Pittsburgh
ENGINEER
WINTER 2017
Quarterly Publication of the Engineers' Society of Western Pennsylvania

Michael Baker
INTERNATIONAL

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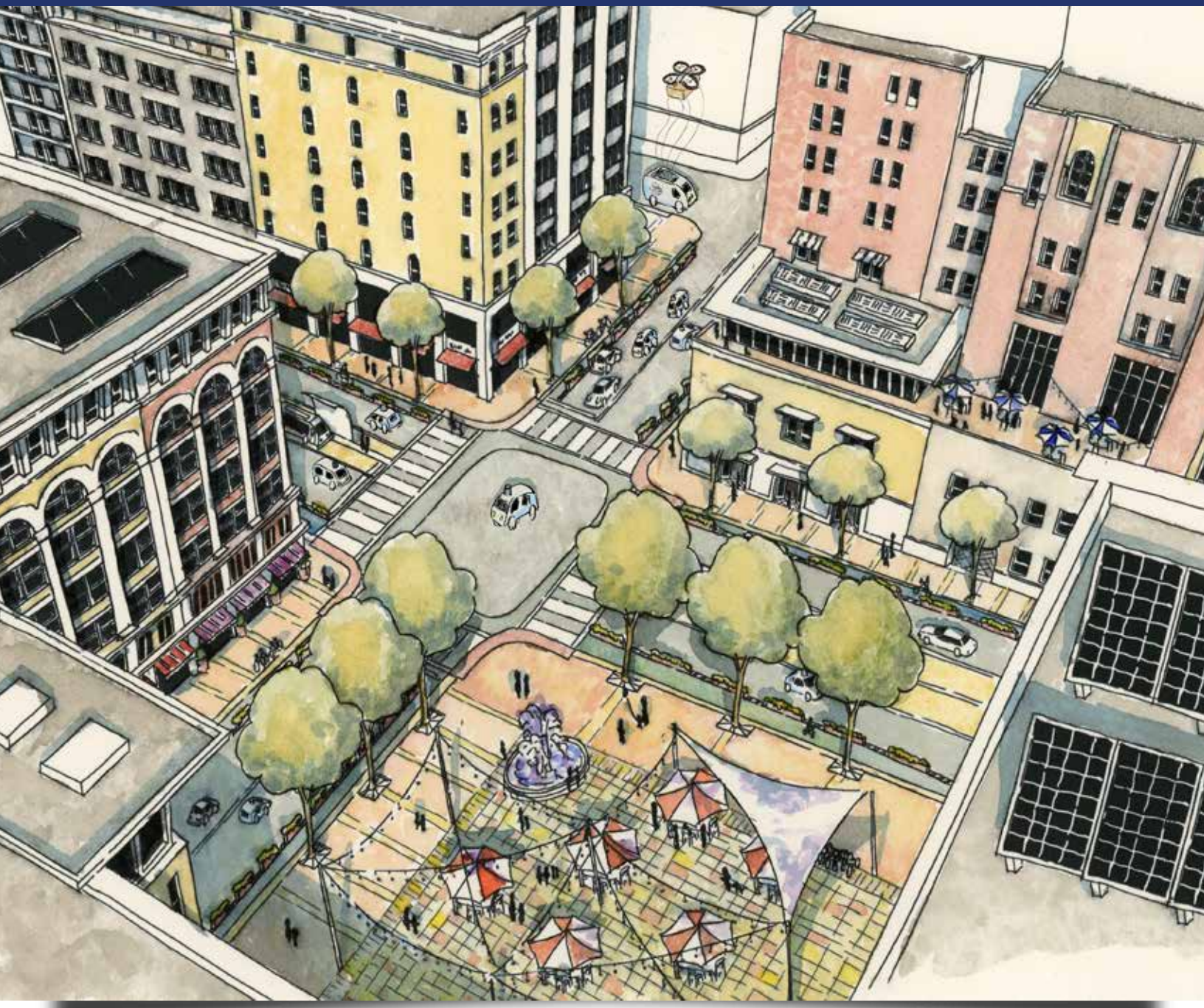

Leaders in urban mobility and innovative technology

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ESWP 1880
ENGINEERS' SOCIETY of WESTERN PENNSYLVANIA

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Guest Editor Column

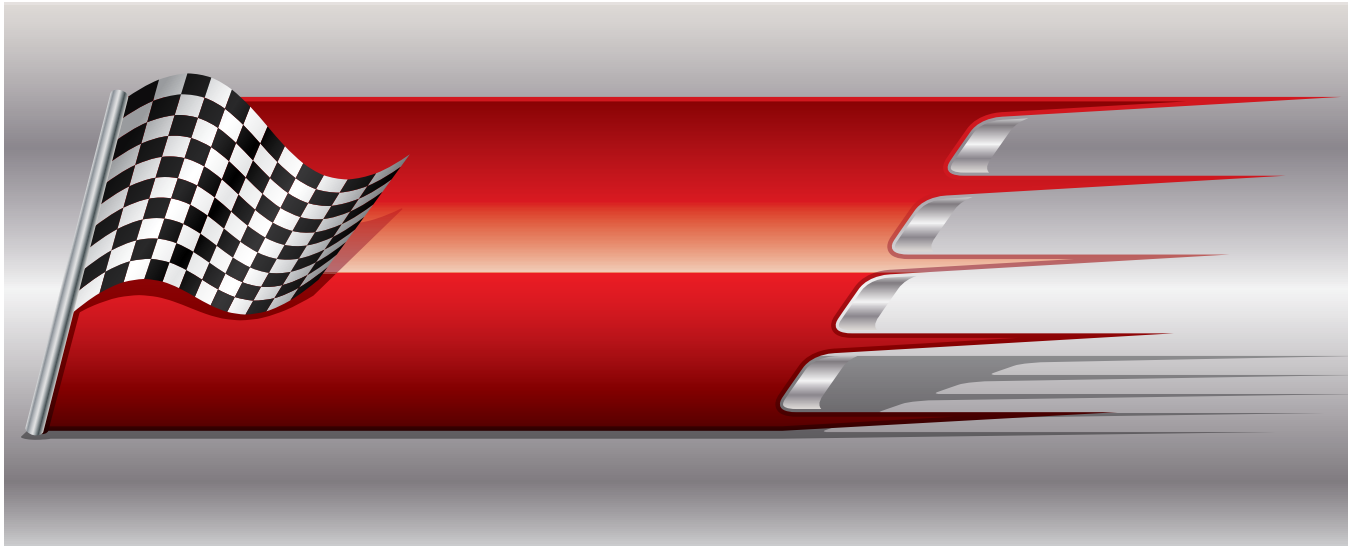
By: Mike Zappa

I'm an old school engineer. There are a lot of us out there who could be thinking about retirement, but are concerned about "what will I do after I retire?" I am 68 years old with no set date for retirement.

What I have been able to do is adapt my knowledge and skills, not only in business, but also to my personal "at home" life. In business, I am a partner in a commercial real estate firm that manages office buildings, medical offices, sports complexes, and retail strip malls. You might ask, "how does engineering apply to that field?" Well, it does in a big way. The biggest issue experienced in managing a building, and its tenants, is HVAC. Here comes the engineering application to problem solving. Tenants report that it's too hot, it's too cold, it's drafty, etc. I'm sure that if you are in an office building, this problem has happened to you or your company. HVAC installation, particularly in older buildings, may not meet the demands of current technology. With rapid advancements in technology, more stringent ventilation requirements and the average life expectancy of most HVAC equipment spanning 15- 30 years, it is not uncommon for HVAC loads to far exceed what older buildings were designed for at that time. Time to put on your engineering hat and apply your knowledge to solve these sometimes complex issues. This is what my partner and I do in the real estate business -- we are engineers in real estate!

With respect to my hobby, I build and race vintage cars. Vintage is the keyword here, since my younger counterparts considered me vintage! Being a mechanical engineer with hands on mechanical skills, blending the two seemed to be a good fit. "How?" you might ask. Well, my affinity for English cars, particularly Lotus (by the way, Lotus means "Lots Of Trouble Usually Serious"), led me to undertake the repairs that I could not afford at the time to send to a shop. Put your engineering cap on once again and jump in to solve the problem.

