

UPDATE

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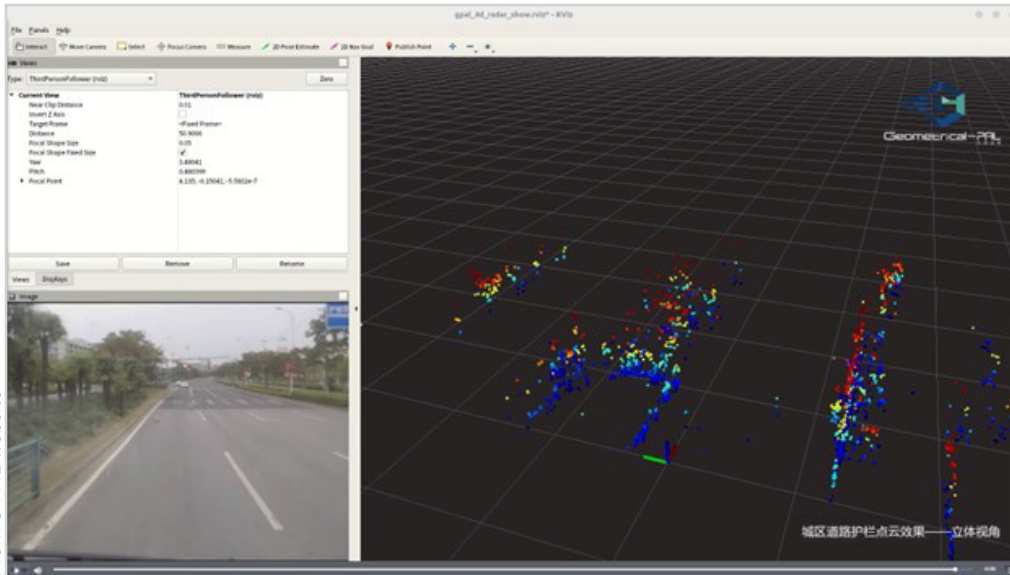
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On the cover

The Boeing 747-8 applies interior features from the 787 Dreamliner to give passengers a greater feeling of space and comfort.

The Boeing Company



G-PAL offers machine perception and learning based total solutions and integrated HW/SW systems for self-driving at various stages.

SAE China office strengthens its capabilities in autonomous and driverless technologies

With the rapid development of autonomous driving technology around the world, SAE Industrial Consulting Services (Shanghai) Co., Ltd. (SAE Shanghai), a wholly owned foreign subsidiary of SAE International (SAEI, and collectively with SAE Shanghai, “SAE”) is strengthening its investment in autonomous and driverless technologies by supporting Geometrical Perception and Learning Co., Ltd. (G-PAL) in China. As a neutral organization, SAE views China as a mobility innovator and G-PAL as a key partner to access regional resources and technologies.

Founded in October 2018, [G-PAL](#) is a high-tech enterprise integrating R&D, manufacturing, sales, and ecological construction of autonomous driving software and hardware products, bringing together first-class technical experts and

teams in the fields of automotive sensors and autonomous driving at home and abroad.

This investment will further optimize the strategic layout of SAE and G-PAL in the field of autonomous driving by:

- Establishing the “Shanghai Municipal Engineering Center of Multi-Perception Fusion and Intelligent Decision for Full Self-Driving (FSD)”
- Developing a joint high-performance FSD computing platform (NPU)
- Building an ecosystem inclusive of FSD related chips, software, testing, and application innovations, in conjunction with piloting the State’s next-gen AI innovation zone in Shanghai
- Strengthening plans for the autonomous and driverless sectors to facilitate future development of the mobility industry.

“SAE is committed to pushing boundaries and progressing advanced knowledge and solutions in mobility, including automobiles,” said Raman Venkatesh, Ph.D., Executive Vice President and Chief Operating Officer of SAE International. “As the trend towards autonomous and driverless technologies becomes clearer, SAE is leveraging the most reliable engineering resources and consensus standards system, as well as its strong talent resources, to help the global autonomous driving industry develop in a healthy and orderly manner. As one of the most vibrant markets for autonomous driving technology development, China has incubated a number of technology companies with outstanding innovation, real-world capabilities and eco-building capabilities. These companies will provide very significant support for us to jointly promote the development of global autonomous driving, and G-PAL is one of the leaders among them.”

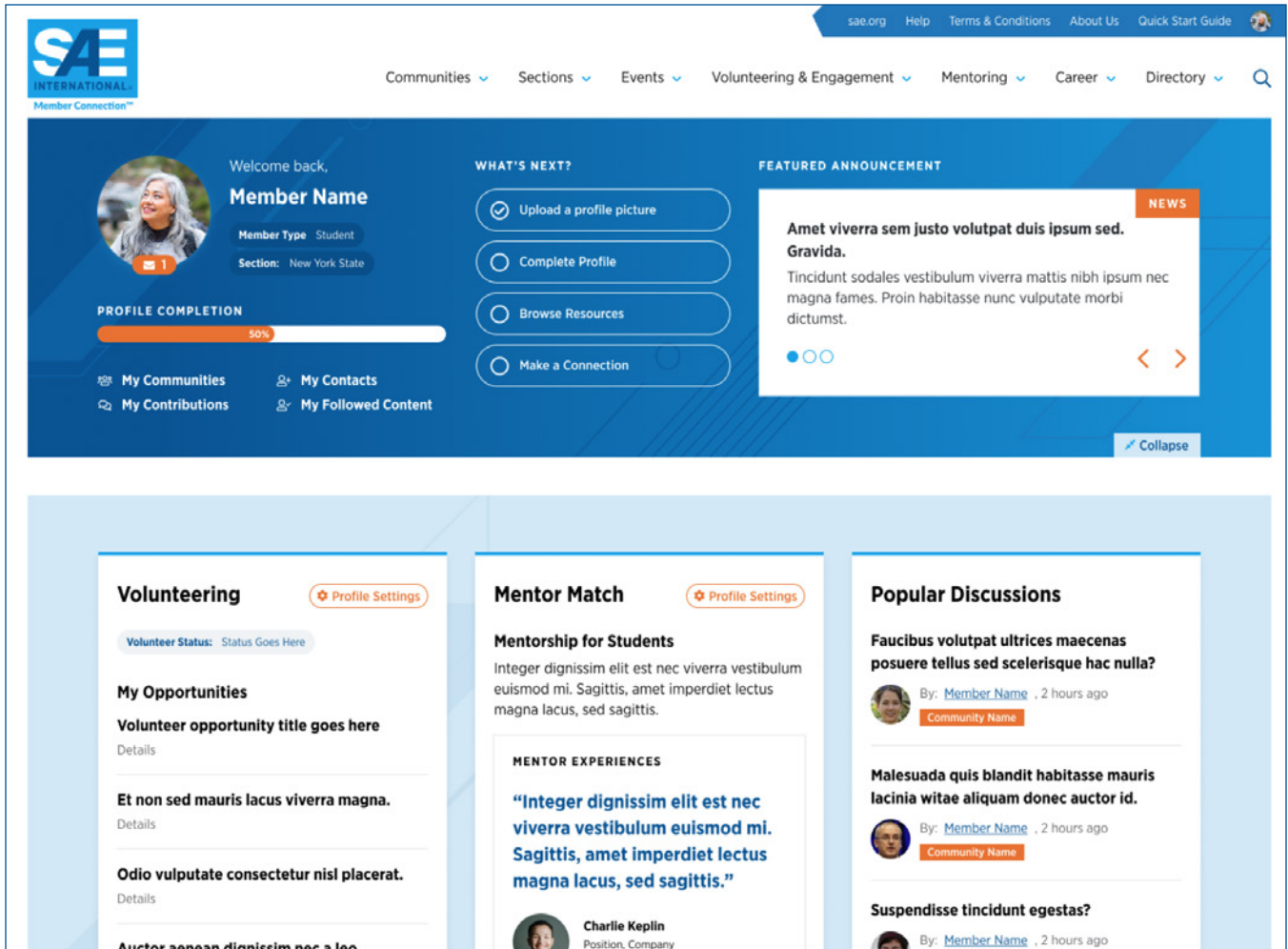
XUE Dan, the CEO of G-PAL, said: “G-PAL has always believed that further development of autonomous driving requires deeper cooperation from the whole industry, and it is a great honor for us to work with SAE, the world’s most authoritative standards organization in mobility. It is a milestone for G-PAL to be able to work alongside SAE on the road of promoting the continuous development of autonomous driving.”

