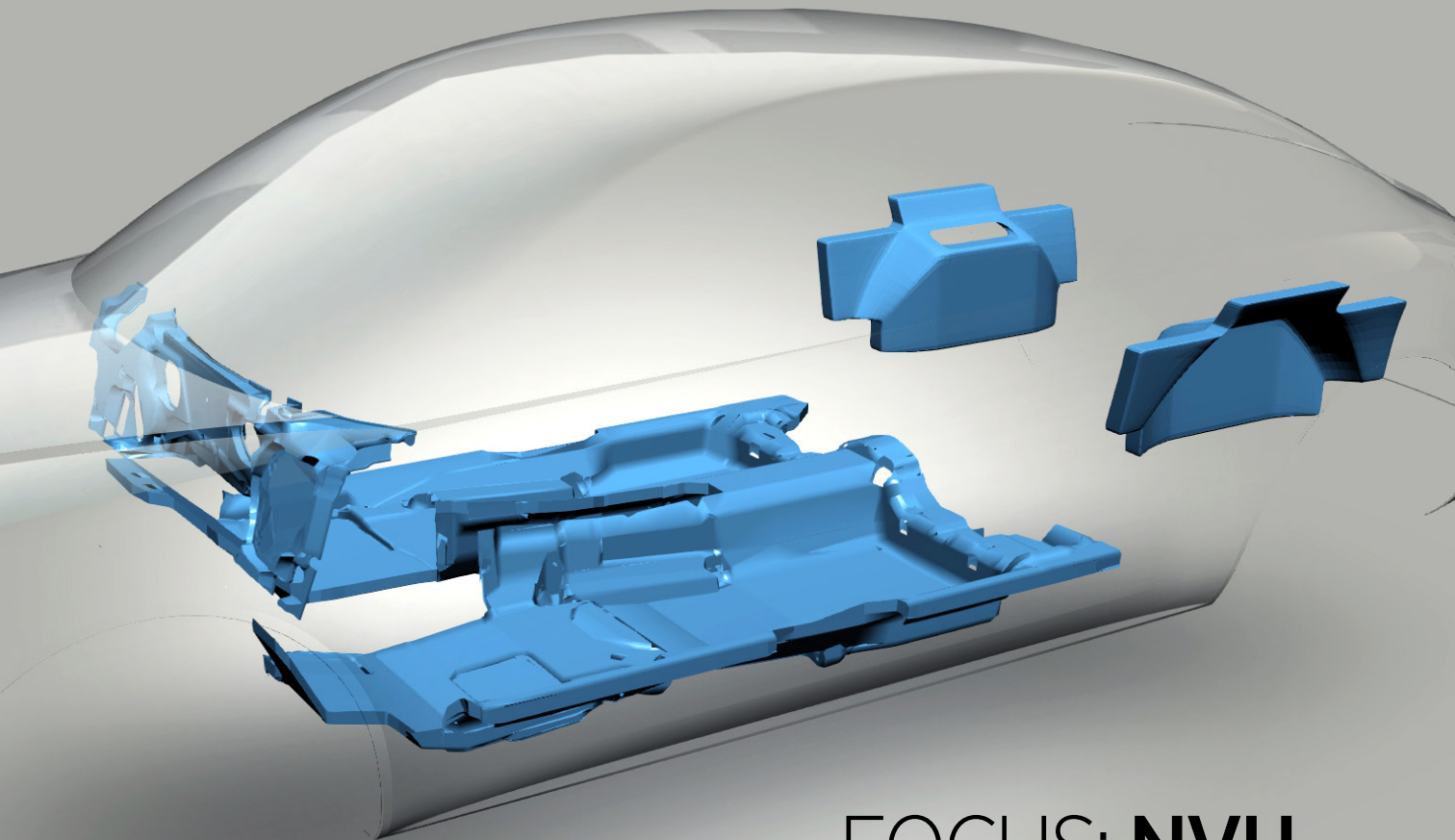


UPDATE

NEWS & INSIGHTS FOR MOBILITY PROFESSIONALS



FOCUS: **NVH**

SAE experts have a lot to say about noise, vibration, and harshness.

GOVERNMENT/INDUSTRY MEETING

January 18-20, 2022
Washington, DC & On-Demand
sae.org/gim

KEYNOTE SPEAKERS:



Sterling Anderson
CPO & Co-Founder
Aurora



Steven Cliff
Administrator
NHTSA

Stay tuned as we confirm more high-ranking agency officials to keynote this critical event!

WORKSHOPS:

- NEW! Legislation, Regulations, Enforcement
- NHTSA/SAE Cyber Security CyberSecurity Workshop

LUNCH ROUNDTABLES:

- Leveling Up Safety
- The Road Ahead: How Recent Government Activity on Vehicle Emissions and Fuel Economy Could Impact What We Do

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State & Federal Government Employees
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*This meeting is co-located with

WASHINGTON, DC
AUTO SHOW 



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On the cover

Special materials placed in the right places makes all the difference in NVH.

Autoneum

Using blockchain for aviation parts tracking

SAE International recently announced a cooperative partnership with [SkyThread](#), a Delaware-based startup leveraging blockchain as an enabling technology to track the journey of aviation assets from entry into service to sale, modification, conversion, transfer, redelivery, and final decommissioning.

As part of the partnership with SkyThread, SAE will launch new initiatives and services aimed at improving safety and reliability while also unlocking billions of dollars per year in currently unrealized global industry values, beyond pre-pandemic levels of performance.

“We are excited to partner with SkyThread to collaboratively support the aerospace industry’s digital transformation and help uncover new opportunities for Safety and efficiencies,” said Raman Venkatesh, chief operating officer of SAE International and chairman of SAE Global LLC. “In pursuit of its mission, SAE is uniquely positioned to merge more than a century of consensus building with aviation’s accelerating shift towards a global digital ecosystem, where fair distribution of value is central.”

The aerospace industry currently uses manual processes and highly fragmented legacy information systems, which can affect the quality and timeliness of data flow, even for information that pertains to the same aircraft part or airplane. This creates inefficiencies across many aircraft events, MRO and aftermarket transactions. It is also affected by the perceived risks in data sharing as well as a lack of fair monetization and distribution of value created in and across the ecosystem.

“SkyThread’s blockchain-enabled data network, combined with industry-leading validation, makes



SkyThread

SkyThread CEO Mark Roboff has been a member of SAE since 2019 and currently chairs the SAE-G34/EUROCAE WG-114 Joint International Committee for AI in Aviation.

records and documentation data permanent and unchangeable,” said Mark Roboff, chief executive officer of SkyThread.

“Confidence that parts are genuine, and that maintenance and operating records are authentic cannot be overemphasized. Trust in aircraft safety is everything in this industry.”

Roboff chairs the SAE-G34/EUROCAE WG-114 Joint International Committee for AI in Aviation, which is working to develop the standard for the certification of AI & ML in aviation safety-critical systems.

“SAE G34 is one of the most important committees in aviation,” Roboff told Update. “We are defining the process standard for an accepted means of compliance (i.e. certification) for safety-critical AI and ML. This is a key enabler to new forms of avionics, including those critical to powering autonomous flight. It will also in time revolutionize complex aerospace system and component engineering, redefining the speed and scope of which new products can be specified, designed, built, tested, and ultimately certified. The committee is hard at work at its first process standard, due out in 2022.

SkyThread is a blockchain-enabled data network provider focused on empowering commercial aviation stakeholders to unleash billions in value by rapidly accelerating error-free data exchange among participants. The company has developed a trustworthy, federated

system of record coupled with industry-leading validation logic that makes data permanent and unchangeable. SkyThread

call this authenticating “data for the life of the aircraft.” To learn more about SkyThread, visit www.skythread.aero. ■



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Thinking long-term with automated driving systems

A new partnership between SAE International affiliate IAMTS (International Alliance for Mobility Testing and Standardization) and CITA, an organization that promotes safe and clean vehicles globally, will work to develop recommended best practices for lifetime evaluation of automated driving systems. The goal is to ensure automated driving systems remain safe and effective on the road for the life of the vehicle.

“Understanding and confirming the roadworthiness of a vehicle is a common goal across the globe,” said, Peter Doty, secretariat of IAMTS. “These best practices will be designed to close gaps in standards and regulations for consistent industry use across the globe. They will also identify technical needs for safe performance in the market.”

In the view of Gerhard Müller, president of CITA, “the partner effort between IAMTS and CITA must take into account existing legislation, standards and guidelines to ensure safe and secure lifetime performance of advanced mobility systems.”

IAMTS and CITA kicked off the effort at the IAA Mobility trade event in Munich on September 9, 2021.

CITA, headquartered in Belgium, is the world-wide association of authorities and authorized companies active in the field of vehicle compliance. It gathers more than 140 organizations in over 50 countries. CITA is the impartial partner to enable programs and policies for safe and clean vehicles, with a vision “that sustainable mobility makes the world better.” More information on CITA is available at <https://citainsp.org>.

IAMTS is a global, membership-based alliance of organizations involved in the testing, standardization, and certification of advanced mobility systems and



services. The alliance works to develop and grow an international portfolio of smart mobility testbeds that meet the highest quality implementation and operational standards. For more information about IAMTS, including membership, visit <http://iamts.org> or contact info@iamts.org.

IAMTS is a program of [SAE Industry Technologies Consortia \(SAE ITC\)](#), which is an affiliate of SAE International. The SAE ITC team specializes in establishing and managing consortia by providing proven processes, tools and resources. SAE ITC enables public, private, academic and government organizations to connect and collaborate in neutral, pre-competitive forums thus empowering the setting and implementation of strategic business improvements. ■



PROPEL participate.
engage.
volunteer.