I have been performing restorations and racing cars for over 45 years. What I learned in school, business, and life experience I have applied to my hobby. Back in 1969, Pitt had a '69 Trans Am Camaro raced by Bob Fryer and Company. I wanted so much to be part of that team, but upperclassman prevailed. This is when my interest in racing began. Suspension set up is most important. Spring rates, geometry motion for each wheel, and strength of materials, all sound like engineering to me.



Where do you fit in at ESWP?

ESWP welcomes all members to join any of our active volunteer committees. Our Publications, Program, Affiliated Technical Societies, and Student Outreach Committees are all currently seeking new members. Consider becoming more active at ESWP by volunteering. Simply contact the ESWP office at eswp@eswp.com to learn more.

Pittsburgh Vintage Grand Prix Celebrates 36 Years

By: Ted Sohier

Pulling off the track and returning to the infield after a class win in a weekend of Sports Car Club of America (SCCA) road races, I set about returning the race car to its road car status -- replacing the race wheels and tires with street ones, peeling off the race numbers and headlight tape, and so on. That's when I discovered that I'd finished the race with only two of the five lugs that secured the left front wheel. This was at Summit Point Raceway, a twisty 2-mile, 10-turn road course near Cumberland, Maryland. It features several high-speed right-hand turns, one at the bottom of a hill, putting massive stress on the driver's side front wheel and tire on my front-wheel drive car, and snapping off three lug bolts. Another lap 'til the checkered flag, and I might have been headed for the weeds, or worse.

In SCCA's Showroom Stock classes, in which I raced, no modifications were permitted, other than for safety – roll bar, multi-point safety belts, a window net, and fire extinguisher. It wasn't built as a race car, but it was a relatively new car – only 2 years old and well maintained. It was a well-made car, and a race winner, but it hadn't been designed or strengthened to withstand the rigors of racing.

Now, imagine taking a car that's not 2, but 62 years old, and putting it on a race track. Not only is it an old car – it's old technology, old metallurgy, old systems and designs. But that old machinery has a fascination for a new breed of competitor, the vintage race driver. While it's true that an impressive number of drivers in Schenley Park each July for the Pittsburgh Vintage Grand Prix (PVGP) might be called "vintage" themselves, the term refers to the sport of racing older cars. Indeed, the youngest of the cars racing at Schenley Park – the most recent – are some 45 years old.

The PVGP started with one day of racing in Schenley Park, Labor Day weekend of 1983. The event has just celebrated its 35th year, and now encompasses about 10 days of vintage car-related activities including a road rally, several car shows, a black-tie gala, an elegant jet center event, two full weekends of racing at two separate venues, and a whole lot more. Since 1983, the Vintage Grand Prix has staged vintage automobile events to raise funds for two Pittsburgh-area charities focused on autism and individuals with intellectual disabilities. To date, the PVGP has contributed more than $5-million to the Autism Society of Pittsburgh and the Allegheny Valley School. A thousand volunteers, hundreds of race cars, and thousands of show cars have combined for one of the Pittsburgh area's largest spectator events every year.

Vintage racing is a sport that's really taken off in the last several decades. It's an extension of the car restoring and collecting hobbies, but one that respects the automobile as a machine – a tool – and not just a work of art. It honors the engineering and innovation of earlier times, as well as the heritage of automobile racing. Cars have been raced, after all, pretty much since the first time there were two of them on the same road at the same time.

Unlike the class I participated in, where the cars are raced as delivered, our vintage race cars have been carefully prepared for the track. Rules mandate that the cars should be prepared as they were, or might have been, raced in period, but that still permits considerable modification. But, old cars are full of old parts -- old welds, old steel and aluminum, old joints and fasteners -- and when they're raced, they're being used in a way that places extraordinary stresses on all their components; stresses that would take a toll on a brand-new car. So, the organizers of these events are serious about making sure the cars are up to the challenges. On the Schenley Park circuit, those include nearly constant turns, bumps and potholes, off-camber curves resulting from the high-crowned public road, and always the threat of accidental contact with a curb, storm drain, hay bale, or even tree trunk or light pole – hazards not encountered on a purpose-built race track. The Schenley Park course is notorious for the repeated heavy use of brakes. Longtime MG-TD racer (and multiple PVGP race winner) Manley Ford says drivers brake "a heck of a lot harder here than at almost any other track we race on." Add the possibility of rain, and, of course, the fact that the drivers are going as fast as they dare all the time, and you have a daunting proposition. It's a task that requires a serious approach to safety in all aspects.

Developed over the years by the serious road racing community of the SCCA, which began sanctioning road racing in the late 1940s, scrutineering, or tech

inspection, provides an opportunity for another pair of eyes, in addition to the driver's/builder's/mechanic's, to inspect each race car. At other events, some of the tech inspection is aimed at assuring that cars meet requirements of their individual race classes. But, in vintage racing, as in SCCA, the main focus is on the safety of the cars – safety equipment, safe racecar construction, and in safe condition.

Tivvy Shenton has served as Chief of Tech for the Pittsburgh Vintage Grand Prix for about 25 years. He's a former vintage racer, and many-time winner here in his Jaguar XK-140. His resume includes apprenticeship at Rolls Royce in his native England, and work for several of Ford's European factory racing programs before moving to the U.S. Now living in Virginia, he runs Tivvy's Autocraft, in Danville, which builds and restores vintage cars.

PVGP Tech Chief Tivvy Shenton and his Jaguar XK-140, dominant for many years in the Over-2 liter Production class at Schenley Park

Tivvy states that the emphasis of his team of inspectors is "strictly on safety." They check for potential issues with, for instance, suspension bushings and steering linkage. They look for cracks in brake rotors and on chassis components, especially on single-seat ("formula") cars and sports racers. They'll check seat mounting, seat belts, fire extinguishers (all cars must carry at least a 2.5 lb. bottle), and the design and installation of roll bars. They're interested in the fuel system, looking for leaks, the location and mounting of fuel tanks, and the installation of fuel cells and bladders.

Tivvy says tech inspection isn't restricted to the cars themselves. Inspectors also want to make sure the drivers are using approved fireproof suits and gloves, and that their helmets are current and approved. Helmets, in particular, have a limited lifespan, and carry labels indicating build-year and Snell Foundation ratings.

John Bechtol, owner and driver of several vintage race cars, who's the PVGP's Competition Director, points out that improvements in suspension stiffness, power, cornering speeds, and increases in weight or changes in weight distribution all have effects on vehicle dynamics, and can bring out weaknesses in components not necessarily expected. Improved suspension allows higher cornering speeds, resulting in increased stresses on suspension parts, wheels, wheel bearings, and half shafts.

John says Tivvy, in fact, spotted a crack in the frame of John's Formula Super Vee before one race. It wouldn't pass tech, so John returned it to his race prep garage, where it was repaired in time to return to the park and make the race. John points out that when formula cars like his suffer a problem, it can be a nightmare for the driver. Open wheel cars have very little bodywork to shield the driver and components, so when they go off the road, or come into contact with another racecar, damage is likely, and injury a possibility. So, John says, most drivers are happy to have another pair of eyes go over their cars before they take to the track.

MG-TD racer and mechanic Manley Ford says that the tech crew is checking items a driver or mechanic might

Tech inspectors make their rounds through the paddock at PittRace. Jeff Graham, of Kittyhawk, NC, patiently awaits a visit to his 1958 Austin Healey Sprite

not even think of, especially if he's been scrambling to get the car ready. For instance, there's an expiration date on racecar seat belts. Manley mentions that sunlight can damage the belts, particularly in cars where the cockpit is open to the elements. They check throttle linkage, to make sure that the throttle return spring is firmly attached; and that a quick-release steering wheel actually locks back onto the column when it's supposed to. Constant removal and replacement can wear locking and latching mechanisms.

Racecars must pass tech before each race weekend. In Pittsburgh, where the PVGP runs two race weekends back to back each July (at PittRace first, then Schenley Park), cars racing both weekends must pass tech at each. Some drivers, like PVGP winner Mark Maehling, bring two cars, to race in two different classes. For two weekends, that means four visits to the scrutineers. Mark says when you're preparing two cars to race, its twice as easy to overlook a potential problem.