Billy Xu, General Manager of the SAE

China Office, added: “Seizing the wave of intelligent upgrading and development of a high-quality automotive industry is an important goal for SAE. As a leader in China’s autonomous driving field, G-PAL has built a steady and profound foundation in technology accumulation, application implementation and ecological construction. We look forward to G-PAL actively joining the SAE standards committees, working with the global industrial companies and experts to develop consensus standards, building exchange platforms, and resource pools, and cultivating cutting-edge talents around solving society’s mobility needs to boost the global automotive industry.”

SAE Shanghai’s investment in G-PAL further enhances the ability of integration and innovation and contributes to the provision of safe, clean, and easy-to-use solutions for the sustainable high-quality development of the global automotive industry.

Since its founding, G-PAL has innovatively used 4D MMW Imaging radars as the main sensors, combined with visual, LWIR and other sensors to create an all-weather pixel-level fusion sensing system. Based on this, G-PAL develops a full-stack autonomous driving system software that integrates sensing, decision-making, planning and control and can provide an integrated system and total solution for L2-L4 autonomous driving software and hardware based on machine perception and deep learning. ■



Take a drive on the re-engineered SAE member and volunteer online community with an interactive component.

Connexion+ is a new and more lively community

By the time you read this article, you may already have experienced the re-engineered, interactive website for SAE members and volunteers to find information, volunteer on SAE's behalf, and engage in discussions with other members and volunteers. For those who have not yet, it's called [Connexion+](#) and it is a combination of the former SAE Member Connection and the former SAE Propel.

Member Connection was an exclusive member benefit: it provided a virtual space for discussing technical content, managing your membership, building your network around the globe, and more. SAE Propel was an online platform that aggregated all of the SAE volunteer opportunities available to you. You could also sign up for alerts via the volunteer pool and customize your profile for the pool, choosing the amount of time you

have to give back, any technical areas of interest, etc.

Because the SAE Membership and Engagement Team was intent on providing a seamless, one-stop-shop experience for SAE members and volunteers collectively, tangible changes to the platforms were necessary. Now you can access the member-only communities, as well as the volunteer opportunities, in one place via Connexion+. The navigation has been improved, the personalization has been improved and, most importantly, your experience has been improved!

Savings for SAE members

Whether you're traveling for business or pleasure, use your SAE Avis and Budget Car Rental Savings Program to get you where you need to go. Members can book online and save up to 35% off with Pay Now rates. Explore additional offers like complimentary upgrades or enroll in Avis Preferred® or Budget Fastbreak® to skip the line and enjoy expedited service. You'll also receive reward points for every qualifying dollar you spend.

Secure your car rental with Avis: www.avis.com/en/association/A672021 and use your Avis Worldwide Discount (AWD) number A672021.

Or, to book online with Budget: www.budget.com/en/association/B079527 and use your Budget Customer Discount (BCD) number B079527. ■

Check out the upcoming events hosted in SAE Connexion+

SEPTEMBER

- **Membership Information Session:** September 21. Learn about the latest member benefits.
- **Virtual Mentor Mixer:** September 27–28; theme TBD

OCTOBER

- **New book releases:** Chat with the Expert (authors of new SAE books)

NOVEMBER

- **Virtual Mentor Mixer:** November 15–16; Theme: burnout

DECEMBER

- **Membership Information Session:** December 14. Learn about the latest member benefits.
- **Diversity, Equity and Inclusion Chat with the Expert,** Cheryl Thompson, Founder and CEO, Center for Automotive Diversity, Inclusion, and Advancement

Schedule subject to change. For the latest schedule of activities in [Connexion+](#), click on the 'Events' tab. ■

TECH FOCUS: VEHICLE INTERIORS

Engineering the cabin for comfort, convenience, and safety.

“We invented something no one knew how to certify.”

-Kevin Walsh

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Boeing

Kevin Walsh was project engineer on the first passenger 747-8 (all seat classes).

NO SITTING STILL FOR THIS SAE AEROSPACE STANDARDS COMMITTEE



With thousands of aerospace standards requiring continuous review — and sometimes, revision — SAE International must rely on a large number of volunteer engineers to keep its portfolio relevant and up to date.

One of the more notable of them is Kevin Walsh, Technical Fellow, The Boeing Company. He has served on the SAE Aircraft SEAT Committee since it was established in 1997, and since 2019 has been at its helm as chair. For his leadership of this committee, Walsh recently was recognized with the prestigious

SAE [James M. Crawford Executive Standards Committee Outstanding Achievement Award](#).

More on Walsh later.

About the SEAT Committee: It has published 29 documents, with one new document and two revisions currently under way, according to SAE International's Judith Ritchie, Director, Government and Industry Affairs - Aerospace. The group addresses all facets of aircraft seats — design, maintenance, and in-service experience — and is responsible for aircraft seat systems design and performance standards development.

There are 350 participants in the committee from OEMs, suppliers, aircraft seat equipment companies, consulting firms, government, and others across the aerospace and defense industries. "The committee is respected for its open communication between manufacturers, operators, and regulators, working together to develop standards that enhance safety and efficiency," Ritchie told *Update*.

In addition to aircraft seat design, the committee addresses seatbelt/restraint systems and performance standards. Two important documents that the SEAT committee developed and is now revising are [AS8043C Restraint Systems for Civil Aircraft](#) and [AS8049E Performance Standard for Seats in Civil Rotorcraft, Transport Aircraft, and General Aviation Aircraft](#). These standards are referenced in FAA and EASA certification requirements.

In answer to the COVID-19 pandemic, the SEAT Committee worked with the [National Institute for Aviation Research](#) at Wichita State University to evaluate the effect of liquid disinfectants on the physical, mechanical, and flammability properties of materials used in aircraft seats. It subsequently

published [ARP8463 Methods for Determining the Effect of Liquid Disinfectants on Seats in Transport Aircraft](#).

With the advancement of a new industry segment — Advanced Air Mobility (AAM) Aircraft — the SEAT Committee was requested to develop a specific standard appropriate to AAM aircraft. In association with EUROCAE, the group has developed [AS6849 Performance Standards for Passenger & Crew Seats in Advanced Air Mobility \(AAM\) Aircraft](#), which is due to be published soon.

This SAE Aerospace Standard (AS) defines qualification requirements and minimum documentation requirements for forward and aft facing seats in AAM aircraft, according to Ritchie. “The goal is to achieve occupant protection under normal operational loads and to define test and evaluation criteria to demonstrate occupant protection when the seat is subjected to statically applied ultimate loads and to dynamic test conditions.”

Ritchie noted that while AS6849 addresses system performance, responsibility for the seating system is divided between the seat manufacturer and the installation applicant. The seat manufacturer’s responsibility consists of meeting all the seat system performance requirements. The installation applicant has the ultimate system responsibility in assuring that all requirements for safe seat installation have been met.

This AS is dependent on [AS8049D -](#)



SAE International

Walsh (left) accepts SAE’s James M. Crawford Executive Standards Committee Outstanding Achievement Award from SAE President Sri Srinath at the AeroTech conference in March 2022.

[Performance Standard for Seats in Civil Rotorcraft, Transport Aircraft, and General Aviation Aircraft](#) and cannot be used

without it. AS6849 provides revisions to the corresponding sections of AS8049D to incorporate new material specific to AAM aircraft seats. Sections beginning “Modify...” change the current wording of AS8049D by incorporating text applicable to the new seat category. Sections beginning “Add...” incorporate new sections into AS8049D. All other sections are unmodified.