Propel: All about volunteerism

SAE Propel, SAE International's volunteer engagement platform at connection.sae.org/saepropel helps you find all of SAE's current volunteer and engagement opportunities from across the organization in one place. Getting involved with SAE will help you maintain sharp skill sets and build upon skills you already have. It's a great way to explore new fields and expand your work portfolio in your field. And don't forget: It's the perfect way to meet new people who share the same passion as you for bettering their personal development, industry, and our future generation. By engaging with SAE you can:

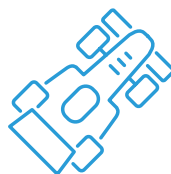
- Advance your career or gain career experience
- Provide inspiration and guidance to the future generation
- Connect to the engineering community

Get started today by visiting connection.sae.org/saepropel and setting up your profile. This will get you matched with opportunities that suit your skills, interests,

and expertise, from leading a committee to getting involved in STEM programs.

Volunteer Opportunities

The three highlighted volunteer opportunities for this issue of *Update* are:



Trust anchors and Authentication Task Force



Technical Standards Airport Snow and Ice Control Equipment Committee (G-15)

A World In Motion Seeking STEM Volunteers to work with PreK-8 Students

For a complete list of all volunteer and engagement opportunities, please visit SAE Propel. Link to the opportunity list [here](#). ■

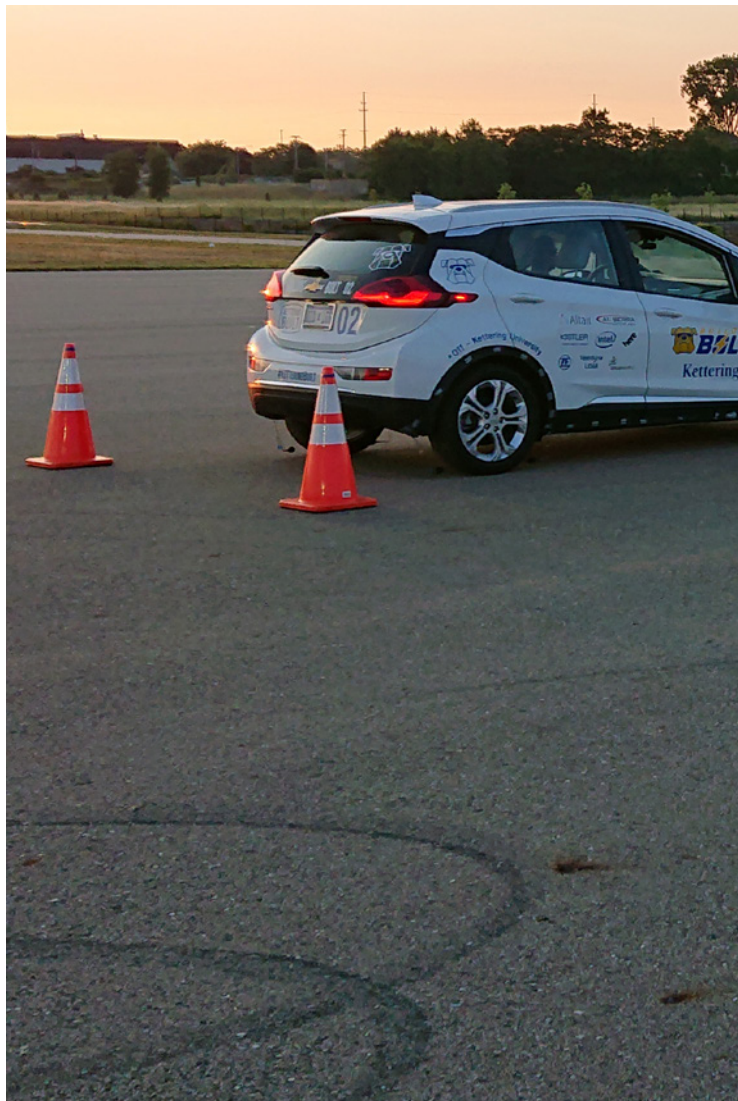
PROPEL participate.
engage.
volunteer.

FOCUS: NVH

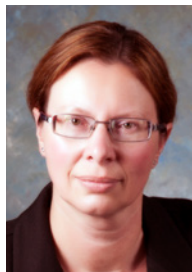
As with other aspects of a vehicle, advances in NVH (noise, vibration, and harshness) come in steps. The steps and advances described in this special section are reported by some of SAE International's most trusted experts in the field. For a fuller picture, visit [sae.org](https://www.sae.org) to learn about all of the books, journals, conferences, and other NVH intellectual property that SAE offers.

IN THIS SECTION

- 6 Internal Combustion, Electrification, and the future of Automotive NVH
- 12 Tackling interior noise with materials
- 14 Overcoming fear of the unknown in NVH
- 19 Working towards a noise-free world




Early morning pass-by noise testing of an electric vehicle at the GM Mobility Research Center, an inner-city proving ground owned by Kettering University and located in Flint, Michigan.



ABOUT THE AUTHOR

Jennifer Bastiaan, Ph.D., an Associate Editor of the SAE International Journal of Vehicle Dynamics, Stability, and NVH, wrote this article for *Update*. She is an Associate Professor of Mechanical Engineering at Kettering University.



INTERNAL COMBUSTION, ELECTRIFICATION, AND THE FUTURE OF AUTOMOTIVE NVH

Jennifer Bastiaan / Kettering University

In the past, the Internal Combustion (IC) engine was a significant concern for automotive Noise, Vibration, and Harshness (NVH) engineers. IC powertrains were both the boon and bane of NVH vehicle development. On the unfavorable side, the worst IC engines were a discomforting source of unwelcome sound and mechanical vibration. On the

beneficial side, the best IC engines were the source of customer pleasing vibrations and desirable soundscapes. Certain North American V8 and European I6 gasoline engines come to mind as examples of this. Furthermore, IC engines usually provided a side benefit: they masked undesirable vehicle noises. Considering the IC engine, its air induction system, and its exhaust system as a combined source of NVH, the overall effect was often to cover other less appealing noise and vibration sources in a vehicle from the point of view of its human occupants.

Regardless of their advantages and disadvantages in the NVH sphere, IC engines are rapidly disappearing from ground vehicles. Replacing them are electric machines, which are known to be significantly quieter than their IC engine counterparts. Substitution of IC powertrains with less noisy and often less massive electric powertrains leads to manifold NVH design challenges. Chief among these challenges is the lack of masking noise, but there are also new and unique NVH characteristics associated with electric motors that must be addressed.

Unfortunately, not much knowledge from the study of powertrain vibration carries over from IC engines to electric motors. Traditionally, the IC engine was treated as a relatively low frequency NVH source. For example, many studies have been published about IC engine idle vibration, which is associated with low frequencies. The most important difference in electric motors from a vibration perspective is the frequency range of vibration produced, where high frequency vibrations are present that were not a

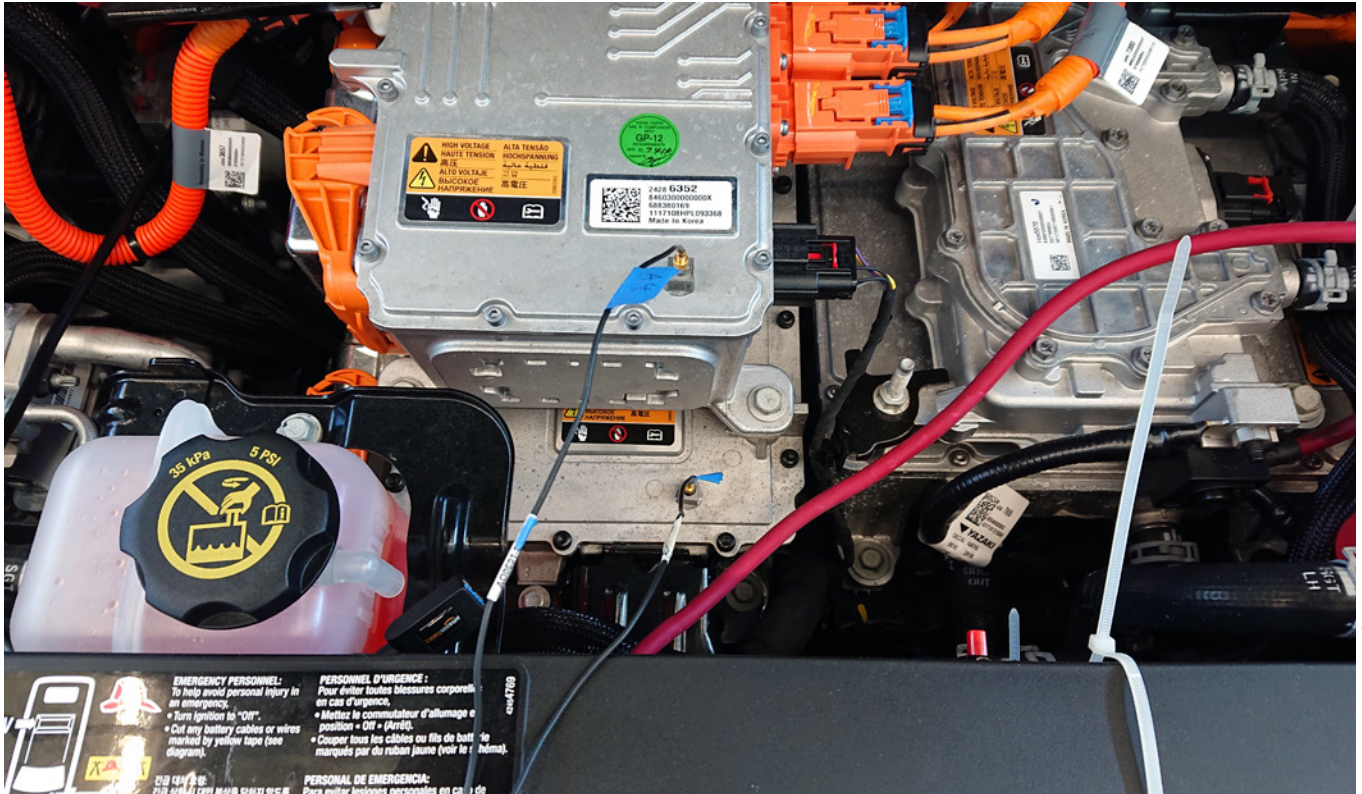


Jennifer Bastiaan / Kettering University

In this test an electric vehicle is instrumented with tire microphones at all four corners, with two microphones per tire, one in front and one behind, to understand the tire contribution to pass-by noise.

concern in the case of IC engines. For example, the operating frequency of some of power electronics in an electric vehicle is in the 10 kHz and above frequency range. These higher frequencies of interest drive a new engineering focus on their implications to driving comfort in automobiles.