Issues concerning particular cars are noted in the cars' own logbooks, which must be presented to scrutineers during tech inspections prior to each race event. The vintage racing magazine Victory Lane also makes an effort to publicize common failures and weaknesses in particular models, alerting inspectors to known tech and safety issues and problems. And, as Executive Director Dan Delbianco points out, the racers themselves help their fellow racers and competitors in a show of support and cooperation not often seen in the pits and paddocks at other race events, lending tools, parts, and expertise.

Top 3 in the Pre-War/MG-TD race. From left, Manley Ford, Middleville, MI; George Shafer, Somerset, PA; and Kurt Byrnes, Upper St. Clair, PA

There are a number of organizations that sanction vintage car racing – Vintage Sports Car Club of America (VSCCA), Vintage Racer Group (VRG), Historic Sportscar Racing (HSR), Sportscar Vintage Racing Association (SVRA), Vintage Sports Car Drivers Association (VSCDA) are a few – and most, like the Pittsburgh Vintage Grand Prix, are members of the Vintage Motorsports Council. In fact, the PVGP's John Bechtol is its vice president. Many of these organizations have their own sets of rules, and the Council has been organized to help coordination and cooperation among them, particularly in the area of driver instruction and licensing.

A portion of the VMC mission statement reads: "All racing is dangerous and only the proper attitude of the driver and the careful preparation of the cars will diminish the danger and will enhance our appreciation of this sport."

While the modern world races ahead, it seems, toward autonomous cars, a small society of individuals races, with a look over their shoulders, and with a love and respect for the technology and machinery of times past.

Come and join us at the Pittsburgh Vintage Grand Prix this July. It's our 36th year of showing and competing with old cars, and raising funds for charity. PVGP.org

WVU RESEARCH GIVES SELF-DRIVING VEHICLES A BOOST

While the future of vehicles may be driverless, West Virginia University (WVU) is steering the technology in the right direction.

More and more cars being sold today include semi-automated features ranging from self-parking to lane departure to automatic braking, but fully automated vehicles are on the horizon. WVU's researchers are working to improve vehicle and smart infrastructure technology that underpins their development and their benefit to communities in areas such as safety, energy, traffic, economic opportunity and more.

Victor Fragoso is assistant professor in the Lane Department of Computer Science and Electrical Engineering at WVU. His research is focused on improving the artificial intelligence of autonomous agents, which includes driverless vehicles.

"With autonomous vehicles, the car is essentially a robot – an agent that perceives the world and understands what is happening in it," Fragoso said. "There is a lot of variability in the world, so we derive algorithms that take that into account and help the vehicle understand the world as robustly as possible so that it can take action."

Fragoso describes an algorithm as a recipe to solve a problem or task. And the vehicles of the future need to have the most comprehensive cook book around.

"With autonomous vehicles, the car is essentially a robot – an agent that perceives the world and understands what is happening in it,"

Fragoso is currently working on a project funded by the National Science Foundation that will help self-driving cars "see" better. He is investigating ways in which the vehicle computer can reason about the different objects it detects and its confidence in accurately recognizing those objects.

Cameras onboard self-driving vehicles gather two-dimensional images. His work develops models that use that data to generate three-dimensional reconstructions of the environment that help the vehicle localize itself (or determine where it is in the city).

Fragoso is also working on artificial intelligence capable of adapting itself to a dynamic environment.

He explains that the models he develops predict common patterns, providing the vehicle with information to make decisions such as when to accelerate, turn and brake, but there are always rare events and outliers that have to be taken into account and embedded into the algorithms.

"Vehicles must account for every possible failure, and there are so many variables," Fragoso said. "That means we must build the algorithms to make them as adaptive as possible. They must account for every possible failure and scenario that could occur, which requires a lot of

data and processing. That means it is also important for them to be fast and efficient."

Kakan Dey, assistant professor of civil and environmental engineering and director of the connected and automated transportation lab, is working on several projects related to how driverless vehicles can benefit communities.

"The ultimate purpose of these advancements in technology and infrastructure is to serve society's transportation needs," Dey said.

One research project he is working on is focused on the shared mobility concept, which seeks ways to provide increased access to transportation for wider spread communities through a service model similar to ride-sharing models like Uber.

Typically, shared mobility is designed for large, urban cities, but Dey is exploring how that model could be implemented in rural communities such as those in West Virginia.

"To develop effective models, we have to find out what are the transportation needs of communities as well as the characteristics of those communities," Dey said. "Integration with existing transit systems to improve end-to-end service for communities could make things more economically viable and increase the prosperity of the state."

Dey is also working on a project related to safety implications of autonomous vehicles operating with conventional non-autonomous vehicles.

Both Dey and Fragoso say that one of the biggest challenges for the future of autonomous vehicles is the transition phase of a "mixed" traffic environment that includes both manual and driverless vehicles.

"We have to teach them to live together," Fragoso said. "From and artificial intelligence perspective, we have to do a lot of reasoning and prediction of what the human driver is going to do so that the driverless vehicle can react."

Dey says that with hundreds of autonomous vehicles on the road being tested, new state and federal laws and policies are necessary to facilitate the maturation of this new frontier and promote new technologies.

"Although autonomous vehicles may fall in the transportation engineering domain, changing vehicle technology and smart infrastructure is truly interdisciplinary," Dey said. "There is a huge social component and this paradigm shift will have an impact on nearly all aspects of our lives."

Release provided courtesy of West Virginia University

Living the Dream

By: Wayne Ferens

Like many automobile enthusiasts I fell in love with cars at a very young age. When I received a pedal car from my parents on my third birthday I knew I was hooked. I grew up in the Bloomfield/Shadyside area of Pittsburgh on the east-end where some of the cities first auto manufacturers and car dealers were established in the early 1900's to supply the growing demand for the automobile. Bigelow and Baum Boulevard, originally part of the Lincoln Highway, and Liberty Avenue were primary roads that extended into the growing east side. Gulf Oil Corporation established the first Drive-in filling station on Baum in 1913.

Gulf Oil's 1st Drive-In Filling Station

Ford, Packard and Hudson soon followed building small assembly plants in the area - although no longer in operation, the buildings still exist. New and used car dealers seemed to be on every block and corner selling those precious gems with names in brass, stainless steel and chrome that spelled out Ford, Oldsmobile, Packard, Studebaker, Buick, Chevrolet and others. Yes, like all young car enthusiasts I was in seventh-heaven.

I attended college in Dearborn, Michigan and began my career working for General Motors and Ford Motor Company in Engine and Power-train development before moving on into management at Honda Motor Company. A dream come true. Since Detroit was known as the "Motor City" the industry had the best labor force in the world. Designers, draftsmen, machinist, engineers, technicians and production people that I had the opportunity to meet and work with made such an impression on me that in my retirement, I still consider myself lucky to have been a part of the greatest industry in the world. Talk about passion - in every department and plant, no matter what company you worked for - the goal was to be the best and do the best job you can, and produce the best product because in the end it was personal.

"...The goal was to be the best and do the best job you can, and produce the best product because in the end it was personal"

Today's designers and engineers are using the most advanced technology available. Manufacturers are spending billions of dollars just to keep pace with the competition. The products are being designed, developed, tested and produced faster, more efficiently, with higher quality, using advanced structural materials and automated production. Some specialty manufacturers like Ferrari, McLaren, Lamborghini and Bugatti are advertising their exotic automobiles as 'Super Ultra High Tech' products. For America to remain competitive in the global market it is going to take an educated and highly skilled workforce.

Early Ford Motor Company Assembly Plant

As a Board Member of the Society of Automotive Engineers (SAE), I often talk to young students about the industry, how it's progressing and also changing. The cars today, and future products will be powered not only by highly efficient gasoline engines, but electric/gas hybrids, full electric, natural gas and hydrogen. They will be loaded with hi-tech batteries, computers, modules, sensors and artificial intelligence (AI). Will we be able to adequately train these future mechanical, electrical, chemical, material engineers and technicians to keep this industry going? Who will service these products? Will the industry have the experienced and skilled management to guide these industrial giants with the passion, vision, expertise and honesty to keep the focus on building the best, most efficient, safest products for those who wish to buy them?

