basis. So, I think you'll see that same trickle-down effect that the NASCARS and everybody else will look at some type of hybridization to be able to make their cars more sustainable and, look again, look more like the road-going cars because it aligns with the market.

Neil Canter:
Right, so you've talked about piston seal rings, which you said is close to your heart in terms of some of the sources for improving sustainability, reducing friction. We've talked about fuel and going to a hybridization. Are there any other engineering that you see is ongoing or should be under development to make the internal combustion engine more sustainable?

Lake Speed:
Well, I think if you look at Formula E, which is kind of a sidestep to the question you asked me in terms of the engines, you look at Formula E, which is again part of FIA (the Federation International Automobile), which is essentially the global sanctioning body for motor racing. They have a full electric series called Formula E and those guys are tackling the challenges of what a straight EV system needs from bearings and materials and the electric motor. You and I attended the STLE conference back in November of last year that addressed those things and a lot of the points that were brought up, in terms of heat capacity and friction reduction, that all aligns indirectly with what Formula E is trying to do, but it

also is kind of tangent actually to what we're seeing in NASCAR and Formula One, making gearboxes more efficient, so I see there being more crossover, almost like, not a divergence, but more of a convergence of technology that lower viscosity oils with unique additives and more unique engineered base oils are going to basically start to cross pollinate that you'll see what we're doing in racing where we want the very lowest viscosity, we want the very lowest amount of friction with the least amount of wear. What combinations of materials and coatings and base oil and additive technology can be deployed in racing? I think it will make its way into the passenger cars as well, kind of like we mentioned at the very top that what a racing engine will look like about 10-20 years ago looks a lot like a modern GF-6 Motorola today. I think we'll see that same thing, and the pace of change I think will just continue to elevate. I think that's the thing that technology seems to just be, it's not even linear, it seems like it's just completely exponential and so it's hard to even guess what would happen five years or 10 years from now, just based on the fact that technology development seems to be going so quickly.

Neil Canter:
It almost sounds like it could be parabolic, as opposed to being linear in terms of taking off. Let's go back to the hybridization. The batteries, obviously, you mentioned the Mercedes development and you've also mentioned Formula E, which is electric vehicles. What's your assessment right now, the battery electric vehicle technology that's being used, whether it be the hybrid that's being used in Formula One or what the Formula E people are using right now, where do you see that and where are the improvements going to take place there?

Lake Speed:
Well, I see the full of electric, you know, the EVs having a pretty dominant position. In drag racing, the NHRA (National Hot Rod Association) have already created some classes and have announced some rules this past year at some of the major racing trade shows that they're creating some class rules that will allow for electric cars. I believe at the US Nationals the previous year, they were doing some demonstrations with the Ford Cobra Jet, which is an all-electric race car that you can buy from Ford and, of course, you know what's great about drag racing is that you don't have to turn left or right. You just go fast in a straight line, so the extra weight that comes along with full battery electric vehicle doesn't hurt you as much because there's not that nimbleness where you need, if you're trying to turn left and right, that's where power density plays a big role. In drag racing, it is all about going fast in a straight line, and if it weighs a little bit more, but it's way more powerful, it can pay for itself at some point.

Neil Canter:
So, what about the noise element because people are drag racing and you hear a lot of noise, which is why people like the sport. Drag racing electric vehicles, Lake, and people don't hear anything isn't that going to be a turn off for some people?

Lake Speed:
I don't know, so this way I think you may hear the roar of the stands, you know, when the guy with the Tesla drags the guy with the 69 Camaro and just waste him. I think you may hear the Bluebirds a little bit more or something. But see, Neil, that's the case there are people that are buying Teslas. In fact, like these Tesla plaids will show up at some like on relative rung open drag races and they will totally destroy the hopped up big cubic inch, big block Chevy with nitrous, they just waste them because they're so much more powerful. The power rate ratio is there, and, of course, the instantaneous torque and that's really the key thing that because electric motors make instantaneous torque, there's not an import curve or the engine has to accelerate to be able to make more torque. It's just there from the hit. I see

electric vehicles having a real place in drag racing. Of course, the sound and the smell is something that's a big thing for everybody.

Neil Canter:
Well, let me ask one more thing and this is very exciting in terms of where this thing is going. How is Formula One and even the EV circuit wrestling with the whole weight issue with batteries. Batteries are heavy, whether it be lithium-ion batteries or some other type of battery. How are they dealing with that in terms of lightening the load, if you will, to improve efficiency and sustainability?