Award winner and expert

An aeronautical engineer with many years of international experience in aircraft design,

stress, and certification, Walsh specializes in seats across a broad range of platforms including general, business, and commercial aircraft as well as head-of-state completions. The chartered engineer (U.K. equivalent to U.S. P.E.) and Fellow of the Royal Aeronautical Society found his engineering passion when the crash test requirements for aircraft seats were published in 1988. He is now widely recognized within the aviation seat industry as an expert in seat design, static and dynamic seat testing, occupant injury mitigation, flammability, seat installation, and multi-agency certification.

A career highlight, he told *Update*, was leading the industry through the creation of AS6316 Performance Standards for Oblique Facing Passenger Seats in Transport Aircraft. “At the time, this was something new to the industry. We had invented something that no one knew how

to certify. So, working with all the stakeholders, we built consensus around requirements that have stood for over five years now without modification.”

In addition to writing standards for SAE, Walsh has written many internal standards for Boeing and has served as primary author and editor of several industry-consensus comments to FAA advisory circulars.

His leadership of the SAE SEAT Committee also counts as a career highlight, he said, “It’s a wonderful opportunity to bring the committee up to date and set it on a firm foundation for the next 25 years with active participation from the next generation of committee leaders.”

An engineering journey

Many exciting years passed between his developing an interest in space as a young man living outside London within hearing distance of Heathrow Airport and his chairing the SAE committee.

“I became fascinated with flight and all things aerospace as a result of the Apollo missions,” he told *Update*. “I remember being told at school when we were tasked with writing a fictional essay, ‘Kevin, you are not to write about space, again!’ I quickly figured out you had to be Russian or American to become an astronaut, so I ended up switching my ambitions to engineering instead.”

Walsh earned a B.S.C. honors degree in aeronautical Engineering from The City



Kevin Walsh

Walsh with the first seat he ever certified.

University, London, in 1981.

In that same year, he landed his first job, with British Aerospace (now known as BAE Systems), where he used FEA and other tools for stress analysis of fighter jet wings, among other things.

“One of the strangest calculations I had to do was to determine the bursting strength of a honeycomb panel following a nuclear thermal shock,” Walsh said. “Those were the days before perforated core. The experience set me on the road of civil aviation, where I could use my skills to help people rather than kill them.”

And so in 1988, he took the position of stress engineer at Pilatus on that company’s PC-12 aircraft. “One day,” Walsh recalled, “the chief stress engineer popped out of his office looking for someone to work the seats for the aircraft. The qualifications were that you had to speak English and be able to travel. And then he looked at me!”

“I have worked seats ever since.”

Walsh eventually moved into the position of senior stress engineer at Pilatus.



Walsh in Tucson along with about 20 other distinguished SAE volunteers for recognition as member of SAE’s 2021 Top Contributor Class.

“Looking back,” said Walsh, “I’m proudest of the work I did on the PC-12. Not only was I the engineer responsible for the seats, but I also created the finite element model for the production stress analysis of the entire aircraft. I learned a lot of skills on that aircraft that I still use today.”

By coincidence, a PC-12 is based at the airfield Walsh lives near today.

“Every time it flies over, I look up because of the distinctive sound it makes. Being responsible for the entire aircraft provided a huge level of pride of ownership, even though I recognize that I was only part of a larger team,” he said.

In 1996, Walsh took a position with a seat maker in the U.S. because that’s where the action is in terms of regulation, he said.

And then? “I went from Chief Engineer [at DeCrane] to just another engineer at Boeing until they figured out what I could do,” he said.

A lot, it turns out. At Boeing, he was project engineer for the first passenger 747-8, all seats. His current position is Boeing Technical Fellow - Seats. ■

40^{YEAR} ANNIVERSARY

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September 25 – 28, 2022 | Grand Rapids, MI

“It is extremely important to participate as it delineates future tendencies, starts important discussions, and provide incomparable chance for networking with the Brake chain industry.”

- 2021 BRAKE Attendee

Its Good to be Back in Person

This year's Brake Colloquium will feature a combination of organized networking opportunities, an interactive exhibition, and leading subject matter experts participating in technical presentations, interactive panels, tutorials, keynote roundtable, and more.

Technical Session Topics:

- Advances in Brake Component and Brake System Design
- Brake Emissions Measurement and Characterization
- Brake Mechatronics and Controls Products
- Brake Systems for High Performance and Racing Application
- Critical Braking Issues Related to the Performance and Safety of Commercial Vehicles
- Developments and Innovations in Friction Materials and Friction Couples
- Fundamental Mechanisms of Friction and Vibration
- Improving Brake NVH (Noise, Vibration and Harshness) Performance
- Innovations in Wheel Bearing and Seals and Their Impact on Brake Corners
- Latest Advancement in Simulation Technologies
- Testing and Measurement Methods for New Braking Technologies
- Wind Turbine, Railway, and Heavy Machinery Brakes

sae.org/brake

SAE webinars take a look inside

Webinars produced by various SAE units cover the spectrum of on- and off-road vehicle technologies, including those related to comfort, convenience and other factors impacting drivers, pilots, and passengers.

[Understanding Military and Specialty Transparencies](#)

From reconnaissance to air-to-air combat, to tactical aerial bombing, to today's most sophisticated missions, the evolution of military aircraft has resulted in significant changes to the concept, design, function, and manufacturing techniques of transparency systems. Transparencies are designed to sustain bird strikes, rain erosion, static dissipation, chemical resistance, and harsh weather conditions including exposure to UV rays, humidity, and extreme heat or cold, as well as other mechanical challenges. Cutting-edge technology is imperative to manage tough specifications for the performance of a transparency and the threats it's built to overcome. This 30-minute Webinar provides details about



Boeing

In partnership with Boeing, PPG has been the supplier of the flightdeck windows since the inception of the CH-47 Chinook program in the 1960s. PPG uses a glass design that is highly resistant against rotorwash debris, sand and dust, and bird impact.

the technology of aerospace transparencies for military aircraft, land vehicles, and architectural blast and ballistic solutions. Aspects of the complexity of transparency manufacturing and production are discussed. Includes Q&A. Webinar available until April 20, 2023.

[Digital Solutions to Design Vehicles for Noise and Vibration](#)

This 60-minute Webinar discusses digital solutions that can be used by OEMs to find and mitigate potential noise issues from the earliest stages of design, reducing development risks and providing better designs. Specifically, it examines digital solutions by SIMULIA that can minimize the noise and vibration inside the cabin while reducing cost and development time. Because of their inherent

advantages over physical testing methods, these solutions can bring much more feedback about the design performance into each stage of development. They can improve the ability for designers and engineers to innovate in balancing design aesthetics with acoustic performance. Audience Q&A follows the presentation. Webinar available until November 12, 2022.

Developing Displays and Human Machine Interfaces for Electric Vehicles

This 30-minute Webinar covers the wide range of engineered material components and stack-ups as well as the design considerations that go into developing high-reliability EV displays, dashboards, and next-generation human-machine interface (HMI) consoles. Topics include design tips, how components interact, and how to achieve thinner, clearer, better performing multifunctional material solutions through design integration and streamlined design for manufacture. An audience Q&A follows the presentation. This webinar is



2024 Chevrolet Blazer

available until April 28, 2023.