Yes, I have all the faith in the world the young people in this country can do anything just like those early industrial pioneers that started this great industry. A farm boy named Henry Ford, a plumber named Buick, a wagon maker named Durant and the two brothers in Detroit who were machinist named Dodge. They all had things in common, and if you learn about these captains of industry, those that did and didn't make it, those silent heroes working in the shadows with new ideas - creating, innovating, designing, building and making their dreams a reality you would be amazed. The one thing they all did was they got up in the morning and went to work. Some worked harder and some worked smarter than others, some went broke, some became rich, some became richer, but like that farm boy from Dearborn once said: "Whether you think you can or you can't … your right!"


Wayne Ferens

Wayne Ferens is retired after 45 years in the automobile business that included General Motors, Ford Motor Company, Honda Motor Company and new car dealer. Automotive history is one of his passions and has written much about the industry. He is a member of the Henry Ford Heritage Association (HFHA), and a founder of the Piquette Model T Museum in Detroit. He is an avid car and motorcycle collector, and is presently a SAE board member.

ESWP Member News

More than 75 firms are represented in the Corporate Member program of the Engineers' Society of Western Pennsylvania (ESWP). Corporate Memberships are available at 3 levels: Gold, Silver and Bronze. Gold members are entitled to 14 memberships that can be exchanged by employees; Silver, 9; and Bronze, 5 — annual dues are $2400, $1700, and $1000 respectively. In addition, ESWP Corporate Member Firms may add 2 additional individuals in our Under-35 age category at no additional cost!

We also offer Individual Memberships, including a Government rate (full-time), with annual dues of only $50.00! Also, our new Dining Membership allows use of the Executive Dining Room for conducting client entertaining in a great private club setting, all for only $50 annual dues, plus regular entry fee. More information can be found at eswp.com. Please contact the ESWP Office (412-261-0710) for additional details.

Membership in ESWP comes with a long list of benefits! From our continuing education opportunities earning you Professional Development Hours (PDHs), to the business networking events in our Executive Dining Room, there is something for everyone in your organization. Also, ESWP is helping the next generation of engineers with student outreach programs, giving you the opportunity to participate in many rewarding programs.

ESWP Gold Corporate Member Firms

AECOM

gai consultants
transforming ideas into reality

MATRIX NAC

ARCADIS
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GATEWAY
On Call. On Time. On Target.

Michael Baker
INTERNATIONAL

CDM Smith

PARSONS

DIGIOIAGRAY
CONSULTING ENGINEERS & SCIENTISTS

HATCH

solutions21

DEI
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TeleTracking
Workflow Automation for Healthcare.™

ESWP Silver Corporate Member Firms

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KU Resources, Inc.

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TRUMBULL
LINDY PAVING

CDR MAGUIRE

CEC
Civil & Environmental
Consultants, Inc.

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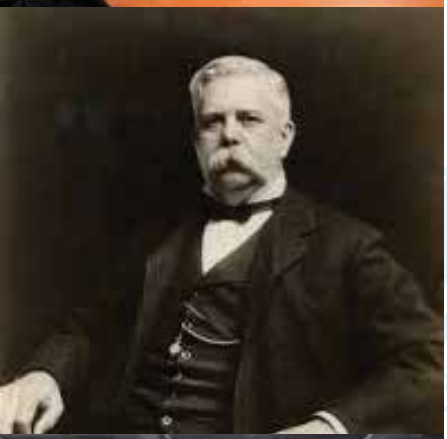


THIS YEAR, AT ESWP

Our Mission

Advance the engineering profession and position Western Pennsylvania as a Center for Engineering Excellence and Innovation

Objectives

Seek and prepare the next-generation of engineers

Offer professional development and networking opportunities

Collaborate on engineering matters of regional and civic importance

Highlight achievements from a diverse spectrum of engineering and related fields

Strategic Initiatives

PROMOTE ESWP AND POSITION THE SOCIETY FOR SUCCESS

- Raise awareness and grow membership
- Increase use of the Engineers' Club
- Develop and distribute exceptional publications

PROVIDE WORLD-CLASS PROFESSIONAL DEVELOPMENT

- Deploy exceptional conferences
- Offer educational and networking events; highlighting innovative technologies and industry best practices
- Provide professional outreach and services to affiliated technical societies

DEVELOP AND SUPPORT FUTURE ENGINEERS

- Mobilize and activate our young members
- Collaborate with local universities
- Promote and participate in STEM (Science, Technology, Engineering, and Mathematics) activities

Belonging to ESWP

Whether you're an individual or a business, an engineer, student or other professional – you'll enjoy a variety of benefits with our affordable annual memberships

Dining at the Engineers' Club

ESWP is located in the stately Pittsburgh Engineers Building, in the heart of downtown Pittsburgh. Our location and award-winning cuisine make it the perfect lunch club for professionals looking for both distinction and affordability.

The perfect facilities – available for your next lunch, banquet or meeting

THE EXECUTIVE DINING ROOM & THE VAULT

- Lunch Served M-F from 11:30AM–1:30PM
- Reservations not required, but appreciated (especially for larger parties)
- Can accommodate banquets & meetings: Breakfast, Lunch and Dinner
- Full audio visual capabilities with Wi-Fi enabled
- The vault serves as an intimate dining room for up to 12 guests

THE BOARD ROOM

One of our most popular rooms, the Board Room is traditionally set conference style and can accommodate 20 people comfortably. Natural lighting makes the room comfortable for meetings and conferences, along with the full range of AV services.

THE MAIN DINING ROOM

The Main Dining Room, our largest room, is located on the second floor of the Pittsburgh Engineers' Building. It can be set with different table configurations for meetings, conferences and social events, along with the full range of AV services. The room can accommodate 25-125 people.

Our Annual Awards Banquet

For more than 130 years, members and friends of the Engineers' Society of Western Pennsylvania have gathered to celebrate engineering, and recognize the best and brightest stars in the profession. Awards presented include:

- The Metcalf Award – Our Lifetime Achievement Award

- Project of the Year Awards – Presented for engineering excellence in categories of Transportation, Technology, Sustainability, & Commercial
- Engineer of the Year

STEM Outreach

ESWP is dedicated to encouraging the "next generation" of engineers, through innovative, enjoyable, and hands-on learning opportunities, and other activities, such as the Members College Scholarship.

Original programs such as our Design Lives Here program, the ACE Mentor Program, and the nationally renowned Future City Competition offer students the opportunity to learn by doing, alongside professional engineers, mentors, and teachers.

Pittsburgh ENGINEER Magazine

ESWP publishes the quarterly Pittsburgh ENGINEER magazine, covering interesting and timely topics on all engineering disciplines.

ESWP Sponsored Conferences

INTERNATIONAL WATER CONFERENCE® (LOGO)

The ESWP-sponsored International Water Conference® is the world's leading technical conference on industrial water and waste water treatment. For more than 75 years, attendees from around the world have attended this international event.

INTERNATIONAL BRIDGE CONFERENCE® (LOGO)

Since 1983, ESWP's International Bridge Conference® attracts a world-wide audience for technical presentations, tours, seminars and exhibits. Held in the City of Bridges, the IBC now attracts more than 1,500 attendees annually.

PA BROWNFIELDS CONFERENCE (LOGO)

Since 1995, ESWP has been committed to the cleanup of environmentally impaired industrial sites. Originally titled the 'Industrial Site Recycling Conference', this event preceded the term "brownfields".

Who is part of ESWP?

ENGINEERS

A multi-disciplined community of more than 850 members and more than 400 different firms

NON-ENGINEERS

Associate members from healthcare, finance, law, insurance, government

AFFILIATES

Home to more than 30 different technical & professional organizations, providing administrative support services

Affiliated Technical Societies

In addition to calling ESWP "home", Affiliated Societies enjoy many other membership benefits as described here. You can learn more about our affiliates by clicking on the link to their website, or contacting the officer currently listed with their respective association.