Beyond different powertrain frequency content, an example of a startling difference between conventional IC vehicles and their electric counterparts is in pass-by noise regulations. Conventional vehicles are subject to pass-by noise regulations that ensure they are not too loud. Conversely, electric vehicles are subject to pass-by noise regulations that ensure they are not too quiet. Electric vehicles are quiet when passing by since the only primary carry-over noise source from conventional vehicles is tire noise.



Jennifer Bastiaan / Kettering University

In this test an electric powertrain is instrumented with accelerometers to deduce the powertrain contribution to electric vehicle pass-by noise.

Minimum noise requirements have been placed on electric vehicles to enhance their aural detectability from the standpoint of blind and low vision pedestrians, especially at low vehicle speeds. Monitoring of this audibility concern by the National Highway Traffic Safety Administration (NHTSA) resulted in the creation of Federal Motor Vehicle Safety Standard (FMVSS) No. 141, “Minimum Sound Requirements for Hybrid and Electric Vehicles”, which requires pedestrian alert sounds to be added to electric vehicles. A system designed to add such pedestrian alert sounds is known as an Acoustic Vehicle Alerting System (AVAS). FMVSS No. 141 applies to fully electric vehicles, as well as to hybrid electric vehicles that can be operated in a purely electric mode. The standard mandates pass-by noise testing of electric vehicles at three constant speeds of

10, 20, and 30 KPH, for the purpose of validating the aural detectability of the vehicle and its acoustic alerting system.

Meeting with the FMVSS No. 141 regulatory standard is a fascinating NVH problem, as it is easy to imagine how an electric vehicle might meet the legal requirement and simultaneously annoy the occupants of the vehicle and / or the people outside of the vehicle. Picture an ice cream truck driving through your neighborhood while playing a shopworn melody to attract young customers. This aural

detectability solution is not likely to be directly applied in the case of electric vehicles, but the possibility is certainly there.

Faculty members at Kettering University are often asked by students to provide advice about future career paths. Students want to prepare for consequential fields with staying power, and rightly so. For some students, especially those with a proclivity to dynamic systems topics, the study of NVH is a recommended path. Kettering University has a group of faculty members with deep knowledge of NVH from both industrial and academic backgrounds. They are engaged in teaching and mentoring of interested students, with the goal of preparing them to contribute to an NVH field that has retained its relevance in a changing automobile industry. These new NVH engineers will be in demand not only in the development of electric vehicles now, but in the design of automated vehicles in the future.

Consider the structures required to mount self-driving vehicle sensors like Light Detection And Ranging (LiDAR) devices. How stiff does the



Jennifer Bastiaan / Kettering University

A Kettering University research team confirms correct pass-by noise recordings at the Harris Mobility Research Annex, a building located at the GM Mobility Research Center.

underlying vehicle structure need to be for these sensors to function properly? How compliant can the underlying vehicle structure be before the device provides unreliable outputs? The answers to these and other questions in automation will be researched and provided by NVH engineers. There has never been a better time to work in automotive NVH. ■

VC Investments

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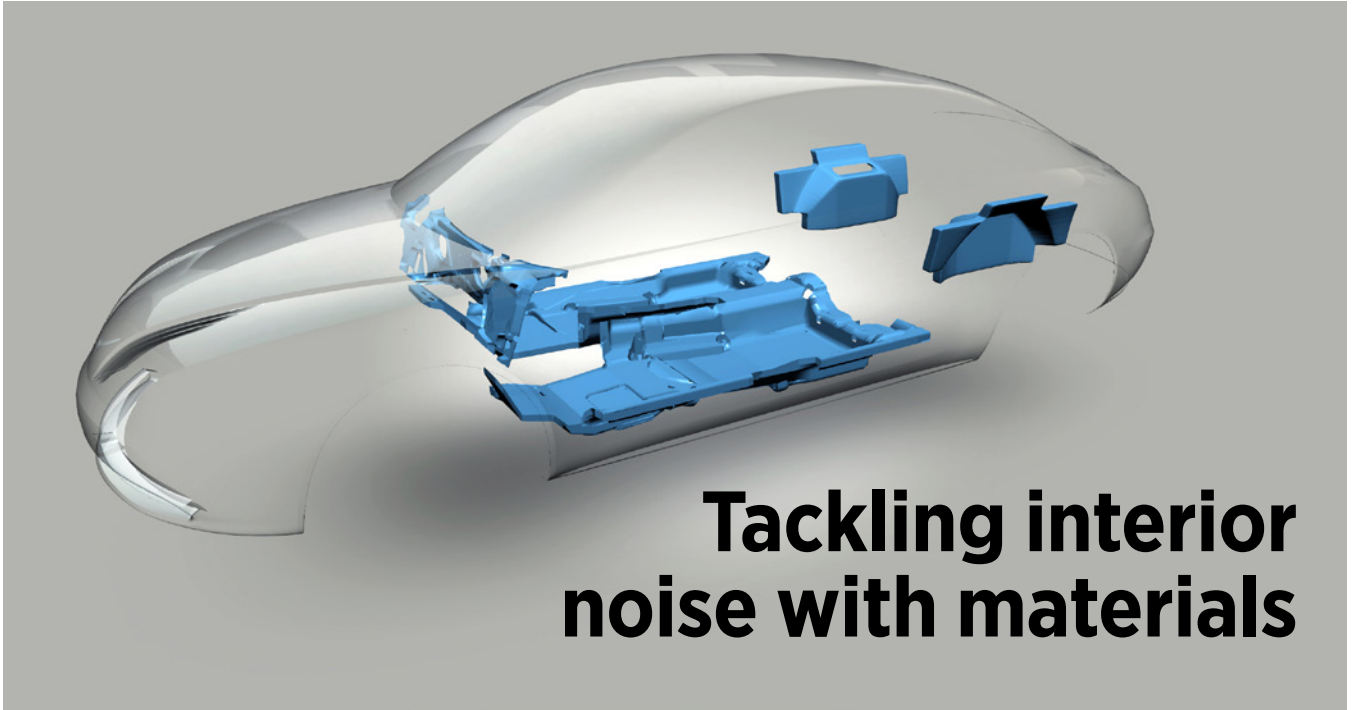
kodiak

evTOL
EV Charging

Audi

5G

Energy
swiftmile



Tackling interior noise with materials

Andrea Frey calls herself “an acoustic materials person” who deals mainly with airborne noise that makes its way into the cabin.

And so “I don’t have a lot to say about making engines sound powerful or reducing gear whine,” she told *Update*. “My focus has always been interior noise and acoustic materials to affect the path of noise into the car. The idea is to make the interior a more pleasant place for the passengers.”

Frey’s title at [Autoneum](#) is Senior Project Engineer. In the company’s North American headquarters in Novi, Mich., she manages acoustic testing and development for European and electric OEMs, in addition to performing laboratory and on-road testing for other projects as needed. She is the secretary of the SAE Acoustical Material Committee and has authored or co-authored several technical papers related to material sound absorption.

Two hemi-anechoic chambers are among the tools



SAE member Andrea Frey serves as secretary of the SAE Acoustical Material Committee.

and equipment used by engineers at Autoneum’s Novi facility. Frey is part of a team that comprises acousticians, technicians, and simulation experts.

“Our big focus right now is how best to apply acoustic materials in electric vehicles, because they’re still pretty newish,” she said. “In the automotive industry, we have a lot of experience with using heavy acoustic materials on the firewall to block the noise coming in from the engine. There’s a lot of experience isolating the engine so it doesn’t transmit noise through the vehicle’s structure. There’s a lot of experience with active noise control: playing sounds through the speakers that can mask or make the engine sound more powerful, depending on what you want. But when the engine noise is gone, as with EVs, now all of a sudden you can hear whines and clicks and all the annoying transient sounds that you couldn’t hear before.

“That’s something we’re addressing while at the same time addressing sustainability. We want the materials to be both constructed from recycled materials and recyclable at end of life, we want the production process to be sustainable, and we want to ensure that our products contribute to the overall sustainability of the vehicle.”