Solutions for Automotive Interior Colors

While the exterior of the car may be the first thing you see, the interior of the vehicle is where your driving experience happens. The design and color of a car's interior are central to consumer perception and play a pivotal role in the purchase decision. Controlling the interior color of a cabin is difficult because the components come in different textures from many suppliers and are assembled using diverse materials. Coordination and quality control are essential to ensure a harmonious interior, including the overall design as well as the color of the dashboard, seats, steering wheel, cabin, and even flooring. This 30-minute Webinar discusses the types of surfaces found in vehicles and the considerations to think about when measuring these various surfaces, including gloss surfaces, the difference in gloss angle measurements, different instrument geometries, and the importance of keeping the same geometry through your supply chain. Webinar available until November 2, 2022. ■

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sae.org/comvec

Design of the in-vehicle experience

Designing an in-vehicle experience is becoming both increasingly more complex and important. The process involves new stakeholders, and the dynamics of decision-making are shifting. At the same time, existing guidelines require adaptations or amendments to cope with novel technologies and to provide new players with appropriate guidelines to ensure safe and usable experiences for the driving context. In this EDGE Research report, [Design of the In-Vehicle Experience](#), three major areas of unsettled topics are addressed: designing the physical experience, designing the digital experience, and evaluating the entire in-vehicle experience.

The physical in-vehicle experience is going through a step change with novel modalities and increasing amounts of displays. While OEMs will continue to use these physical aspects to distinguish themselves, designs will initially diverge and ultimately converge, bringing the digital aspects to the front stage.

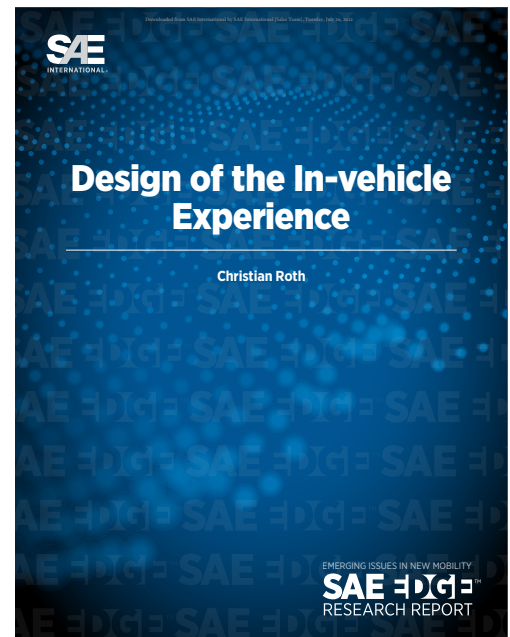
Efforts to standardize the handling of data and contextual information between the vehicle and third-party services that are part of the in-vehicle experience are vital to enable a comprehensive experience and safety-critical functions for the user. The integration of external OS, either as additional platforms or as primary infotainment systems, is another major unsettled aspect of the digital in-vehicle experience. Currently, this process is handled individually, and improvements for OEMs, OS providers, and app developers could be made by defining standard interfaces for a more seamless experience.

Sharing research insights in a working group to define safety thresholds for novel physical and digital



The author of this SAE EDGE Research Report, Christian Roth, is the Chief Executive Officer of fka SV Inc., a research company and trusted partner of the Silicon Valley automotive ecosystem.

fka SV Inc.



aspects could support the creation of more suitable guidelines. Additionally, more research should be supported to define new metrics or methods for evaluating experiences such as managing drivers' attention rather than measuring distraction. ■

SAE Fellow helps conquer COVID for cars

SAE International is proud to have as a member and Fellow Gursaran D. Mathur, Ph.D., P.E. He is known for being an effective, long-time warrior in the battle for more healthy and comfortable vehicle cabin air, as well as for more efficient HVAC systems.

SAE is not the only organization to recognize his effectiveness. Mathur was indirectly celebrated by virtue of his company, Highly-Marelli North America (formerly CalsonicKansei North America), Farmington Hills, Mich., capturing a CES 2022 Innovation Award for a COVID-killing product for cars that he was largely responsible for developing.

At Highly-Marelli North America, he is Senior Technical Specialist, Climate Control, and Senior Manager in Development Engineering. His responsibilities include product design, development, and research in automotive thermal systems.

The company's award-winning Indoor Air Quality (IAQ) Purification System deploys UV-A and UV-C light combined with a titanium-dioxide (TiO₂) filter to destroy airborne bacteria and viruses, including COVID-19, with greater than 99% effectiveness within 15 minutes, according to Mathur. IAQ incorporates semiconductor photocatalysis to drive a chemical reaction with the filter. TiO₂ is an excellent photocatalyst material due to its efficient photoactivity, high stability, low cost, and environmental safety.

SAE's *Automotive Engineering* magazine detailed the Highly-Marelli/Mathur innovation [here](#). Mathur has written several SAE technical papers on the technologies involved, including [UV-LEDs Based Photocatalytic Cabin IAQ System to Eliminate Viruses Encountered in a Conditioned Space](#).



SAE International

Gursaran D. Mathur, Ph.D., P.E., at the 2022 SAE Fellows Reception and Recognition ceremony. He was elected SAE Fellow in 2005. For more than 20 years, Mathur has been organizing sessions in the areas of thermal management and climate control for several SAE International conferences, including WCX.

The two-UV light design is key to the product and accompanying patents. Sensors capable of detecting viruses are very expensive and primarily in hospital use, Mathur is quoted as saying in that *AE* article. To moderate cost, which during the time of development was 40-80% more than the cost of the HVAC itself, the Marelli system incorporates a simple on-off control, with timing based on empirical data derived from test chamber results.

"I came up with this idea in 2017 and developed a prototype unit for demonstrating the

technology for virus destruction and odor reductions,” Mathur told *Update*. “I had started working prior to the start of the current pandemic. So basically, I was the principal investigator for this project.”

Mathur said the Highly-Marelli system will be equipped on a vehicle with production starting next year. “Unfortunately, since it is not in production yet, I am unable to provide you the name of the OEM or the vehicle details. We are currently working with many OEMs (EV & ICE) for possibility of including such system in one of their future vehicles.”

Pending for Mathur are two U.S. patents associated with the technology.

Autonomous vehicles, “where people can be facing each other,” were the original targets for the technology, Mathur told *Update*. “This is a great technology that can be used for number of applications, including homes, offices, mass transportations (train, buses, airplanes), ambulances, etcetera.”

“LEDs are bit expensive now, but the price will come down as the application grows in the automotive sector,” he added.

Highly-Marelli has developed and tested multiple IAQ prototypes that can be used in multiple applications, such as an HVAC unit installed inside the cockpit

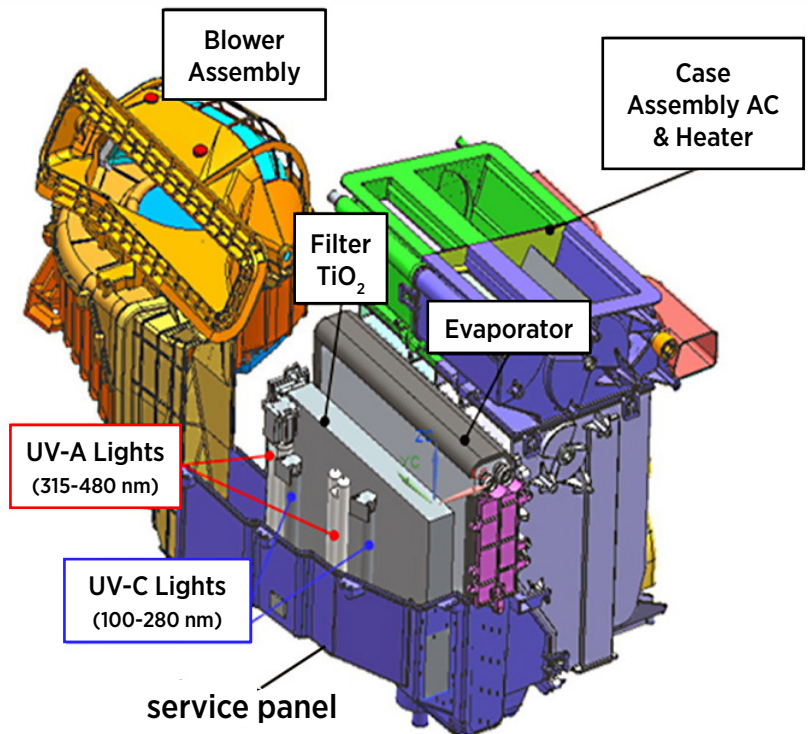
COVID-19 and vehicle interior air quality in general are serious concern: But engineers working in those and other areas are allowed to have fun.