The following professional organizations are just some of the Affiliated Technical Society members of ESWP.

- ASCE – American Society of Civil Engineers
- PMI – Project Management Institute
- PSPE – PA Society of Professional Engineers
- SAME – Society of American Military Engineers
- SWE – Society of Women Engineers

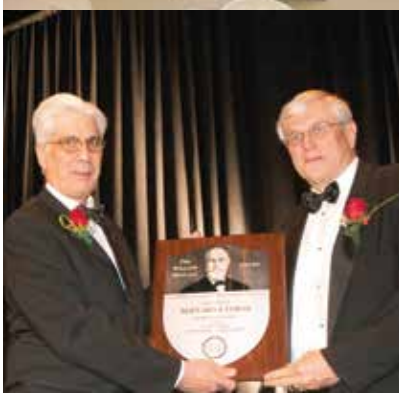
It's your ESWP! How can ESWP help you?

To learn more about the ways that an ESWP membership can help you grow, personally and professionally:

Visit eswp.com
Call 412-261- 0710
Email eswp@eswp.com

Engineers' Society of Western Pennsylvania

337 Fourth Avenue Pittsburgh, PA 15222



ESWP Bronze Corporate Member Firms

Ten Minutes
with Mike Zappa

ESWP Publications Committee Member Paul Parise sat down with Guest Editor Mike Zappa to discuss his lifelong interest in vintage cars, racing, and automotive engineering - then and now. Here are the highlights of that conversation...

Paul Parise: What's your all-time favorite car?

Mike Zappa: As far as a race car or a street car?

PP: Could be any.

MZ: As far as a race car goes, a Chevron B16. Probably my all-time favorite car. It was a prototype car built back in the 60's that came with an YBM four-cylinder. It was extremely fast, it handled extremely well, great car. It ran Le Mans in '69, probably my all-time favorite race car. All-time favorite street car, most likely a Jaguar E-Type.

PP: I agree, that's a great car. So just to infer a little bit about your background, originally you were enamored with race cars in school at Pitt and later it led to show cars and the like, so if you could, about the show car period, how did you get into that and what did you like about it?

1965 FORD GT 40 MKI

Zappa: Being a car fanatic I always liked going to car shows to see what they had to offer and I wanted to be a participant. With the show cars, the frustrating part of was, (particularly when you got into concourse), the points they would take off if you had a blade of grass on your tire or if you had a speck of dust on your hood. That became extremely frustrating for me and I wanted to utilize the car more than just driving it to a show, putting it on the lawn, sit there and watch it and bring it home and put it in the garage. I wanted to actively participate in really using the car for what it was designed for. That's what led me to probably the racing side of it all.

Parise: How long did it take you to come to that realization? A couple years?

Zappa: Well, I guess everybody has the excuse. When you have children, it sort of changes your lifestyle a little bit; it definitely changed mine. I could have a car for an entrant to a car show with the kids and it wouldn't cost me any money to participate. I probably did that for about four years. Once the kids were old enough and in school, I started making a little bit more money, I then swung straight into racing the cars.

Parise: So into the racing portion of your automotive career, what was the first race car you had and how did you get involved in racing where you could actually enter a race and what was that process?

Zappa: Well of course being from Pittsburgh, the Pittsburgh Vintage Grand Prix was a big attraction. It all started with the car shows at Pittsburgh Vintage Grand Prix. I was watching these race cars go around Schenley Park and I said "I'd love to do that!" So the idea was to find a car that would suit me best. Initially I was attracted to formula cars at that time so I bought myself what is known as a Lotus 18. It's a Lotus 18 Formula Jr. because the Lotus 18 V8 ran Formula 1. This had a little four-cylinder motor in it that was great for Schenley Park. So I bought the car, probably paid more than I should have, but I had an absolute blast driving it, there's no doubt about that.

Parise: And from there you went onto bigger-bore engines or what was the next step on the run on the ladder?

Zappa: I think what we transitioned to was I got away from open-wheeled cars and stepped into prototype cars immediately. That's when I started to drive and own the Chevron B16, then a Lola T212, these were all race-production cars that really were fast, lightweight, and they were considered sport racers. I found myself wanting this need for speed which led me to the Ford GT or otherwise known in America as the GT40. You know we had a 289 Mark I which I just sold that car a year ago. That car at Elkhart Lake would do 212 miles an hour on the back straight, wheel to wheel with another car. So that need for speed was definitely being fulfilled. Now that I'm older, I'm probably stepping down to a production car like an MGB which I race at Schenley.

1962 MGB Race Car

Parise: I think the one thing people don't realize, unless you are a car guy, is the Ford GT 40 really was commissioned as a Ferrari beater, from what I understand Henry Ford II was actually going to buy Ferrari at one point and eventually pulled out of that deal. I think he commissioned that car specifically to beat Enzo Ferrari in Le Mans, which he successfully did, right?

Zappa: That's correct. Henry Ford II did try to buy Ferrari, Enzo turned him down. That's what ticked-off Henry to build the Ford GT. The Ford GT, which Eric Broadley was the basic designer who was also the designer for the Chevron B16, there are some similarities in the cars that they were coupe cars with the engine in the rear, etc. only the Ford had a much bigger engine. The Ford GT was almost a Lola design originally, it was a Ford Lola and then a Ford GT and they raced with several different types of engines back then also. Then it evolved; of course in '66 and '67 when they swept Le Mans 1,2,3 won first with the 289 first and then with the 427 cars.

Parise: I think one of the interesting things now is, that if you look at how race cars were designed and built in that era, which would be in the 60's and you fast-forward to today, it's an entirely different ball game. Where at least, to some degree back then, you could be almost a nobody building a race car in the back of your garage where nowadays it's a much more involved effort, both from a monetary standpoint and what have you. I guess maybe that's the allure with vintage racing, is that kind of what draws you? Its carburetors and things we know might not be around or what is it?

Zappa: You've got to remember back then in the 60's and even in the early 70's we didn't have computers to analyze every motion of the car, what was being stressed, what wasn't being stressed. Engineers now apply computers to the car design and the whole world changed immediately, you have active suspensions that are computer controlled, whereas in the vintage cars, you crank a nut here or there to change the suspension setting or to change the shock setting, now it's all done electronically. You know, the steering assist or drive-by-wire, I mean back in the '60's we were essentially hooked-up to the tires and the steering wheel, now its drive-by-wire, there's no hook-up from the wheels, to the steering rack to the steering wheel in the car. People don't realize it, but that's a fact, that's where we are today. We're so advanced technically today, these are some of the things that make the cars much more expensive and much faster too, but not as much fun as far as I am concerned. Back then it was driver skill, today it's how good the car is designed and how good the car behaves on the race track. You can almost throw somebody with some limited experience in a car like that and they'll go fast.

Parise: To that end, one of the things I saw recently, there's a documentary on Amazon right now and the preface of that is essentially Nissan commissioned a driver for Le Mans who trained on video games. There was a competition, they came up through the ranks on these video games and eventually it got to a point where they put them in a real car and then put them through Le Mans. So it's kind of interesting to have that point be made.

Parise: Back to vintage cars and some of the good things that are enjoyable about driving them and whatnot, what about the safety aspect. How does that play into what you do as a vintage racer and how do you address that concern?

Zappa: You know these cars are not cars designed with air bags. What they do have on the fuel side is they have a fuel cell, which is modern. Back in the day, they just had the gas tank, a steel tank, now they're foam-lined, they're sometimes double-lined so that the fuel upon impact is contained within the actual environment it's been put it. That's just one thing, we are strapped-in pretty seriously with probably either a 5 or a 6-point harness, you have roll cages that are mandatory that if the car flips. I'll be honest, I've had a couple of serious shunts in the vintage car and with that because of the cages and the fuel cell being what it is , etc., the car was totally destroyed but I came out

with some minor bruises. So there is safety but it's not like modern day cars today, it's a different type and I mean you get into a race car today, back then they didn't wear seat belts. Well now even vintage cars are required to have seat belts.

Parise: What about things like tires? Are you running modern compounds or something different?