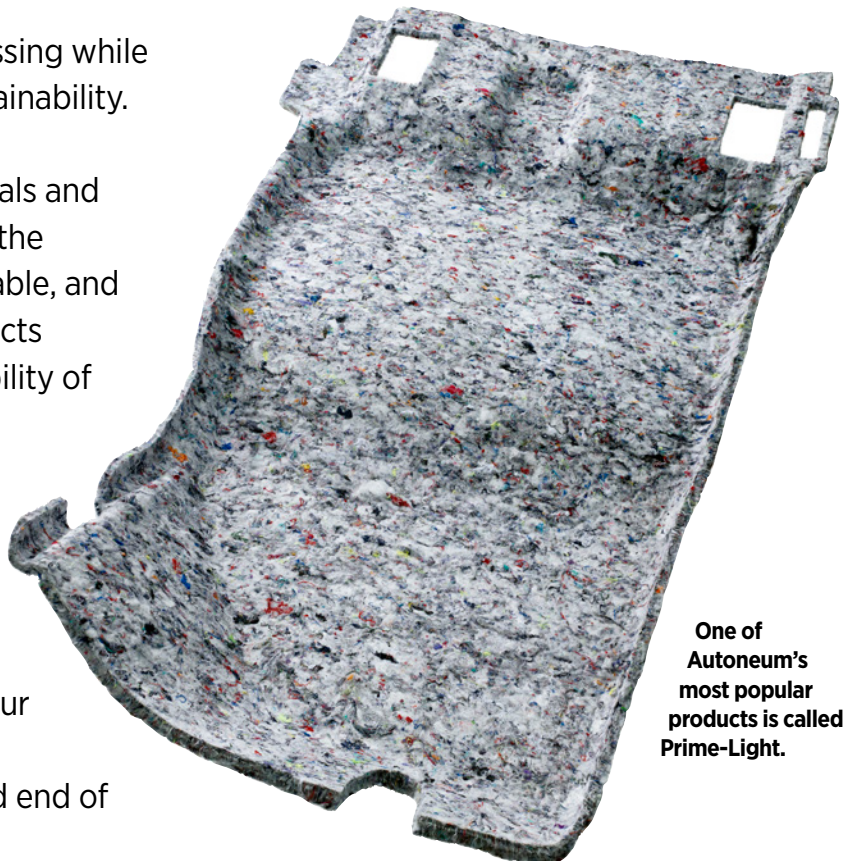
In 2020, Autoneum launched “Autoneum Pure.,” a branding that is based on a comprehensive set of criteria assessing the sustainability performance of a product in all four phases of its life cycle: material procurement, production, use and end of life.”

“Autoneum Pure.” products consist of Prime-Light for interior flooring and insulation, Di-Light for carpets systems, Ultra-Silent for exterior solutions, and Hybrid-Acoustics PET for e-motor or engine encapsulation.

“Generally, the most effective way to deal with noise is to deal with it at the source. That’s not always possible, and that’s where acoustic materials come in,” said Frey.

She was lead author of a paper titled “Interior Floor Engineering: Acoustic vs. Compression Performance” at the recent SAE Noise and Vibration Conference in Grand Rapids, Mich. The paper can be purchased [here](#). ■

By Patrick Ponticel, *Update* editor



One of Autoneum’s most popular products is called Prime-Light.

Overcoming fear of the unknown in NVH

In the late 1980s and early 1990s, many news writers from the nation's top newspapers and automotive magazines came to Detroit to talk with the OEMs for an understanding of how the domestic OEMs are preparing for global competition.

Quality was obviously the biggest issue, but with that came other issues—one of them being NVH. Some people think Sound Quality (SQ) was invented at that time. Although, SQ has been around for a long time, automotive globalization really changed everything. We had to look at everything differently.

At the SAE World Congress (now called WCX) in the headliner sessions for three years in a row in the 1990s, an NVH engineer from a U.S. OEM and a German headliner manufacturer disagreed on the



gail-thornton.co.uk

Concern about passenger comfort pre-dated the “horseless carriage.”

acoustics of a headliner in a vehicle.

The U.S. OEM NVH engineer qualified why the headliner needs to be an acoustics-performing product and the German headliner manufacturer justified why the headliner does not need to be an acoustical part to provide the right acoustic in the vehicle. You can see, although each vehicle has four wheels, an engine, and an audio system, the design philosophies were very different.

Although all OEMs have their own individuality and uniqueness, when everything is put together, it was very obvious that there were three different cultures



ABOUT THE AUTHOR

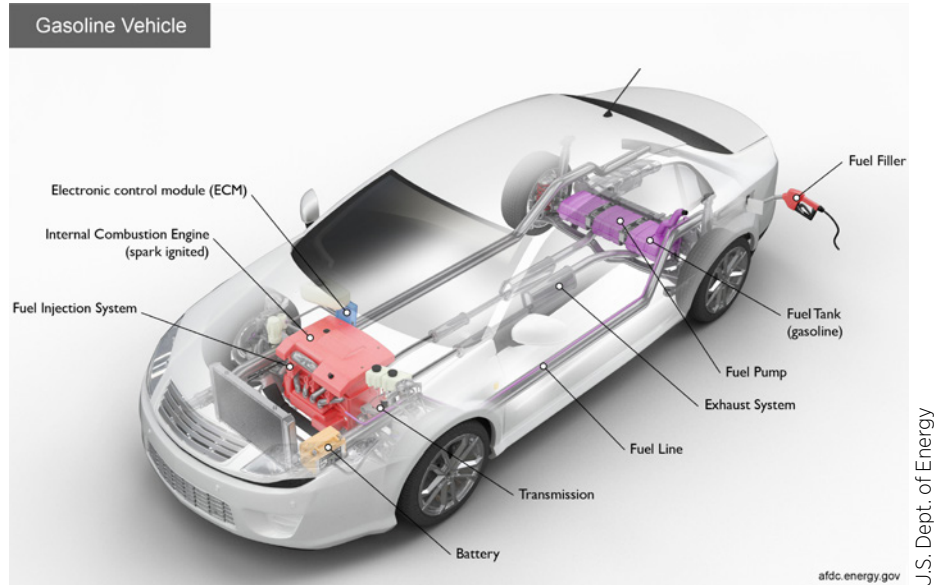
Pranab Saha, Ph.D., a renowned expert in NVH with several publications to his credit including a new SAE book, [“Acoustical Materials, Solving the Challenge of Vehicle Noise”](#), wrote this article for *Update*. He is highly decorated for his work, being named an SAE Fellow in 2017 and awarded the SAE Medal of Honor in 2021. Saha is principal consultant at Kolano and Saha Engineers, Inc.

in designing and building a car in these days: the US, European, and Japanese cultures.

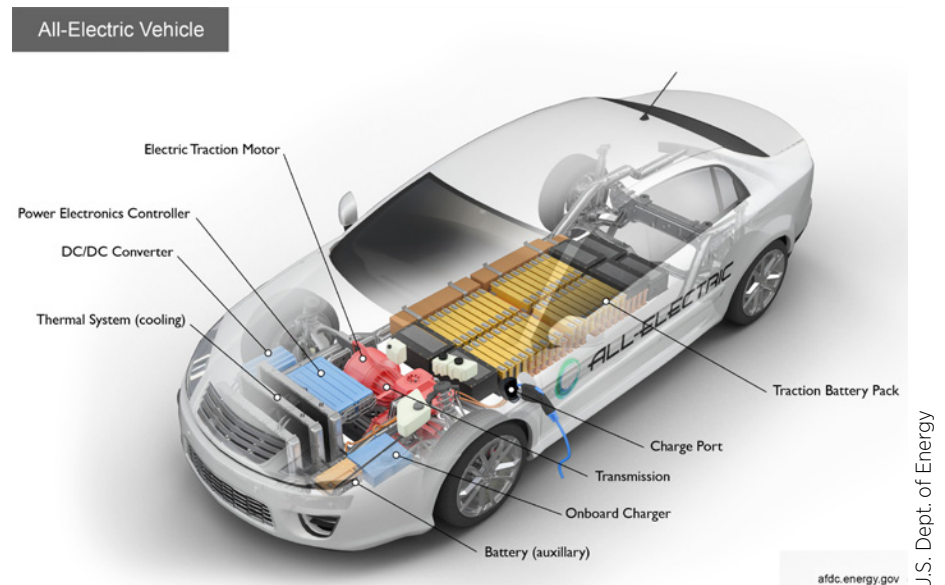
There is often a reluctance to accept the unknown. The mobility industry and the NVH industry are not too far from that, although reasons are somewhat different.

The move from horse-drawn vehicles to the automobile was the same. Average people could not afford it, they feared the unknown and the speed. Going from an ICE (internal combustion engine) to an EV (electric vehicle) and eventually to an AV (autonomous vehicle) has similar concerns as well.

Although most of us are delighted and excited about new technology, many of us are concerned of the safety of both EVs and AVs. In particular, the AV's interior is likely to be re-landscaped more dramatically than what we have ever experienced. With that comes the concerns of the safety of



Main components of an ICE vehicle.



Main components of an EV.

the occupants in the vehicle. The OEMs are making sure these concerns are addressed properly.

The reluctance of accepting unknowns affects the NVH area as well. In the early 1990s, work started in active noise cancellation (ANC). Initially, it was dominant in the exhaust system, as that noise was more repeatable and predictable. Eventually, it was extended to reduce the



SAE International

Saha recently gave the Hillquist Lecture at the SAE Noise and Vibration Conference. That recording is not currently available, but you can listen to him talking about his new book in a video [here](#).

vehicle interior noise for regular driving. Although the technology and the knowledge base has matured, the application of ANC is far less than one would have expected. Therefore, the demand for using passive sound package treatments has noticeably increased.

These materials have been used from the beginning of the automobile industry. They have taken a key role in reducing both exterior and interior vehicle noise.