With fun in mind, Mathur asked his HVAC team to offer ideas for the product’s brand name. Among the suggestions:



- Eradictor
- GermEx
- BioBreeze
- A whole family of names incorporating the word “zap” — Zapify, ZapGenie, etc.

By whatever name, the innovation secured Mathur recognition from within Highly-Marelli top management, both locally and in Japan.

Mathur has published more than 115 technical papers and chairs the committee for SAE [J3344 Measurement of CO2 Build Up in Passenger Compartment](#).” Also, he is a member of SAE’s Cabin Disinfection



HVAC case with TiO2 filter and UV lights installed as shown, covered by service panel.

	UV PHOTOCATALYSIS	CARBON ACTIVATED	IONIZER + PARTICLE	HEPA
FILTER EFFICIENCY	95~98%	~95%	88~90%	99.97%
VIRUS AND BACTERIA REMOVAL	 Kills Instantly	✗	✗	 >0.3 microns stays on filter
Comment	Eliminates virus Instantly	Cannot Eliminates virus		Virus & bacteria stay on the filter and die with time

Marelli

Comparison of potential HVAC cabin air decontamination systems shows Marelli's is most effective.

Practices Committee, which is working to make his solution a guideline for automobiles.

He has been supporting the SAE Interior Climate Control Committee for the past 20 years in the development of standards for use by OEMs, suppliers, and service providers. He had extensively worked on alternative refrigerants, as well.

SAE has recognized Mathur's work by presenting him with the Forest R. McFarland and Lloyd L. Withrow Distinguished Speaker awards.

"I am glad to be a part of SAE for the past 24-plus years," he told *Update*.

Mathur has also distinguished himself with other professional societies, including the American

Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE); the American Society of Mechanical Engineers (ASME); and the Japan Society of Automotive Engineers (JSAE). He is recipient of ASME's Best Paper Award for his paper, "Performance Enhancement of Residential AC systems," and ASHRAE's Distinguished Service and George B. Hightower Technical Achievement awards.

Mathur's specialization is in the areas of HVAC for automotive, residential, and commercial systems. Other special areas of expertise for Mathur include heat exchangers including internally and externally enhanced surfaces; two-phase fluid-flow and heat transfer (boiling and condensation); alternate refrigerants; heat recovery systems including two-phase thermosiphon loops and heat pipe heat exchangers; system and component modeling of thermal systems; experimentation in the HVAC/thermal systems including solar heating and cooling; electrification including electric compressors, heat pump systems, and high-voltage water heaters. ■

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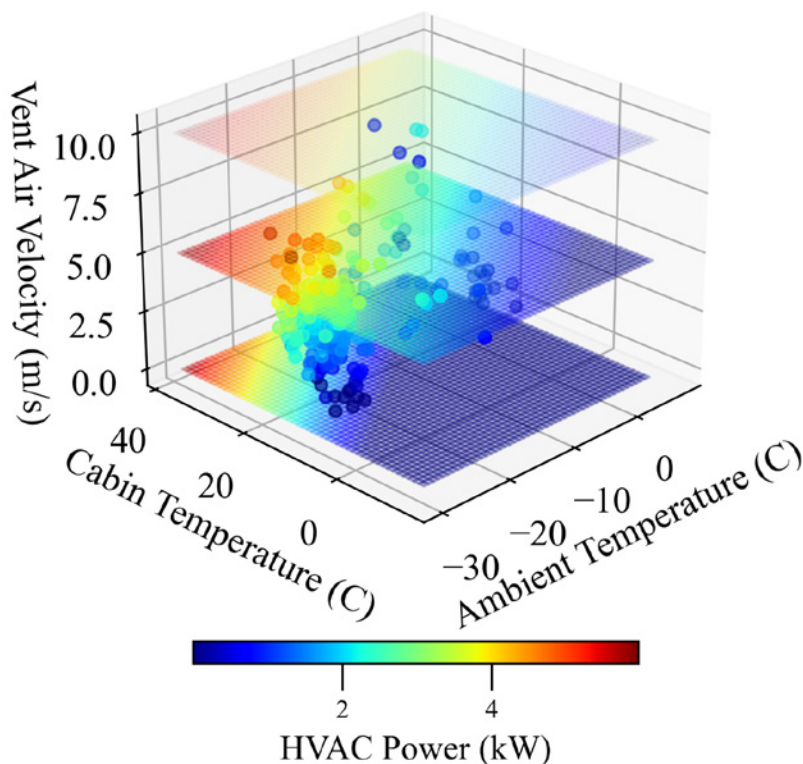
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Tech paper holds keys to comfortable vehicle interiors

The global adoption of battery and hybrid electric vehicles (EVs) continues to grow, with consumers and governments hopeful that a shift toward more sustainable transportation will help reduce harmful particulate emissions produced by internal combustion engines (ICEs). With increasing environmental regulations implemented by the U.S. Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA) on light-duty vehicle greenhouse gas emissions, along with rising fuel and maintenance costs, last-mile delivery fleets are encouraged to make a rapid shift towards electrification.

The SAE technical paper titled [Modeling Climate Control Loads and the Impact on Vehicle Range for Last-Mile Electric Delivery Trucks in Cold Climates](#) addresses that topic, as can be read in heavily abbreviated form below.

Limited by current battery capacity and scarcity of charging stations, range anxiety

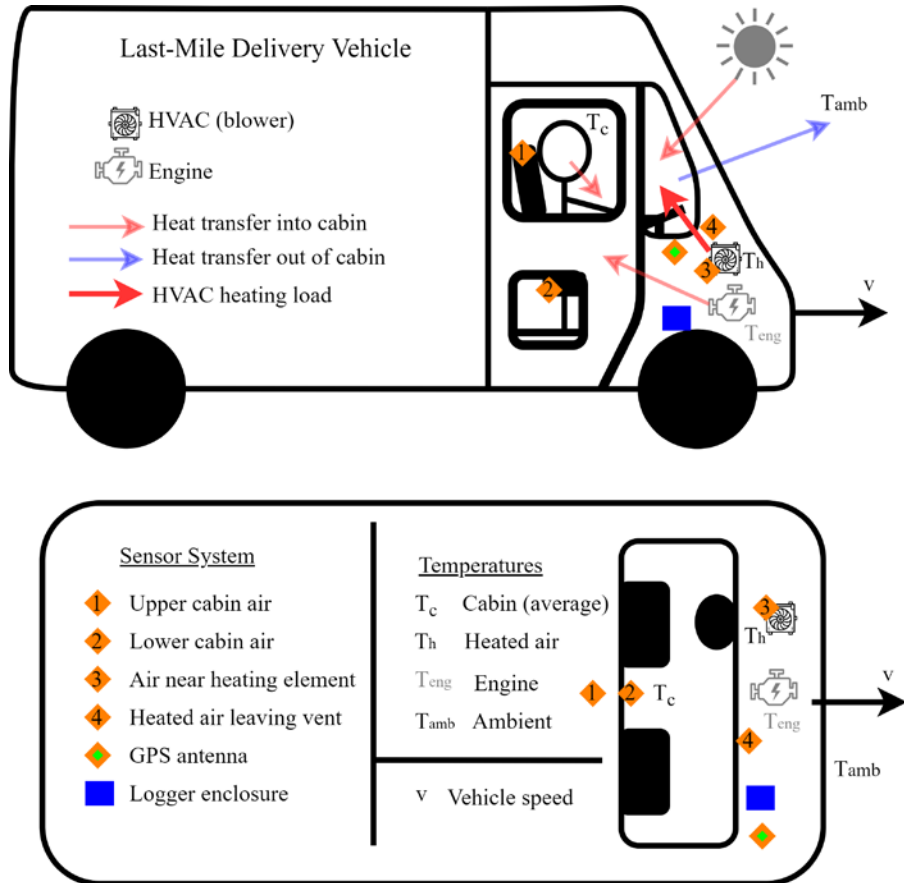


Cabin temperature, ambient temperature, vent air speed.

remains a major concern for battery electric vehicle (BEV) consumers, which would naturally extend to prospective fleet operators considering electrification. As with any passenger vehicle, BEVs require cabin climate control for passenger thermal comfort. As one of the major auxiliary energy devices, the load of a heating and cooling system can have substantial negative impact on a vehicle's energy efficiency and driving range]. Thus, quantifying the impact of temperature-correlated changes in auxiliary loads on vehicle range is critical for decision making in the context of vehicle routing, charger placement optimization, and fleet electrification in different climates.