Zappa: Tire manufacturers are producing tires that are engineered for the vintage car, probably with a little bit more modern compound in it but they are tires that meet what we call the vintage spec. They're doing a great job. Pirelli, Hoosier, they're all doing a great job of producing a tire that is suitable for the vintage car.

Parise: So with that, where would you like to see the automotive industry go as a whole? Clearly there's a movement towards emissions and things of that nature and even electric cars, that maybe to some folks take the fun out of it. What's your vision to keep that fun aspect of cars and keep the industry alive?

Zappa: In my vision, I am a driver. I hate to see driverless cars and trucks on the road. That's, to me, why even have a car? Just jump on a train or an airplane because you don't need it at that point. I mean, the electric cars they're great. Tesla builds an incredibly fast car that I see keeps running pace with the Hellcat built by Dodge. I mean they're running neck-and-neck in a quarter mile. But to take the driving experience away from the driver? What purpose is that? Now you're just a passenger in the back seat.

Parise: I think with that, one thing we need to keep in mind in the automotive industry is while there is a push for greener technologies and other things that might make it more convenient, there's still a handful of folks that enjoy cars and enjoy working on them and all of the excitement that comes with them, so hopefully we'll be able to see some technology and still keep that aspect in the future. I appreciate you being with us and thank you very much.

Zappa: Thank you.

You can learn about Mike Zappa and Zappa Racing by visiting his website, found here: https://www.zapparacing.com/about-us

Making Mr. Ford Proud

By Cathy Benscoter, Penn State Beaver

In Spring 2012, when Penn State University's Beaver Campus engineering students built a working replica of Henry Ford's first combustion engine, their professor, Jim Hendrickson, had one goal: run it for William Clay Ford Jr., the chairman of the Ford Motor Company.

"I invited Mr. Ford to come to campus to see it," Hendrickson said. "Our understanding was that Henry Ford's original was thrown out somewhere along the way. I thought his great-grandson would like to see one running."

It took over a year, but that goal became become reality. And today, that engine is a permanent fixture in the Ford legacy.

THE KITCHEN SINK

Hendrickson, assistant teaching professor of engineering at Penn State Beaver, is famous for the projects he gives his students.

Over the years they've created a 3D model of a mill in Ohio, refurbished a blacksmith forge in Hookstown, Pa., and reverse engineered the Bessemer oil field pumping engine at Moraine State Park in Butler County.

"The test of a good project to me is: Does it have historical significance?" Hendrickson said. "One of the things I try to do is make students appreciate how great something actually was in that time period because it's hard to do now."

His other considerations: Have any college students ever accomplished such a thing and could I actually do it?

Penn State University Beaver Campus Students Demonstrate their Replica Engine in Detroit

"If I'm not completely certain I could, then it's a good student project," he said with a small smile.

In 2012 for his Engineering Mechanics: Dynamics course, he decided to kick it up a notch.

While reading the owner's manual to his grandfather's 1908 Model T, Hendrickson got an idea. "I started to think about it. This might be a neat project. We could build a car here," he said.

Ford's first combustion engine, known as the Kitchen Sink Engine, was never installed in a vehicle. Instead, it served as a proof of concept for his first car, the 1896 Quadricycle.

"The story goes that on Christmas Eve 1893, Henry Ford had his wife put down the turkey and come to the kitchen sink to help him start this thing," Hendrickson said.

The engine was plugged into a light socket, and Ford and his wife regulated the fuel intake by hand. They got it started, and Ford went on to automotive history.

It seemed like a great idea for a project, Hendrickson said, and he handed it over to his class of 11 sophomores with ample funding. "Being a generous sort, I gave them a budget of $1," he said.

A semester, dozens of donated parts, and a cup of coffee (that's where the group spent their dollar) later, the students had a working engine.

They called in Beaver alumnus John Grace, managing

engineer of the paint facility at Ford's Dearborn Truck Plant, to help.

Grace knows many people at the Henry Ford Museum and Greenfield Village in Dearborn, Mich. He put the professor in touch with Jim Johnson, senior manager of creative programs.

Despite having the original engine in storage and a nearly identical replica of it on display in Greenfield Village, Johnson was immediately interested, and Hendrickson knew why: "The replica they have doesn't work," Hendrickson said. "Ours does."

DETROIT ROAD TRIP

Johnson invited Hendrickson and his students to display their replica at 2012 Maker Faire Detroit, an invention fair hosted annually by the museum. The students were given space in the museum's tent alongside reproductions of the Quadricycle, an 1885 Benz Patent-Motorwagen, an 1885 Daimler Reitwagen, and Ford's 1901 "Sweepstakes" race car.

PSU/Beaver Campus engineering students demonstrating the engine at Maker Faire

"Everyone loved seeing the engine run and hearing the students talk about it," Johnson said.

That included the judges of the fair, who awarded the students three blue ribbons for their project. Christian Overland, executive vice president of The Henry Ford, was particularly impressed.

"I like Penn State Beaver's engine because it's using a preeminent historical story and object and reinvestigating that," Overland said after presenting the first of the ribbons to the students. "It's obviously a piece that works. More importantly, when I talked to the students about it, I could see there's a real team here."

Clara Deck, the museum's senior conservator of historical resources, choked up when she saw the reproduction running. "We have the original, but I've never seen it run," she said, swiping at a tear. "We've thought about getting our replica started. Every year we want to make it run and get it out here for people to see, but we've never had anyone who had the time to tinker with it."

After the campus's successful appearance at Maker Faire, it was clear that Hendrickson and museum officials were both interested in forging a lasting relationship.

Eventually, Tom Varitek, senior manager of program operations, who was heading up the museum's plans for Ford's 150th birthday celebration in summer 2013 asked Hedrickson to loan it for a hands-on, interactive display for Greenfield Village.

The exhibit, "Henry Ford and His Machines," would follow the young Ford at three crucial stages in his life: at 12, when he took apart his father's watch; at 19, when he became interested in steam engines; and at 30, when he began investigating gasoline engines.

On the night of July 30, the 150th anniversary of Henry Ford's birth. William Clay Ford Jr. hosted a dinner at the museum for members of the Detroit Economic Club. Guests took rides in Model Ts and strolled the streets of the village.

And at the heart of it all was Penn State Beaver's Kitchen Sink Engine.

"We ran it almost continuously all night during the party," said Micki Kitchen, manager of community life and industry programs. "We'd turn it on for about 15 seconds then turn it off again. Then someone else would come up and talk to us, and we'd turn it on again. Everybody got such a kick out of it. It was really fun to watch their reactions."

"Everybody," of course, included William Clay Ford Jr. himself.

STILL RUNNING

Hendrickson is still a bit awed by the attention the project has gotten from museum officials.

"My biggest surprise is how it's been adopted by them," he said. "I didn't really expect it was going to be something that would end up on display at The Henry Ford. That part of it kind of took on a life of its own."

The engine was originally scheduled to return home in September 2012, but the deadline was extended one month, then another. As of November 2017, it is still on display in Greenfield Village, where they regularly fire it up for visitors.

With the engine's undeniable success at the museum under his belt, Hendrickson has now set his sights higher. "My goal is to get their replica and bring it back to get it started," he said.

Preparing Cities for the Revolution

Public policy must evolve along with technology. In the last automobile revolution, public policy favored the suburbs by investing in highways, subsidizing gas and subsidizing single-family homes. Left unregulated, the emergence of autonomous vehicles (AVs), or driverless cars, may perpetuate business as-usual operations and increase congestion, encourage sprawl and exacerbate growing inequalities. Public agencies may face lower transit ridership and lost revenues from transit tickets, parking fees, traffic fines, and other once-reliable revenue sources. Conversely, if proper policies are in place, AV technology has the potential to dramatically reduce traffic congestion, enhance public transit, redevelop parking and encourage the growth of walkable, mixed-use communities.

Policymakers must seize the opportunity to steer our cities toward a more accessible, equitable, and sustainable future. In light of the AV revolution, we have identified six priorities for cities, transit operators and other public agencies to consider.