The sound package materials have changed significantly as well—from heavyweight to



Volkswagen

Passenger comfort becomes an even more important consideration in automated vehicles.

lightweight materials, from fibrous to cellular materials, and then back to much better fibrous materials, natural and recyclable fibers, fire retardant and high temperature resistance cellular materials, die-cut parts to moldable able parts, from airborne to structure-borne solutions, and then the latest from a two-layer to a single-layer dissipative system. ■



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Events	Enjoy discounted registration on most SAE owned conferences, including SAE's flagship event, WCX.
Awards and Recognition	Advance in your career and earn recognition from your peers through more than 60 awards (many of which are for members only) across all mobility industries.
Leadership	Enhance your leadership skills through volunteer activities, board positions, and Section Officer Roles. Get recognized as an SAE Fellow – the highest grade of membership – given to long-term members who have made a significant impact on society's mobility technology.
Partner Discounts	Save more than the cost of your annual dues and support SAE development and programs through our partner program discounts on business services, insurance, travel, entertainment, gym memberships, and more.
The Career Counselor Series	Gain access to multiple videos on topics like stress management, public speaking, time management and more.
SAE Propel connection.sae.org/saepropel	Take advantage of SAE's engagement portal, where you can advance your career, guide the future generation and connect to the engineering community by signing up as a volunteer.
Update Newsletter	Stay up to date on current topics in mobility engineering with a members-only subscription to SAE's online newsletter, featuring SAE news, technical articles, and member content.
Sections	Become involved in your local SAE Section, and meet other engineers from your area who are working in the mobility technology field and keeping you up-to-date on the latest technical information. You also have the opportunity to serve on your section's governing board or committee.
Career Center	View employer job listings seven days in advance of the general public.

Visit sae.org/participate/membership for more information and to become a member today!

Working toward a noise-free world

Squeals occur often in everyday life. We are all familiar with the sound of a worn door hinge and chalk on blackboard, just to name a few. You are probably hearing the high-pitched sound inside your head as you are reading this. They are the result of friction induced vibration with low damping.

The automotive industry has been dealing with this challenge for decades. Brake squeal is one of the most common problems for vehicle manufacturers and results in high warranty costs. Most drivers have probably experienced the phenomenon to some degree, but few are aware of the amount of work it requires to eliminate brake noise. Every vehicle requires a different solution. Brake pad insulators, commonly referred to as “shims,” are the primary

ABOUT THE AUTHOR

The article was written for *Update* by 25-year SAE member Eric Denys, General Manager Meneta North America, and Chairman of the SAE Brake NVH Standards Committee.



Eric Denys interfaces with the latest Meneta noise dynos.

Meneta Group



Meneta Group

The Meneta Black Box is being used to optimize the shim material and reduce the amount of dyno testing.

device used to reduce brake squeal for passenger cars throughout the world.

NVH Testing and Simulation

As a major supplier of automotive brake components, including noise-damping shims, Meneta Group is continuously investigating means to reduce disc brake noise. We test extensively in our dynos which can physically simulate all desired weather conditions and brake systems. We have an advantage in this regard, because all our dynos are built in-house. This means that we can customize them directly to our needs and continuously improve their performance.

Where Meneta has truly shown its innovative approach in the development of brake noise solutions, however, is by

developing the unique computer simulation tool known as The Meneta Black Box. It is a tool that can accurately simulate the NVH impact of a shim over temperature and pressure in a full brake squeal FEA simulation model.

The tool is completely free of charge for our customers and acts as a pre-selecting and pre-screening tool before the final validation on a dyno. The Black Box has proven to reduce dyno usage by 5-40 %, depending on the project. This makes it the fastest, cheapest, and most environmentally friendly shim development method. It took our German branch more than 2.5 years to develop it, but we are very happy with the results.

With these two competitive advantages, Meneta has a strong position in the market to provide the best solutions.

The electric vehicle challenge

The market is transitioning toward electric vehicles, and this poses entirely new noise-damping challenges.

Battery electric vehicles (BEVs) have different brake duty cycles than internal combustion engine (ICE) vehicles and will require brake shims with unique properties for damping, compressibility, and durability. We believe that Meneta is at the forefront of the development of these new products.

BEV brake systems operate at lower temperatures than conventional brake systems, and this influences the noise mechanisms and solutions. This problem is referred to as “cold noise” and is one of the biggest challenges facing the brake industry. Meneta has already introduced pioneering products to accommodate this new segment:

- EPB Hybrid Adhesive: A1
- Cold Noise Adhesive: C2

A1 is a new adhesive that offers superior cold noise damping compared to silicone and has excellent oozing performance under high pressures like when activating the Electric Parking Brake (EPB). C2 is an acrylic adhesive that is comparable to standard OE acrylic adhesives but offers peak damping performance at 32°F (0°C), and may even add damping all the way down to about 0°F (-18°C). Both adhesives have been selected as the best noise solution on various projects, and can already be found on cars, driving on the streets.

Meneta is constantly developing new products, and one of the most promising projects concerns rubber.

Right now, we are looking into a new type of rubber that offers low compressibility to reduce brake drag while keeping the rubber isolation properties for noise performance. We are excited to see how it will be received by the market once we are ready to introduce it. ■

We hope this FOCUS section was helpful to you. If you would like to comment on any of the articles in it, email us at update@sae.org. Use the same email address if you would like to submit an article for an upcoming *Update* FOCUS section; please refer to the editorial calendar below.

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FEBRUARY 2022

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MARCH 2022

Automated vehicles

APRIL 2022

Engineering tools

MAY 2022

Cybersecurity

JUNE 2022

Testing

What's happening in the Member Connection

It all starts here: This is your link to SAE's Membership Community and where you can discuss the latest technical topics with other mobility industry engineers, give back through volunteerism, learn about your benefits, and much, much more!



General Motors



General Motors

Hot Topics

SAE is a global community—post questions and discuss the latest technical topics from anywhere in the world. Below are a few popular recent threads. Add your voice today!

QUESTION ABOUT ADAPTIVE CRUISE CONTROL

Has anybody studied interactions between multiple cars with ACC? For example, if there's a string of cars in a row all running ACC, could there be a "slinky" effect or other undesirable outcome, as each of the systems reacts independently to speed changes that other vehicles make? – Add your voice [here](#).

IGNITION ATDC

I am trying to find out if there is something obvious and compelling that I am missing in the logic and dynamics of my argument that ignition ATDC for high C/R engines at low revs should be acceptable and might prevent the waste of time, money and energy—and hopefully would enable me to learn something beneficial in the process and avoid a potential disaster. – Add your voice [here](#).

Member Connection Chat...

What is a Chat? It's a two-day session with an SAE subject matter expert on a variety of technical topics and soft-skill development domains such as leadership. Add your voice to this dialogue—ask questions, provide answers and, ultimately, gain insights from SAE and its members around the globe. Future Chats are being planned, but none is yet scheduled. Stay tuned. The last Chat centered on an upcoming eBook by Joan Wills, the newest member on the SAE International Board of Directors. The title of the SAE book will be *"Doing the Heavy Lifting: Insights from Women Leading the Commercial Vehicle Industry"* and will be available in January 2022.

What's New



Two free books for SAE Members

Through the end of the year, you can claim two free books: “[The Road to the Top is Not on the Map: Conversations with Top Women of the Automotive Industry](#)” – mention code R491FREE when you call SAE Customer Service; and “[Cybersecurity for Commercial Vehicles](#)” – mention code R464FREE when you call SAE Customer Service. Call toll-free – 1.877.606.7323 (U.S. and Canada only), 1.724.776.4970 (Outside U.S. and Canada).

Member-Get-A-Member

As a member of SAE International, you are an important ambassador in helping SAE grow and maintain a strong membership roster. Share what you value in your SAE Membership with your professional network and encourage them to join SAE. When you participate in the

Member-Get-a-Member Campaign, you'll not only help ensure that your colleagues, staff members, and other business associates enjoy the same benefits of membership that you do, but you'll also earn yourself a \$10 digital Amazon gift card per new member. The more members you get, the more money in gift cards you earn. [Get Started Today!](#)

Member discount for SAE scholarly journals

[Special issues of SAE International's Scholarly Journals Program](#) will be available to SAE Members for only \$99 (normally \$175).

Promoting dynamic “hot” topics in the field, special issues offer comprehensive overviews of a wide range of promising and innovative research areas in mobility

engineering. Each issue is administered by one or more expert guest editors and includes rigorously peer-reviewed articles from top researchers across industry, academia, and government. ■




Twelve special issues are available at discount.

SAE standard offers more streamlined process to correct aerospace suppliers' quality problems

A supplier quality engineer goes to a supplier site to ensure the supplier can meet the requirements of the contract; however, the supplier quality engineer identifies a major Quality Management System deficiency. Traditionally, the supplier quality engineer would need to issue a supplier corrective action to the supplier, and this would kick off the corrective action process between the supplier and the customer. The supplier quality engineer is responsible for agreeing on the containment and correction, approving the root cause and corrective action, and conducting verification and validation when the corrective action is implemented. This represents a lot of unplanned activity for the supplier quality engineer.