Co-author of SAE technical paper 2022-01-0199 William Northrop is a heavily engaged 15-year SAE member. He currently is Associate Professor and Director of the Thomas E. Murphy Engine Research Laboratory at the University of Minnesota.



Data collection system to implement proposed method. Along with the placements of sensor system components, the side view drawing (a) shows the metabolic, radiative, ambient, HVAC, and engine heat transfer components.

This work introduces and presents the results from a simple and accurate physics-based model for heating, ventilation, and air conditioning (HVAC) loads. Linear HVAC load models were developed for a last-mile delivery vehicle from which field data was collected during winter driving. Furthermore, the proposed method adds the auxiliary HVAC load model to a previously

tuned vehicle model and road load equation to estimate the impact driving in different (i.e. extreme cold) ambient conditions on the range of the modeled BEV through multiple simulations. The presented method provides a cheap, adaptable, and scalable framework for assessing the impact of dynamic auxiliary loads on electric vehicle range. Because the proposed method focuses on estimating increased HVAC loads in extreme temperatures, it does not currently address the impact of ambient conditions on battery degradation (i.e. nominal capacity loss) but is intended to aid in future analyses toward this goal. ■

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Brainwave-verified driver-alert system for collision avoidance

A team of researchers from George Washington University and Virginia Tech used their brains to conduct a study that tapped into the brains of test subjects in hopes of paving the way for improved collision-avoidance systems.

The team's work is described in [this SAE technical paper](#) published in the [SAE International Journal of Transportation Safety](#).

Azim Eskandarian, a 25-year SAE member, was part of the research team, which acknowledged that more verification and validation of their work is necessary.

According to the paper, collision alert and avoidance systems (CAS) could help to minimize driver errors. They are instrumental as an advanced driver-assistance system (ADAS) when the vehicle is facing potential hazards. Developing effective ADAS/CAS, which provides alerts to the driver, requires a fundamental understanding of human sensory perception and response capabilities.

This research explores the premise that external stimulation can effectively improve drivers' reaction and response capabilities. Our study proposes a light-emitting diode (LED)-based driver warning system to prevent potential collisions while evaluating novel signal-processing algorithms to explore the correlation between driver brain



SAE International

Thirty subjects were used in the simulator testing regime by the research team.

signals and external visual stimulation.

When the vehicle approaches emerging obstacles or potential hazards, an LED light box flashes to warn the driver through visual stimulation to avoid the collision through braking.

Thirty (30) subjects completed a driving simulator experiment under different near-collision scenarios. The Steady-State Visually Evoked Potentials (SSVEP) of the drivers' brain signals and their collision-mitigation (control performance) data were analyzed to evaluate the LED warning system's effectiveness. The results show that, among other things, the proposed modified canonical correlation analysis evaluation (CCA-EVA) algorithm can detect SSVEP responses with 4.68% higher accuracy than the Adaptive Kalman filter. ■

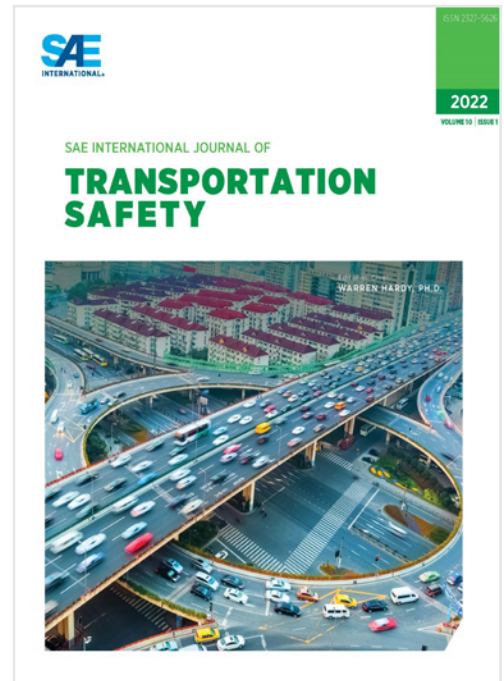
Rear-seat safety gets the attention it deserves

Experimentation and regulations involving vehicle occupant protection typically focus on the front seats, which are where 92% of motor vehicle fatalities occur, according to a team of researchers at Virginia Polytechnic Institute and State University.

And so it makes sense that the safety of the front seats has improved greatly over the years, usually outperforming the rear seats.

The rise of ridesharing and automated driving systems (ADS) is expected to increase rear-seat occupancy by adults, which may increase occupant injury risks. The main objective of a recent study by The Virginia Poly team, described [here](#) in the [SAE International Journal of Transportation Safety](#), was to develop an efficient numerical methodology that could be used to evaluate the safety performance of current vehicle rear seats.

The rear-seat models of eight vehicles were developed based on their geometry reconstructed from three-dimensional (3D) digitizer scans. Seat foam material properties were taken from tests of each seat. Validated finite element (FE) models of THOR-50M and Hybrid III male 50th percentile anthropomorphic test devices (ATDs) were positioned and settled in each seat model. The frontal New Car Assessment Program (NCAP) crash pulses were applied to each vehicle. Injury likelihood was assessed by a summary of the AIS3+ risk curves for the head, neck, and chest. Then, six rear seats were selected and tested on a sled. The restraint system model and dummy pre-crash position were slightly adjusted based on the test data.



The accuracy of the numerical approach to investigate the safety of rear seats was evaluated by the researchers under varying scaled NCAP pulses against sled test data. Overall, the seat models with advanced restraints (e.g., pretensioners, load limiters) and/or a steep seat pan angle had the lowest injury risk. The results of the simulations with varying impact pulses showed reasonable agreement with test data that validate the numerical

assessment of rear-seat safety proposed in this study. The total injury risk ranged from 36% to near certainty, indicating significant room for improvement in the design of rear seats.

However, matching the safety of front seats in the rear seats is not as simple as replicating front seat protections in rear seats; features such as airbags cannot be installed for rear seats the same way as for front seats, and there are additional considerations such as size constraints or ensuring the seats are also safe for children.

To create a safer rear seat, it is important to understand the nature of injuries in the rear seats. For example, adults are more often unbelted in the rear seats, which greatly increases injury rates. Moreover, when belted, the thorax is the most common seriously injured body region, followed by the abdomen. For both of these regions, injuries are primarily due to interaction with the belt.

Experimental and computational studies have shown that pretensioners and load limiters, uncommon in rear seats, but common in the front seats, could decrease the risk and severity of thoracic injury in the rear seats. Typical experimental and computational approaches to studying injury risk in the rear seats involve either a simplified seat or a single seat from a commercial vehicle. These prior studies have focused on modifying the restraint system, such as airbags and seat belts, or modifying seat parameters such as the pan/back angles or stiffness.

The numerical methodology developed in this study provided a reasonable ranking of rear-seat safety. Therefore, parametric seat models, like those used in this study, could be used in the future in various design of experiments (DOE) and optimization. ■

We hope this TECH 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* TECH FOCUS section; please refer to the editorial calendar below.