1. LEVERAGE TECHNOLOGY TO ENHANCE MOBILITY

The majority of the U.S. population cannot easily compare the speed, convenience and cost of driving with other alternatives. While a range of apps have begun to fill this gap (e.g. Moovit, Transit App, Swiftly, Moovel), data is often missing or outdated as transit agencies and private operators are reluctant to share data. Further, payment systems don't work with each other, making it difficult to track and incentivize multimodal trips. To create a level playing field between AV services and public transit, cities need to work with private operators and app developers to create universal apps that will schedule, book and pay for any transportation option under one platform. After entering a destination, riders could compare options to find the fastest, cheapest, lowest environmental impact trip. While some apps already offer scheduling and booking features, payment is often restricted to apps controlled by private operators (e.g. Uber, Lyft, CitiBike) and public operators (e.g. MTA eTix, DART GoPass, Metro Mobile). Cities should engage private apps and private operators to integrate universal payment with the mapping and booking of trips to improve the user transit experience.

2. PRIORITIZE AND MODERNIZE PUBLIC TRANSIT

To compete with AV, public transit must become more convenient. Despite its lower cost, public transit is often slower and less convenient as riders have to walk, bike or drive to the closest station for their first and last miles. In addition, riders have to coordinate transit schedules and pay for each part of their trip separately.

With driverless technology, private taxi services may become so affordable that riders will opt for AVs for the full trip and bypass transit, especially in off-peak hours with low congestion. Services such as Uber

already offer shared rides at prices that competes with public transit. In peak hours, transit may remain competitive if it operates on a dedicated route (e.g. rail, dedicated bus routes) that bypasses congestion. In off-peak hours, transit operators must provide faster, more convenient service to remain competitive or create partnerships that provide access to difficult-to-serve areas of the city.

With AV technology, public transit can transform into a seamless, point-to-point service. To enable this vision, cities and transit agencies should consider:

- Prioritizing high-demand corridors
- Using driverless shuttles for first and last-mile connections to stations
- Expanding mobility hubs to accommodate for driverless shuttles

3. IMPLEMENT DYNAMIC PRICING

Today, private services complement and compete with public transit. To close the first and last mile gaps, Uber and Lyft have partnered with SEPTA in Philadelphia to subsidize rides that begin or end at a transit station. At the same time, Uber offers shared rides at lower costs than public transit and in areas where transit is readily available. For example, in Manhattan below 125th Street, uberPOOL can cost as little as $2 per ride (or $79 for an unlimited monthly pass) during commuting hours.

Some options are more beneficial from a social cost standpoint depending on the emissions and burden on the transportation network. Given the introduction of AV technology, private services will become even more affordable and compete more directly with public transit. While public transit must continue to improve (e.g. increased frequencies, dedicated guideways, driverless shuttles, smartcards, etc.), cities can also use dynamic pricing to create a more level playing field. A potential dynamic pricing plan may incentivize trips that complement public transit and discentivize trips that compete with public transit. Trip pricing may vary depending on a combination of variables, including:

- Origin and destination
- Number of passengers
- Level of congestion
- Environmental impact
- Household income

Dynamic pricing will have the most impact when riders can compare prices conveniently using a universal app and payment method. For example, in Los Angeles, the city may consider using the Go-LA app and Transit Access Pass to offer an incentive to riders who take the Metro and opt for bikeshare for their last mile.

Dynamic pricing can be enacted through any combination of vehicle miles traveled fee, greenhouse gas tax, weight-distance tax, congestion pricing, or variable tolls, with any revenues generated to subsidize public transit, driverless shuttle services, or other uses that support public policy objectives.

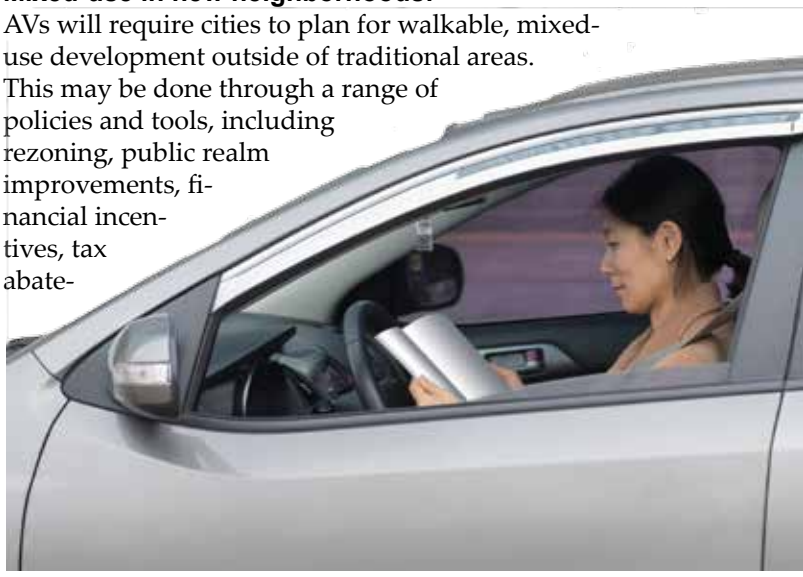
Finally, cities may also use dynamic pricing to address equity and to serve economically distressed areas. For example, a city may choose to subsidize low-income riders from an underserved neighborhood to the nearest transit station. As part of a revitalization plan, the city may consider subsidizing trips that begin or end in a neighborhood. To attract employment uses, cities may choose to subsidize trips that begin and end during commuting hours. Private businesses and property owners, many of which already operate shuttles, may also participate.

4. PLAN FOR MIXED-USE, CAR-LIGHT NEIGHBORHOODS

Previously less accessible places will attract development because of new transportation choices. Cities and suburbs must embrace walkable, mixed-use development to attract and retain residents and businesses. At the same time, smaller towns — with limited room for new development — may struggle to accommodate the new demand. This reinforces the need for regional planning and smart growth policies. To prepare for a driverless future, cities may consider:

New criteria for public transit investments:
When planning for future transit lines, cities and transit agencies often evaluate different alternatives based on the impact on property values, new development, job access and other development goals. Should AVs become widely adopted, such analyses may require revised factors.

Mixed-use in new neighborhoods:
AVs will require cities to plan for walkable, mixed-use development outside of traditional areas. This may be done through a range of policies and tools, including rezoning, public realm improvements, financial incentives, tax abate-



ments, assistance with land acquisition and reduced parking ratios. Parkmerced of San Francisco is 1.5-miles away from the closest BART station, outside of a traditional half-mile station area. However, the apartment complex is providing new residents a monthly $100 transportation credit for use on public transit or Uber.

Parking ratio reduction:
Many cities allow developers to reduce the number of parking spaces in a project if it exists within a quarter or half mile of transit. With AV technology, cities may consider expanding eligibility to projects outside of a half mile of station areas, especially if a developer chooses to provide tenants with transit passes or driverless shuttles.

Parking in-lieu fees:
More than 40 cities across the U.S. have adopted voluntary parking in-lieu fees, which allow developers to pay a fee to the city rather than providing more expensive on-site parking spaces required by the zoning code. Revenues can be directed toward transit passes, driverless shuttle subsidies or other alternative modes of transportation. Cities may need to support developers as they persuade potential lenders that fewer parking spaces are justified.

Require or incentivize alternatives to driving:
Cities can encourage developers to provide alternatives to driving. This can be mandatory in stronger markets or incentivized through additional development rights, tax abatements or fee waivers.

5. ENCOURAGE ADAPTABLE PARKING

Driverless technology will change the quantity, size, location requirements and economics of parking. In the face of this uncertainty, parking lots and garages should be built with eventual redevelopment in mind. Design should allow parking spaces to be converted for residential, office, retail, community facilities or other uses. This may require the provision of level floors, higher ceiling heights and centralized ramps. As parking demand decreases, parking spaces may be converted over one or multiple phases.

Convert on-street parking to public space:
On-street parking can be converted to public use with minimal time and cost. Beginning in 2009, New York City began to experiment with the pedestrianization of Broadway near Times Square. After a successful pilot, the streets were permanently converted into open space and the idea spread throughout New York City and other cities across the U.S.

Redevelop parking lots:
To accelerate redevelopment, cities may consider taxing surface parking lots at a higher rate to encourage redevelopment into more productive uses.