The supplier quality engineer can request that they follow the process described in [AS9018 Aerospace – Customer Identified Major Quality Management System Nonconformity Other Party Collaborative Corrective Action Process](#). A collaboration meeting is held with the supplier quality engineer (customer), the Certified Organization and the Certification Body to agree on the expected output of the corrective action. Then the supplier quality engineer turns over control of the oversight of the corrective action to the Certification Body and the corrective action will be managed in the Certified Organization's corrective action system. The Certification Body is now responsible for agreeing on the containment and correction, approving the root cause and corrective action, and conducting verification and validation

	AEROSPACE STANDARD	AS9018™
	Issued 2021-10	
	Aerospace – Customer Identified Major Quality Management System Nonconformity Other Party Collaborative Corrective Action Process	
	RATIONALE	
	This standard establishes an independent other party evaluation of the corrective action associated with customer identified major Quality Management System (QMS) nonconformities. There is inconsistency in the industry on how customer identified major QMS nonconformities are evaluated by Certification Bodies (CBs) during audit activities. This standard identifies a method to improve communication between the customer, CB, and Certified Organization (CO), and improve corrective action and audit planning processes.	
	FOREWORD	
	This standard establishes requirements for verification of the corrective action process of a customer identified major QMS nonconformity for an Industry Controlled Other Party (ICOP) Aviation, Space, and Defense (ASD) CO. The CO interacts with the CB for review of the root cause analysis and corrective action plan, and Verification and Validation (V&V) of the implemented corrective action. These requirements are built on the principle that the CB who certifies the organization's QMS as being in conformance with an Aerospace Quality Management System (AQMS) standard (i.e., AS9100, AS9110, AS9120) must be aware of major QMS issues in order to adjust surveillance and recertification audit activities, as needed. The CO, in cooperation with the CB, verifies the corrective action and continued validity of the AQMS certification.	
	From this point forward, "Customer Identified Major QMS Nonconformity Other Party Collaborative Corrective Action Process" will be identified as the "Collaboration Process."	
	In this standard, the following terms are used:	
	<ul style="list-style-type: none"> • "Shall" indicates a requirement; • "Should" indicates a recommendation; • "May" indicates a permission; • "Can" indicates a possibility or capability; • "Days" are calendar days, unless otherwise specified; • "E.g." indicate suggestions given for guidance; and • Information marked "NOTE" is for guidance in understanding or clarifying the associated requirement. 	
	<small>SAE Executive Standards Committee Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is advisory in nature, and its applicability and validity for any particular use, including any patent infringement considerations, is the sole responsibility of the user." SAE reserves and will maintain right of first refusal for any period in which this report may be revised, reprinted, modified, or cancelled. SAE makes your written comments and suggestions.</small>	
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	<small>TO PLACE A DOCUMENT ORDER: Tel: 877-487-2233 (toll free USA and Canada) Tel: (724) 776-4000 (outside USA) Fax: (724) 776-4001 Email: CustomerService@sae.org http://www.sae.org</small>	<small>For more information on this standard, visit: http://www.sae.org/standards/content/AS9018</small>
	<small>SAE WEB ADDRESS: http://www.sae.org</small>	

when the corrective action is implemented.

For years, the aviation, space, and defense industry has encouraged the use of the Online Aerospace Supplier Information System Database (OASIS) feedback system to communicate to the Certification Body when there are issues like the one described above. AS9104/1 paragraph 14.3 specifically addresses situations that are appropriate for a customer to notify the certification body—for example, questions or concerns about an organization's quality management system performance.

The aviation, space, and defense industry recognized the need for a clear process for a specific type of corrective action, a Major Quality Management

System nonconformance. Given that the Certification Body is responsible to ensure that their client has met and maintains compliance with the requirements of the applicable Quality Management System standard (9100, 9110, or 9120), this type of nonconformance is a good fit for them to manage. A “9018 writing team” of key stakeholders including government agencies, Original Equipment Manufacturers, and Certification Bodies was established to create a process and write AS9108.

AS9018 was written to document a process to manage major Quality Management System nonconformances identified by the customer. The document establishes requirements for the Customer, the Certified Organization, and the Certification Body. The process identifies the Certification Body to manage the corrective action, providing integrity to their certification process and allowing them to ensure the Certified Organization Quality Management System is brought back into compliance.

One of the most important elements of this process is the

Collaboration Meeting, which brings together the Customer, the Certified Organization, and the Certification Body. This helps bring clarity to 91XX requirements, clarity of the issue and how it relates to the requirements, and drives a consensus on what needs to be done.

After the collaboration meeting, the Certified Organization implements the corrective action plan, with oversight by the Certification Body. The process is managed through the Certified Organization’s Corrective Action system and managed in the same manner that a nonconformance from the Certification Body would be managed, but not in Certification Body system. The process covers the Certified Organization’s implementation, and the Certification Bodies verification and validation of the corrective action. Communication will also continue at major milestones using OASIS and all parties have access.

AS9018 is clear about what it does and does not cover. AS9018 does not cover majors related to products, and it does not cover minors. The document does not allow duplication of effort; if all parties agree to follow this process, the customer is not allowed to duplicate the certification body activities like verification and validation.

This project started as a project for the Americas, however, there has been growing interest internationally as well. The next step will be for the international committee to consider adopting and/or rewriting AS9018 to make it useable worldwide. ■



R. Darrell Taylor, Corporate Associate Director - QMS Maintenance & Integration, Raytheon Technologies, wrote this article for *Update*. He is a member of the SAE G-14 Americas Aerospace Quality Standards Committee (AAQSC) and document sponsor for AS9018 Aerospace – Customer Identified Major Quality Management System Nonconformity Other Party Collaborative Corrective Action Process.

Defending the heavy-vehicle cyber domain

Chris York, director of electronic system cybersecurity at Cummins, makes a point during the recent cybersecurity panel at COMVEC 2021.

SAE International

The COVID-19 pandemic has served as a stark reminder of trucking's essential role in keeping the economy moving. Hacking commercial vehicles poses grave risks that should not be ignored; therefore, adequate cybersecurity measures should be considered and implemented up front in vehicle and system-development programs. That was the consensus of industry experts participating in a cybersecurity panel at the recent SAE COMVEC 2021 conference in Chicago.

Among the panelists was Chris York, director of electronic system cybersecurity at Cummins Inc. The company displays its products at COMVEC and other cybersecurity events so they can be “poked and prodded” for possible cyber vulnerability. Engine controllers, brake

controllers, and telematics units were some of the specific Cummins components available at COMVEC for hands-on discovery.

“We find things out every year and we go back and we’ll [make fixes],” said York, a three-year SAE member. “My perspective is that people are going to learn how to hack this stuff regardless. People are hacking embedded products, IOT products. There’s nothing unique or special about our industry that makes us not a target. You’re better off to engage, meet the hackers where they are and learn how to make your products more robust to these kinds of attacks.”

A major challenge facing the industry is that cybersecurity is not mature and is rapidly changing, York said. And hackers

are becoming more sophisticated.

“The lack of maturity is baked into things like our industry standards,” he said.

“We’ve got things like [SAE] J1939 that is fundamentally not secure. You can send a command to the engine or the transmission requesting more torque, and it’s very simple to do and it’s published.”

The issue spreads throughout the entire supply chain.

“Things that we can do as product developers are limited by the microprocessors we have to work with and their capabilities,” York said. “And there’s only a handful of micros that all of us can use that are suitable for an automotive environment, particularly on engine. So, getting things that have the crypto-capability and resources to do the things that you need to do are challenging. It’s coming along – the things that we’re developing today are a lot better than the things we had 10 years ago.”

“Remote attacks and attacks at scale” are what keeps York awake at night, he said. “If you can shut down an entire fleet or an entire brand of telematics, that would be a Colonial Pipeline type of thing.”

Attackers chain things together, so physical access could initiate a snowball effect, York explained: “You can learn things with physical access and then go find a vulnerability in a telematics system that lets you get access to the truck and CAN to send messages that cause an ECU to stop working or reset. And then if you’ve

got a vulnerability in the wireless carrier that allows you to enumerate the serial numbers of all the vehicles, then you can scale it.”

Electric and autonomous trucks will have a lot more electronic controllers and networks.

“There are more operating systems involved probably than there have been in the past; therefore, there’s more variety of networks,” York said. “So, we might have CAN and CAN FD and Ethernet or LIN all turning up on a vehicle. As the vehicle gets more complicated, it does increase the attack surface and the old adage that ‘security is only as strong as its weakest link’ is very true.”

York noted that engine manufacturers in the recent past placed all their engineering energy on meeting increasingly stricter emissions regulations; cybersecurity efforts took a back seat.

“We have to spend a lot of time squirting fuel, to get the emissions just right,” he said. “The treadmill that we were on for a long time with the vehicle electronics was pretty challenging for all of us, and cybersecurity [suffered].”

Industry standards must evolve and provide a better platform for addressing advanced technologies and vehicles, York said.

Click [here](#) to read a longer version of this article by SAE’s editor-in-chief of Truck and Off-Highway Engineering magazine, Ryan Gehm. ■

Will automated vehicles be safer than conventional vehicles?

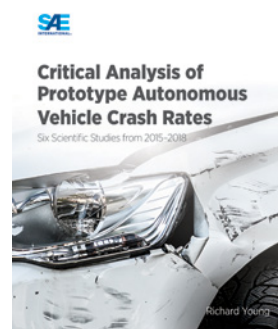
Today the world is witnessing rapid change in many of the large-scale systems of which we humans are a part. Nowhere is this more apparent than in our transportation system where advanced technologies, including automation, are increasingly being integrated at many levels with the hope (and aspiration) of improving safety, among other goals. One of the critically important questions that has emerged about advanced technologies in transportation is how to test the actual effects of these advanced systems on safety, particularly how to evaluate the safety of highly automated driving systems.

Richard Young's *Critical Analysis of Prototype Autonomous Vehicle Crash Rates* does a deep dive into these questions by reviewing and then critically analyzing the first six scientific studies of AV crash rates. These six studies, published from 2015 to 2018, investigated whether the crash rates of prototype AVs with a backup safety driver were lower or higher than the crash rates of CVs. Four studies concluded that AVs increased the crash rate compared to CVs, while the two other studies concluded that AVs decreased it, sometimes after examining almost identical AV data.