Lake Speed:
Right, so I know when Formula One introduced the current engine package, which is a hybrid, they raised the minimum weight on the car that way somebody didn't make an internal combustion engine with very little hybridization to it, just to say it's a hybrid and then my car is super light, so I had the advantage. They tried to make it where you had to work hard, optimizing the hybridization in order to make it work, which, again, hats off to them seeing ahead and just cheat the background right, you make your intentions and align with your incentives. So, I think back to the Mercedes and the EV they just worked on power density, and I think that's probably the best thing, Neil, is that as battery technology improves, if we can increase power density in battery technology, it will begin to close the gap with fuels—normal internal combustion engines—because that's the thing the power density of the gallon of gasoline is quite a bit greater than the current battery technology, but back to additive manufacturing, the things you've talked about in the previous shows, there are some things you can do with additive manufacturing that maybe will allow battery technology to progress to a point where we can begin to close some of that gap in terms of power density, which will make these cars lighter, therefore, more efficient and this part of me kind of loves the idea of the plug-in hybrid where you have this smaller, very thermally efficient, internal combustion engine that's running on a sustainable fuel where we can have you know selective catalytic reduction, where we can do things like that so that the emissions from that vehicle are minute, but it also solves some of the range anxiety and is more friendly for a power grid solution. Again, I think what we'll find is that as governments, as sanctioning bodies create these targets, if we allow for creative solutions you know, and we don't say well this is the route you have to go, now the goal's here come up with creative solutions to get to the goal, that if you allow racers to go do it, racers will find a way—they will always find a way. That's where they're good at.

Neil Canter:
Well, Lake, thank you! I think you've painted a very exciting picture of what the current state and the future of racing is going to be and that pretends, well, I think in the drive to sustainability, with these new technologies coming up and they're going to be applied to passenger cars and maybe even when we talk about commercial vehicles, but even there to trucking as well. So, appreciate your time. Thank you very much.

Lake Speed:
Oh, thank you, Sir. I appreciate the opportunity and hope everybody enjoyed our little chat about all of these things. It's an important problem that we have to address, and I think racing can help us to solve those problems.

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CONTRIBUTORS

Dr. Neil Canter is an STLE Fellow and an STLE Certified Metalworking Fluids Specialist (CMFS)™, with more than 35 years of experience working in the lubricants industry. He received his doctorate in chemistry from the University of Michigan in 1983 and his bachelor's of science in chemistry from Brown University in 1978. Canter runs his own consulting company, Chemical Solutions, specializing in commercial development, marketing, product development and regulatory support for the lubricants industry. Canter is a member of STLE, the American Chemical Society (ACS), and the Society of Automotive Engineers (SAE). He is a contributing editor responsible for writing the monthly Tech Beat column in STLE's TLT magazine. He is also a member of STLE's Metalworking Fluid Education & Training Committee, STLE Education Committee, and the program chair for the STLE Philadelphia Section.

Canter recently assumed the position of STLE Advisor – Technical Programs and Services. Besides providing technical and commercial support, he is also the host of STLE's new podcast series: "Perfecting Motion: Tribology and the Quest for Sustainability."

Lake Speed, Jr., is Vice President of Sales and Marketing for Total Seal Piston Rings and is the son of former NASCAR driver and team owner Lake Speed, Sr. As a kid, Lake Speed, Jr., grew up at racetracks across the country and started racing go-karts when he was 8 years old, though by the time he was a teenager, he realized a driving career was not for him. Lake's father raced in NASCAR from 1980 until 1998. For many of those years, his father operated his own independent race team in Charlotte, NC, so he spent several summers working on his dad's team. By the time he went to college, he was traveling with the team.

Lake graduated from the University of Tennessee with a bachelor's degree in communications. After graduation, he moved to Charlotte and went to work for a local advertising agency. He learned quickly that working on race cars was a lot more fun than designing ads for banks, so he went to work for Melling Racing, which fielded the #9 NASCAR team that Bill Elliott made famous back in the late-1980s. Melling Racing was also one of the original Dodge teams when Dodge got back into NASCAR in 2001. During his time with Melling, they developed an engineering department and began testing programs with the aim to improve performance. After working for Melling Racing, he joined Joe Gibbs Racing in 2004.

At Joe Gibbs Racing, Lake began studying lubrication fundamentals and chemistry. Over the years, he helped lead Joe Gibbs Racing to win over 100 races and 5 championships. In 2019, he joined Total Seal to advance the tribology of piston rings. Lake is a member of STLE and SAE and his background in tribology provides a unique perspective on engine performance and durability.