Mandate or incentivize adaptable parking garages:
As part of a broader overhaul of parking regulations, cities should determine areas where mandates are viable or incentives may be necessary. If incentives are needed, cities may evaluate the value and feasibility of matching grants, tax abatements, lower parking requirements, additional development rights, or other forms of assistance.

6. PROMOTE EQUITABLE ACCESS TO NEW JOBS AND SERVICES

Disadvantaged populations may have unequal access to AV technology and services. To provide access to populations that are not connected to financial institutions, cities should encourage public and private operators to accept pay-as-you-go smartcards for payment or partner with local credit unions to provide financial services, as bikeshares in New York and D.C. have done. For those without smartphone or internet access, cities should encourage private operators or third-party services to provide alternatives means (such as Dial-A-Ride) that can hail a ride on behalf of riders.

To ensure equitable service coverage, cities can choose to regulate or incentivize. As a regulator, cities should explicitly identify equity as a policy goal when approving new or expanded services and provide all operators clear, measurable outcomes (e.g. percent of rides taken by disadvantaged riders, percent of rides originating or ending in a low-income neighborhood) that must be met or exceeded. In addition to regulation, cities may also consider whether financial subsidies are viable and identify the most appropriate mechanism for providing it (e.g. smartcard, universal app).

As AV adoption occurs over time, policymakers must also ensure that those in legacy occupations save the

opportunity to participate in newly created industries. For example, professional drivers may need new training and certifications to operate and maintain an AV. Driver responsibilities may also shift from driving to providing and selling services to riders or managing a large-scale fleet. In most cities, a driving position is relatively accessible and requires minimal training and qualifications. To ensure that these drivers can remain competitive in the new economy, policymakers should partner with automakers and transportation companies to provide drivers with access to the training they need to meet the trends and demands of the industry.

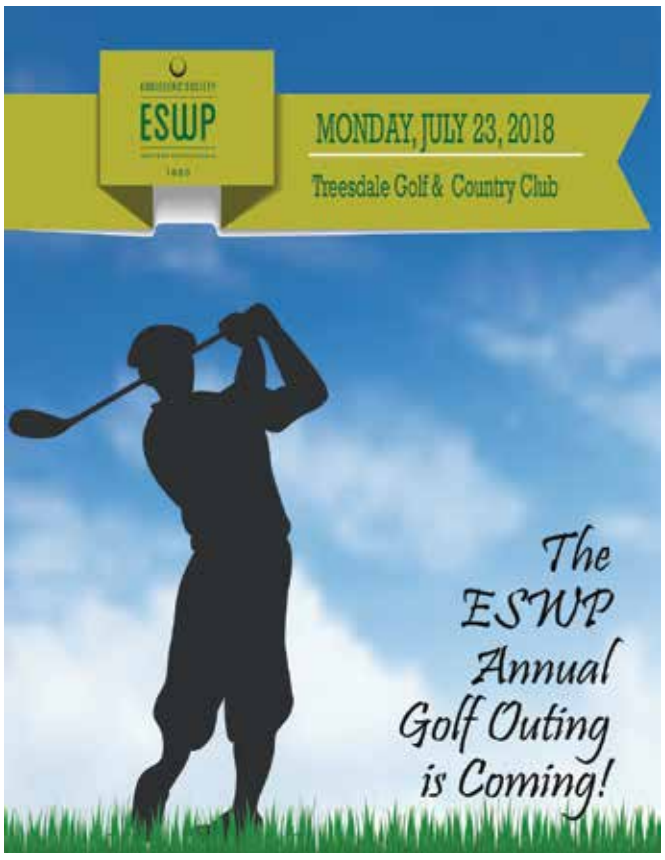
The Road Forward

Cities that are prepared for AVs have a generational opportunity to achieve long-stated goals in mobility, equity, and sustainability, and to deliver a higher quality of life to citizens. Cities that are unprepared may be left behind, or worse, they will watch while decades of economic, social and environmental progress are reversed.

While the speed and pace of AV technology adoption remain unclear, its imminence is certain. In the face of this, city leaders — together with transit agencies, private operators, developers, other stakeholders, and the public at large — have an obligation to define new policies that protect against risks while seizing new opportunities.

These new policies and experiments in shared mobility — and any lessons learned — should inform and provide the foundation for AV policy. We believe cities will succeed if they have clear policy objectives, a deep understanding of these approaches and an appreciation for their interdependencies in a driverless future.

This is an edited excerpt from "Driverless Future: A Policy Roadmap for City Leaders" developed by Arcadis, HR&A Advisors and Sam Schwartz. The full paper is available at www.arcadis.com/driverlessfuture.



LOWERING METHANE EMISSIONS FOR NATURAL GAS VEHICLE FLEET

Fleet of refuse trucks fueled by compressed natural gas (CNG). Over 20 vehicles were tested under the study including five different refuse trucks of our study partner, Waste Management

A new study published in August, 2017 in the Journal of Air and Waste Management Association builds upon recent heavy-duty natural gas vehicle methane emission measurements to model methane emissions from a future, much larger vehicle fleet. The predicted methane emissions rates from a 2035 natural gas fleet cover a wide range depending on technologies adopted and best management practices employed.

This study, conducted by researchers at West Virginia University's (WVU) Center for Alternative Fuels, Engines, and Emissions, comes as the price of natural gas has decreased, leading to interest in natural gas as a cleaner replacement for diesel in heavy-duty vehicles. Natural gas vehicles currently make up a small market share but are predicted to grow significantly over the next few decades.

Methane, the main component of natural gas, is a cleaner burning, lower carbon intensity fuel. However, it is also a powerful greenhouse gas, and leaks from vehicles and fueling stations have the potential to undermine the climate benefits of using natural gas over diesel fuel.

The paper entitled, *Future Methane Emissions from the Heavy-Duty Natural Gas Transportation Sector for Stasis, High, Medium, and Low Scenarios in 2035*, used data from a prior study to project various scenarios in order to evaluate potential emissions reductions of technological advances and best management practices. The study did not look at the full suite of vehicles on the road today but rather focused on vehicles and engines currently under production as these represented those most likely to populate the fleet in the year 2035. For this reason, the study does not estimate emissions from the current fleet

Study Co-PI Dr. Johnson searches for natural gas leaks during the audit of equipment at a compressed natural gas (CNG) station.

"We considered both liquefied natural gas and compressed natural gas technologies employed in a future fleet and considered a range of engine applications including over-the-road and refuse trucks and buses," said Nigel Clark, Professor of Mechanical and Aerospace Engineering, and George Berry Chair at WVU. "Our first study served to highlight fuel losses meriting future attention and we assess the impacts of their potential reductions within this study."

This study found that the biggest reduction in emissions would come from implementing closed crankcase ventilation systems on heavy-duty natural gas spark ignition engines. Adherence to best practices during fueling and fuel station management could also have a significant impact on the amount of methane leaked through reduction in manual venting of LNG tanks and proper design of station and fleet combinations. In addition to current and new technologies, regulation and policy may lead to further developments that could reduce methane emissions.

A new study by researchers at WVU models methane emissions from a future, much larger vehicle fleet.

"While the models in this paper provide valuable insights on technological and management practice improvements to reduce methane emissions as the natural gas fleet grows, the study only looks at the emissions from the fleet and associated infrastructure, or the 'pump-to-wheels' emissions. However, to understand fully the climate benefits of an industry swing from diesel to natural gas, the full 'well-to-wheels' emissions must be considered," said Joe Rudek, lead senior scientist, Environmental Defense Fund.

Support for this study was provided by the Environmental Defense Fund, Cummins, Cummins Westport, Royal Dutch Shell, the American Gas Association, Chart Industries, Clean Energy, the International Council on Clean Transportation, PepsiCo, Volvo Group, Waste Management and Westport Innovations. Support was also provided by West Virginia University's George Berry Chair endowment and the WVU Transportable Chassis Testing Laboratory personnel.

A Scientific Advisory Panel comprised of academic experts in the fields relevant to the study served as independent advisors, reviewing the appropriateness of the methodologies, results and statistical methods.

Release provided courtesy of West Virginia University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