"I attempted to resolve this discrepancy by critically analyzing each study to reduce systematic errors, biases, and best practice violations," said Young. In the book, he identifies key issues (from an epidemiological perspective) that could be improved upon by adopting standardized, robust methods and applying to safety verification. Young strives to equip us with sensitivity, knowledge, and foundation that



Author Richard Young.



can be used to build upon as more data accumulates and as the field harnesses some of the lessons it provides.

"*Critical Analysis of Prototype Autonomous Vehicle Crash Rates* provides a useful compilation of the epidemiology of crash risk computations tailored to driving automation systems, including terminology, a review of computations, and a description of different types of biases for which new data and new computations might be checked when they are being undertaken," said Linda Angell, President and Principal Scientist at Touchstone Evaluations.

"No doubt this is a 'must-have' for everyone involved in the safety of automated vehicles," said Sherry Nigam, Publisher of SAE Books. ■

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JOB OPPORTUNITIES

ADVANCED TECHNOLOGY SPECIALIST-SENSING SYSTEM ALIGNMENT-ALGORITHMS, Warren, MI, General Motors.

Research, develop, & improve high performance, accurate online cameras to inertial measurement unit (IMU) & IMU to center of gravity of vehicle alignment algorithm calibrations, using real-time camera images & IMU data perform calibrations w/ no predefined target input. Research & integrate enhanced embedded perception applications in conventional, hybrid, battery electric vehicle, autonomous vehicle Advanced Driver Assistance hands-free driving & autonomous Super Cruise & Ultra Cruise features (enhanced Levels 2/3 autonomous driving sys) for commercial & fleet vehicles. Research & improve computer vision techniques incldg optical flow, Perspective-n-Point, triangulation, & structure from motion, to detect & track features captured by fisheye & pinhole cameras. Develop IMU pre-integration & quaternion method to calculate local pose change of vehicle, & improve nonlinear global optimization method w/ Bayes filters, extended Kalman filter, Ceres & G2O to calculate best pose estimates of cameras w/ respect to center of gravity of vehicle. Research & develop algorithms incldg clustering, Weibull analysis & Bayesian networks to improve accuracy of image processing & data fusion. PhD, Electrical or Quantum Engineering, Quantum Physics, or related. 12 mos exp as Engineer, Researcher, Technology Specialist, Fellow, or related, researching & developing algorithms, incldg clustering, Weibull analysis, Bayesian networks & data fusion, or related. Mail resume to Ref#4042, GM Global Mobility, 300 Renaissance Center, MC:482-C32-C66, Detroit, MI 48265.

INVESTMENT BUYER, Brose North America, Auburn Hills, MI.

Plan & implement procurement & distribution of machinery, tooling, production equipment such as stator winding equipment, motor assy equipment & End of Line Testers (EOLTs); lab test equipment such as salt spray test chambers, durability & performance test stands; initial spare parts such as wear parts & critical machine cmpts incldg magnetizing yokes; packaging; & material handling equipment such as gravity racks & lift aids for heavy material incldg copper wire drums & line side storage for quality parts (good master/bad test parts). Plan & assure timely purchase & acquisition of assy & test equipment to support existing & establish new production & test facilities in U.S./MEX. Procure & distribute lab test equipment, climate chambers, CMMs, & special drives test benches for facilities located in U.S./MEX. Propose, obtain approval, & implement purchasing & commodity strategies for production equipment in N.A. Collaborate w/ Central Purchasing Depts in Bamberg & Wuerzburg, Germany, to align N. A. strategy w. global assy & test equipment strategy. Define actions & monitor status of strategy implementation in U.S./MEX/CAN. Required travel to suppliers in U.S./CAN/MEX/GER & ITL to verify compliance w/ equipment purchase agreements & assess technical & commercial capabilities, & to mfg plants in U.S. & MEX, to evaluate technical reqmts to be addressed by equipment suppliers, up to 8 wks P/A. Bachelor, Industrial, Mechanical, or Electrical Engineering. 24 mos exp as Engineer, Buyer, or related, planning & implementing distribution of machinery, production equipment such as stator winding equipment, motor assy equipment & EOLTs, & material handling equipment such as gravity racks & lift aids for heavy material, or related. Mail resume to Ref#53221, Brose, Human Resources, 3933 Automation Ave, Auburn Hills, MI 48326.

JOB OPPORTUNITIES

SUBSYSTEM LEAD ENGINEER - ACTIVE SAFETY &VIEWING,

Warren, MI, General Motors. Define software specs for active safety &viewing components &subsystems incldg long range &short range radars. Implement &maintain features for Rear Cross Traffic Alert, Lane Change Alert, Side Blind Zone Alert &Remote Occupant Sensing features, using DOORS &DOORS NG to capture &analyze ASIL rated system software specs for Active Safety subsystems. Define &build mechanization drawings (architectural diagrams) w/ assistance of architecture groups. Review software algorithm models to ensure compliance to requirements. Coordinate w/ external suppliers &internal customer organizations incldg diagnostics teams to define Global B electrical interfaces between ECUs consisting of internally developed &external supplier modules. Verify interfaces are implemented correctly by cross referencing w/ ARXML files each software release. Provide technical support to troubleshoot software issues in Software-in-the-Loop (SIL) &Hardware-in-the-Loop (HIL) environments. Master, Mechanical, Automotive, or Electrical Engineering. 12 months exp as Engineer, Technical Specialist, or related, engineering, implementing &validating math-based &physics-based algorithms, &testing or supporting algorithms on bench in SIL &HIL environments, or related. Mail resume to Ref#20972, GM Global Mobility, 300 Renaissance Center, MC:482-C32-C66, Detroit, MI 48265.

PRODUCT VALIDATION LABORATORY MANAGER,

Plastic Omnium Auto Inergy, Troy, MI. Manage, lead, &mentor laboratory organization of Test/Val Engrs at various levels &Lab Techs to perform timely product validation for Plastic Omnium blow-molded, corrosion resistant plastic fuel tank syss incldg 6 co-extruded, multilayer structures such as Outer virgin HDPE layer; Regrind layer; Outer Adhesive (low density polyethylene) layer; EVOH layer; Inner Adhesive layer; and Inner virgin HDPE layer, "touching the fuel"; Lev3 Fuel Tank Syss; Twin Sheet Blow-Molding; INWIN Fuel Tank Syss for Hybrids. Schedule, coordinate &control testing for fuel tanks syss for OEM vehicle maker projects. Review &release final test reports for internal DVP&R. Dvlp test planning for design verification testing &process verification testing during dvlpmt both internally &at external test sites outsourced by customer or Plastic Omnium. Master, Chemical, Materials, Mechanical Engrg, or related. 12 mos exp as Engineer, engrg &dvlpg cmpnts for blow-molded, corrosion resistant plastic fuel tank syss incldg 6 co-extruded, multilayer structures, or related. Mail resume to Ref#2425-423, POAI Human Resources, 2710 Bellingham Dr., Troy, MI 48083.

INNOVATION VEHICLE ENGINEER,

Warren, MI, General Motors. Evaluate U.S., global, &emerging market psgr vehicle body structures &exterior subcomponents, cmpnts &syss sketches, &designs developed by Creative Designers in Design Studio. Create, maintain, monitor &release 3D models of cmpnts &syss using Unigraphics NX, &Siemens Teamcenter. Assist in early virtual CAE anlys, in SW incldg MATLAB, Simulink, Ansa, LS-DYNA, Primer, Animator, HyperWorks (HyperGraph/HyperView/HyperMesh) &MeshWorks for finite element simulations, incldg psgr vehicle performance under loading incldg crash scenarios. Dvlp &balance engrg, mfg &other program imperatives incldg fuel economy, aerodynamics, mass &cost, w/ vehicle design theme intent (exterior, aero, wheels &cmpnts). Integrate Studio surface w/ engrg criteria using Unigraphics NX, Teamcenter &Vismockup. Discuss &review engrg proposals directly w/ Creative Designers for modifications &changes to sketches &design proposals. Evaluate design sketches to ensure vehicle cmpnt Design for Manufacturability &Design for Assembly. Bachelor, Mechanical or Automotive Engineering, or related. 12 mos exp as Engineer, creating &releasing 3D models of psgr vehicle cmpnts &syss using Unigraphics NX &Siemens Teamcenter tools, or related. Mail resume to Ref#1501, GM Global Mobility, 300 Renaissance Center, MC:482-C32-C66, Detroit, MI 48265.

VEHICLE BENCHMARKING TECHNICAL SPECIALIST,

Warren, MI, General Motors. Work cross functionally to utilize benchmarking resources to understand &rationalize competitor designs &strategies &product lifecycle. Partner w/ Competitive Intelligence &other resource groups to share knowledge in easily usable ways. Collaborate w/ R&D to identify &establish benchmarking information for new technologies. Set Architecture Framing Initiation to Vehicle Program Initiation vehicle dvlpmt timeframe. Lead discussions &partner w/ Benchmarking Engrs to complete vehicle benchmarking anlyss &studies, & to dvlp tools &data usability. Dvlp &publish technical benchmarking reports based on teardown observations, industry reports, SAE papers, patent filings, &technical guides. Coordinate &manage vehicle benchmarking &lessons learned activities. Lead &maintain plan for benchmarking teardowns, workshops, &studies. Own content &documentation of vehicle benchmarking processes ensuring smooth coordination w/ propulsion specific benchmarking processes. Master, Mechanical, Automotive, Aerospace Engrg, or related. 12 mos exp as Engineer, Project or Program Manager, leading or managing complete product lifecycle incldg concept, product dvlpmt, launch &lessons learned, or related. Mail resume to Ref#1601, GM Global Mobility, 300 Renaissance Center, MC:482-C32-C66, Detroit, MI 48265.