Future FOCUS Index

OCTOBER

Sustainable energy technology

NOVEMBER

Smart cities/IoT

DECEMBER

Vehicle dynamics



Ford

A trailered Ford F-150 in action.

SAE committee tackles EV towing

Now that more EV pick-ups, SUVs, and other types of electric-powered vehicles are coming to market, the SAE Tow Vehicle Trailer Rating Committee is debating whether to resume discussion about one of its relevant standards.

The standard in question is [J2807 - Performance Requirements for Determining Tow-Vehicle Gross Combination Weight Rating and Trailer Weight Rating](#). To help the committee determine whether to pursue a revision to account for EVs, the

committee hopes to get involvement from EV truck startups like Rivian, Lordstown, etc. as well as already established companies introducing EV trucks/utilities (GM, Ford, etc.).

Those interested in serving on the committee should contact Mark Zar at mark.zar@sae.org.

“While the committee will need to approve opening J2807 for revisions, developing ideas for revising J2807 can start anytime,” said Committee Chair Stephen Robertson of Toyota. “The input of the EV players is deemed crucial in making a determination, as well as offering comments for actual revision if that is the course chosen.”

Robertson has been involved in vehicle evaluation since 1996, “first as a tire development engineer with Bridgestone/Firestone. I recently retired as of August



Electric truck and SUV maker Rivian runs a towing trial in Death Valley.

26, 2022, from Toyota after more than 20 years at the Toyota Arizona Proving Ground as a vehicle dynamics evaluation engineer. I have been a member of the Tow Vehicle Trailer Rating Committee since 2006,” he told Update.

He became involved in the SAE committee when the Toyota representative on the SAE Motor Vehicle Council asked for someone with trailer towing experience. Robertson was a perfect fit.

“I have worked mostly on

truck and SUV programs and have a personal interest in towing camp trailers and car haulers for racing,” he said. “I was impressed to have such wide support and involvement on the committee from not only OEMs, but also hitch, trailer, and specialty manufacturers and evaluation professionals. We were kind of ahead of our time meeting remotely during the development of J2807. The committee also met a handful of times in-person, including vehicle testing events to confirm our evaluation criteria.”

The committee has maintained J2807 consistently since the original publication in 2008. “We addressed changes to account for weight-distributing hitches and available trailers and equipment,” said Robertson. “The recent increase in electric vehicles has prompted an interest to confirm J2807 remains applicable to these new drivetrains. As we did in the beginning, I would like to get broad involvement from the EV manufacturers to join the committee.” ■



The annual COMVEC conferences draws hundreds to the keynote addresses.

COMVEC: a heavy like no other



COMVEC 2022 will be the second time this year that 16-year SAE member Ameya Joshi, Ph.D. delivers a keynote address at an SAE conference. The Director, Emerging Technologies & Regulations, Environmental Technologies, Corning Inc., had done so earlier this year at WCX World Congress Experience, where he also co-organized a technical session and presented a paper.

SAE International's COMVEC 2022 is the only North American forum that focuses on vehicles and equipment spanning the on-highway, off-highway, agricultural, construction, industrial, military and mining sectors. The event will take place September 20-22, 2022, in Indianapolis, Ind. Industry experts will share insight on the latest commercial advancements in powertrain diversification, electrification and charging strategies, connected digital engineering, the future of commercial vehicle transportation, and other topics.

COMVEC is proud to host commercial vehicle industry-leading keynotes including:

David S. Graziosi, Chairman & Chief Executive Officer, Allison Transmission, will share his perspective on why powering

Upcoming

In addition to COMVEC, SAE will conduct nine other conferences by the end of 2022. To learn more about them, and to register for them, visit <https://www.sae.org/attend>.

future innovation is critical to the industry,

Dana J.H. Pittard, Vice President of Defense Programs, Allison Transmission, will discuss why future innovation is critical to the nation's defense.

Ameya Joshi, Director Emerging Technologies & Regulations, Corning Inc., will share insight on technologies, challenges, and opportunities of transitioning commercial vehicles to zero-impact emissions.

"SAE is excited to bring industry executives together to collaborate and problem solve at COMVEC in Indiana," said Frank Bokulich, Manager of Engineering Events at SAE International. "Attendees will see the latest technology and solutions entering the commercial vehicle industry while learning how others are

overcoming challenges of zero emissions, alternative fuels, electric propulsion, digital data, and connectivity."

COMVEC 2022 will also feature a ride & drive option, allowing attendees to see and experience the newest in commercial vehicle innovation. Vehicles on-site include a Peterbilt 579, Peterbilt 359, an ethanol-powered Class 8 Truck, and an all-electric Class 6 pick-up as well as off-highway equipment like the DANNAR 4.00. For a full list of vehicles and technologies available at the Ride & Drive, visit <https://www.sae.org/attend/comvec/special-events>.

To learn more visit: <https://www.sae.org/attend/comvec>. To register, visit: <https://www.sae.org/attend/comvec/registration>. ■

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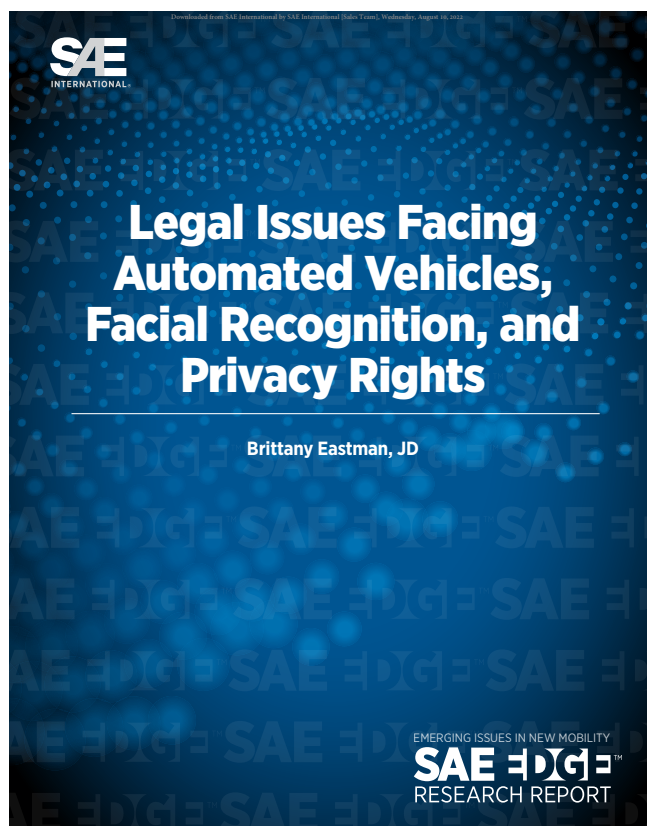
Facing the facts around privacy

Facial recognition software (FRS) is a form of biometric security. It is used to determine people's identity using their faces from photos, videos, or even in real time. Simply, FRS detects a face, analyzes it, converts it to data, and then matches it with images in a database.

That's how BRITTANY EASTMAN, JD, sees the situation in her recently released SAE EDGE Research Report, [Legal Issues Facing Automated Vehicles, Facial Recognition, and Privacy Rights](#).

"This technology is currently being used in vehicles for safety and convenience features, such as detecting driver fatigue, ensuring rideshare drivers are wearing a face covering, or unlocking the vehicle handsfree," she says in the report's introduction. "Public transportation hubs can also use FRS to identify missing persons, intercept domestic terrorism, deter theft, and achieve other security initiatives. Around the world, FRS is even being used on public transportation for payment methods. However, biometric data is sensitive and there are numerous remaining questions about how to implement and regulate FRS in a way that maximizes its safety and security potential while simultaneously ensuring the individual's right to privacy, data security, and technology-based equality.