SENIOR RESEARCHER, Warren, MI, General Motors. Research & develop propulsion control technologies for vehicle powertrain systems. Formulate research problems, plan research tasks & experiments, & execute research studies including experimental & simulation studies. Develop & demonstrate control & diagnostic algorithms to significantly improve fuel economy & energy efficiency, & reduce harmful emissions. Develop mathematical models for physical systems including internal combustion engine, electric motors, batteries, power electronics, thermal systems, heat pumps, fluid flow systems, & air flow through manifolds using first principles, empirical, & data-driven methods to enable control system design & development. Formulate & execute design of experiments to analyze behavior of physical systems to aid mathematical model development. Use MATLAB, Simulink, Python to build software implementations of mathematical models to enable computer aided analysis of vehicle systems & development of control systems. Formulate & adapt novel control system technologies including model predictive control, optimal control, sliding mode control, machine learning, big data analytics. Develop supervisory control strategies using optimal control theory including Pontryagin's minimum principle (PMP), dynamic programming (DP), variational calculus, & convex optimization. PhD, Mechanical or Electrical Engineering. 6 mos exp as Engineer, Researcher, Graduate Research Associate, Graduate Research Assistant, or related, researching or developing mathematical models for physical systems including engine, electric motor, & battery, using first principles, empirical, & data-driven methods, & developing supervisory control strategies using optimal control theory including PMP, DP, & variational calculus, or related. Mail resume to Ref#5557, GM Global Mobility, 300 Renaissance Center, MC:482-C32-C66, Detroit, MI 48265.

SENIOR DESIGN RELEASE ENGINEER-EXTERIOR LIGHTING ELECTRONICS, Warren, MI, General Motors. Engineer, & release program vehicle exterior lighting system electronics in headlamps, taillamps, turn signals, & side indicators, integrated into vehicle electrical architectures, using UG NX, Tc, VisMockup tools. Define electrical interface control document requirements for exterior lighting system interfaces, negotiating packaging & integration issues with engineers. Design circuits for program-specific applications & review supplier designs to ascertain integration to entire vehicle. Create Statements of Requirements for exterior lighting electronics to facilitate development & sourcing of components including LED driver modules (LDMs), LED assembly modules (LAMs), printed circuit boards (PCBs), Flexible Printed Circuits (FPCs) & light emitting diodes. Engineer, design, integrate supplier sourced LDMs, LAMs, wiring harnesses, Interconnect Boards, PCBs, FPCs, & electrical devices including thermistors, capacitors, & fuses, using UG NX, Tc, Vismockup, & ECM tools. Required travel to U.S., MEX, CHN, & JPN Tier I/II supplier plants to review electronics integration & LED electronics assembly manufacturing lines, & debug & validate tooling, machinery, & equipment, up to 4 wks P/A (= to ~8% annual travel). Bachelor, Electrical, Electronics Engineering, or related. 6 mos exp as Engineer, conducting engineering activities for model year start of production programs, or related. Mail resume to Ref#41906, GM Global Mobility, 300 Renaissance Center, MC:482-C32-C66, Detroit, MI 48265.

JOB OPPORTUNITIES

ADVANCED DRIVER ASSISTANCE (ADAS) CONTROLLER INTEGRATION ENGINEER,

Milford, MI, General Motors. Dvlp, integrate &test ADAS ECUs incldg External Object Calculation Module (EOCM) &ADAS Computing Platform (ACP) for conventional &semi-autonomous internal combustion engine &Battery Electric Vehicle passenger vehicles. Dvlp &integrate ADAS features incldg semi-autonomous features incldg Super Cruise &Ultra Cruise, &driver assist features incldg Adaptive Cruise Control, Lane Centering Control, Lane Change on Demand, Lane Keep Assist, &Automatic Emergency Braking. Integrate EOCM &ACP controllers w/ Vehicle Integration Control, Electronic Brake Control, Traction Power Inverter, Engine Control &Body Control Modules, &troubleshoot integration issues. Verify embedded ECU functionality for EOCM &ACP on dSPACE Hardware in the Loop (HIL) bench &in vehicle incldg low level HW interfaces, serial data programming, message authentication, diagnostics, vehicle electrical interfaces &vehicle assy. Troubleshoot vehicle level integration issues incldg HW, SW, calibration, instrumentation, &vehicle wiring using ETAS INCA, Vehicle Spy, CANalyzer tools &NeoVi FIRE 2 HW. Master, Electrical, Automotive, or Mechanical Engrg. 12 mos exp as Engineer, designing or dvlpng automotive controls simulation models for passenger vehicle using dSPACE tool, &integrating plant models w/ HIL test bench for validation of ECUs using ETAS INCA, VehicleSpy, &CANalyzer tools, or related. Mail resume to Ref#1643, GM Global Mobility, 300 Renaissance Center, MC:482-C32-C66, Detroit, MI 48265.

CONTROLS DEVELOPMENT ENGINEER,

Milford, MI, General Motors. Design, develop, test &calibrate embedded SW to control high voltage contactors to connect or isolate High Voltage battery on BEVs to provide power for electric drive units, heating, cooling, charging &accessory power module using C programming language. Implement SW in C conforming to MISRA C Standards, SEI CERT Standards &GM C SW Standards. Complete unit &behavioral testing using RiBeTT &system level testing using GMSim. Execute vehicle &simulation testing following written test procedures, simulating real world maneuvers &random testing using ETAS INCA &AutoVal to determine calibration parameters, replicate reported issues &check for unreported issues. Perform anlys using ETAS MDA to confirm correct behavior of calibrations &SW. Post-process vehicle test data using Excel &MATLAB scripts to automate data anlys &generate graphs for visual representation. Perform root cause vehicle testing issues by reading through/ checking powertrain C source code, analyzing data using ETAS MDA &monitoring CAN bus messages using VehicleSpy. Bachelor, Mechanical, Automotive, or Electrical Engrg. 6 mos exp as Engineer or related, executing vehicle &simulation testing, simulating real world maneuvers &random testing using ETAS INCA to determine calibration parameters, &performing root cause vehicle testing issues checking powertrain C source code, analyzing data using ETAS MDA &monitoring CAN bus messages using VehicleSpy, or related. Mail resume to Ref#1735, GM Global Mobility, 300 Renaissance Center, MC:482-C32-C66, Detroit, MI 48265.

COMPARTMENT MANUFACTURING ENGINEER-ELECTRICAL,

Warren, MI, General Motors. Analyze, verify & determine manufacturing compliance of psgr vehicle multi-branch wiring harnesses, incldg wire, terminals, connectors, coverings & attachments, using Tc VisMockup, E2, Engineering Change Request, & Auros tools. Ensure manufacturability, compliance to mfg reqmts & vehicle assy plant General Assy strategies for psgr vehicle wiring harnesses. Analyze conventional, hybrid & BEV psgr vehicle low voltage wiring harnesses, high voltage cables, battery cables, active & passive sys safety control modules incldg Radar, Park Assist sensors & module, Instrument Panel (IP) electronic cmpnts, AM/FM antennas, GPS antennas, electrical switches, IP Clusters & overhead consoles, power seat controls, vehicle audio systems incldg speakers, amplifiers, microphones, Integrated Center Stack Modules, crash mitigation sensors, BEV electric Drive Unit controls & battery electric control modules incldg Vehicle Integration Control Modules & intelligent battery sensors. Check & determine manufacturing reqmts for high voltage cmpnts incldg propulsion energy storage batteries, vehicle charging inlets, high voltage control modules & low voltage 12V battery. Use PRTS & GVDP processes, Design for Assy, PFMEA, to evaluate & determine & validate wiring harness branch points for multi-branch harnesses, size, connector keying, harness twist points & electrical connections hand access specs & reqmts. Master, Electrical or Power Systems Engineering, Integrated Power Systems, or related. 3 mos exp as Engineer, analyzing or determining technical specs for full psgr vehicle or complete plant electrical sys, or related. Mail resume to Ref#1084, GM Global Mobility, 300 Renaissance Center, MC:482-C32-C66, Detroit, MI 48265.

GLOBAL PRODUCT PROCESS INTEGRATION COMPARTMENT MANUFACTURING ENGINEER-ELECTRICAL TEAM,

Warren, MI, General Motors. Ensure cmpnt product designs manufacturability, compliance w/ mfg reqmts & vehicle assy plant General Assy (GA) strategies for conventional, BEV & autonomous vehicle multi-branch wiring harnesses, incldg wire, terminals, connectors, coverings & attachments, using Tc VisMockup, E2, Engrg Change Request, & Auros tools. Analyze low voltage harnesses, high voltage cables, battery cables, active & passive safety control modules, Instrument Panel electronic cmpnts, body interior & exterior control modules, infotainment syss, switches, clusters & overhead consoles, power seat controls, vehicle audio syss, crash mitigation sensors, electric drive unit controls & battery ECU modules. Check mfg reqmts for high voltage cmpnts incldg propulsion energy storage batteries, vehicle charging inlets, high voltage control modules & low voltage 12-V battery. Conduct virtual studies & assessments thruout vehicle dvlpmnt process to determine manufacturability & GA issues. Perform GA mfg planning studies for new psgr vehicles, MY changes, production volume changes, EWOs, & implementation of new standards of machinery & equipment & updates to BOPs, line balancing activities to meet productivity targets, & development & implementation of plant productivity proposals. Bachelor, Industrial, Mechanical, Electrical, Mechatronics Engrg, or related. 12 mos exp as Industrial Engineer, Mfg Engineer, or Process Engineer, assisting plant w/ line balancing activities to meet productivity targets, dvlpg & implementing plant productivity proposals, or related. Mail resume to Ref#2930, GM Global Mobility, 300 Renaissance Center, MC:482-C32-C66, Detroit, MI 48265.

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