"This report seeks to highlight the



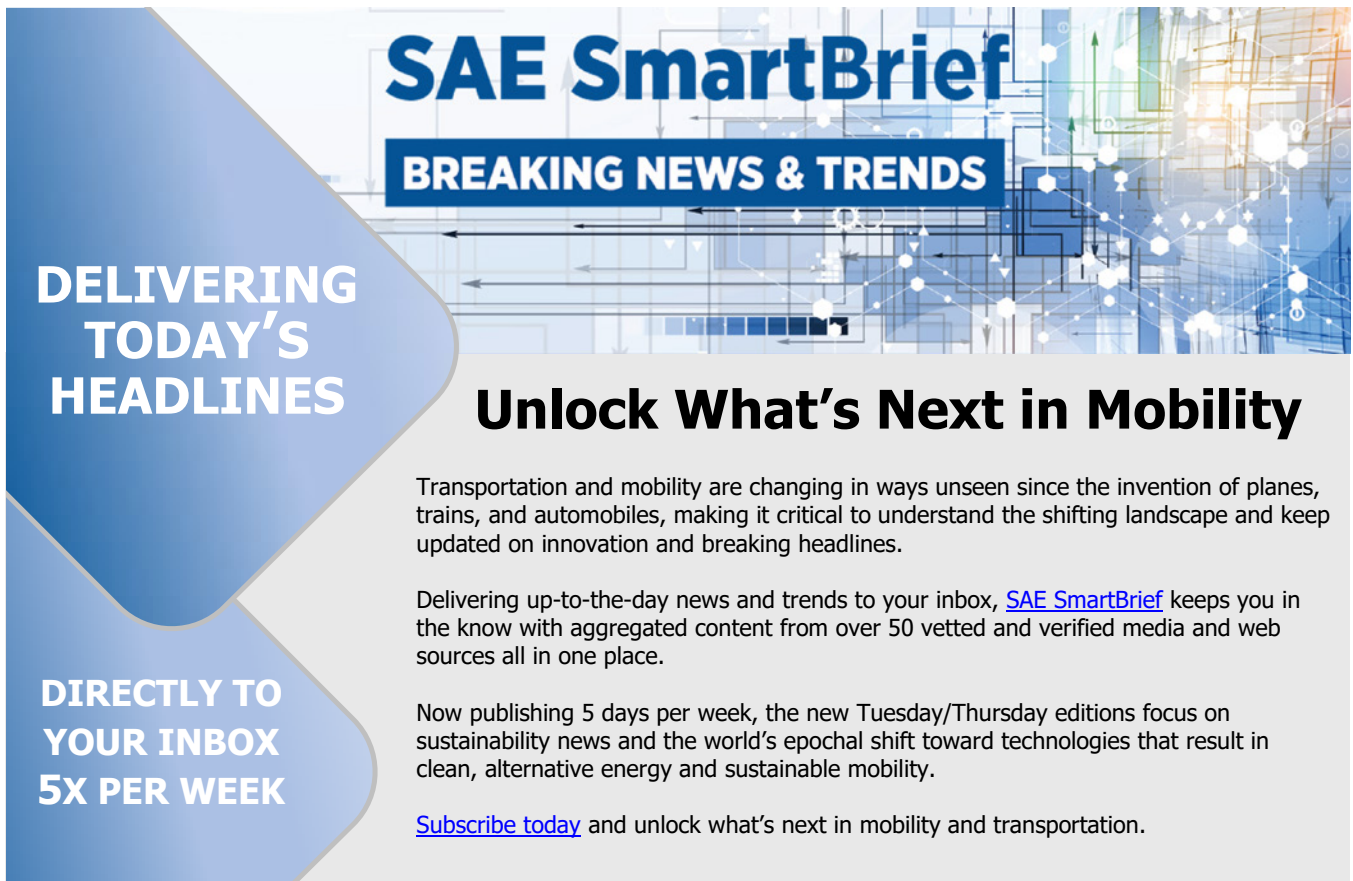
benefits of using FRS in public and private transportation technology and addresses some of the legitimate concerns regarding its use by private corporations and government entities, including law enforcement, and in public transportation hubs and traffic stops. Constitutional questions, including First, Fourth, and Ninth Amendment issues, also remain unanswered. However, these questions do not mean FRS cannot or should not be meaningfully implemented into transportation technology. Rather this report suggests that society can

reconcile the immense pros with the possible cons.

“Some recommendations include regulating database access, determining the level of security to which biometric data is entitled, finding creative solutions to combat racism in technology, and considering how to consciously protect individual rights as connected and automated vehicles share information with one another. FRS is now a permanent part of transportation technology and society; with meaningful legislation and conscious engineering, FRS can make future transportation safer and more convenient.”

FRS already has been incorporated into some production vehicles. Hyundai’s Face Connect, for example, recognizes a driver’s face to unlock the vehicle.

[SAE EDGE Research Reports](#) are intended to identify and illuminate key issues in emerging, but still unsettled, technologies of interest to the mobility industry. The goal of these reports is to stimulate discussion and work in the hope of promoting and speeding resolution of identified issues. These reports are not intended to resolve the challenges they identify or close any topic to further scrutiny. ■



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ELECTRIC MOTOR CONTROLS ENGINEER, Pontiac, MI, General Motors. Engineer & develop motor controls algorithms for high power electric drive system consisting of high voltage power converters (inverters & boost converters) & electric motors (interior-mounted permanent magnet (IPM), & induction machines) using MATLAB, Simulink & dSPACE HIL tools. Plan & perform calibration development & testing in high-voltage dyno, transmission, & vehicle test environment to verify functionality at Function, Controller & System levels prior to production release. Improve extensive motor characterization based on maximum torque per ampere/ voltage to achieve torque accuracy & maximizing system efficiency over operating region incl. field-weakening region. Optimize motor control performance by ensuring control stability in closed-loop current control regulation under field-weakening operation. Perform modeling & simulation of electric drives using MATLAB & Simulink tools. Master, Electrical, Mechanical or Automotive Engineering, or related. 12 mos exp as Engineer, developing or performing high voltage power converter or electric motor (IPM) electrical & thermal performance simulations using MATLAB & Simulink tools, or related. Mail resume to Ref#29377, GM Global Mobility, 300 Renaissance Center, MC:482-C32-C66, Detroit, MI 48265.

COST ENGINEER, Warren, MI, General Motors. Perform & benchmark competitor cost analysis of injection molded plastic cmpnts in seats thru teardown activities, identifying cost reduction opportunities for current & future vehicle prgrms. Coordinate automotive supplier site visits to define improvements in mfg processes. Assure accurate tech assessments during Design Concept Target Approval to Sourcing stage of cost of injection molded seat plastic cmpnts & mfg processes, using Tc Vismockup, TcPCM & Siemens NX of driver & psgr vehicle interior mechanical & electrical component designs at GM U.S. & global high volume vehicle assy & cmpnt mfg plants. Estimate cost of seat systems inclndg front/2nd/3rd row seats considering annual vehicle volumes & production location. Analyze & validate cost estimates for tooling, fixtures, & devices necessary to meet production assy & qlty reqrmnts in different types of process manufactured required to produce cmpnts considering geometry, raw material, mfg process, tool mfg region & cmpnt production region. Required domestic & intl travel to visit automotive component suppliers to assess supplier mfg processes up to 36 days P/A. Bachelor, Mechanical, Mechatronics or Electrical Engineering. 12 mos exp as Engineer or related, developing or validating estimates for tooling to manufacture psgr vehicle parts & assemblies, or related. Mail resume to Ref#102, GM Global Mobility, 300 Renaissance Center, MC:482-C32-C66, Detroit, MI 48265.

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SW ENGINEER - VEHICLE MOTION EMBEDDED CONTROLS (VMEC), Milford, MI, General Motors. Gather & analyze architecture & SW technical reqmts from IBM DOORS & Rhapsody tools & Architecture & Calibrations Team, & formulate embedded SW reqmts. Engr, design, & dvlp embedded ECU for Electronic Stability Control, Traction Control & Anti-Lock Braking Systems controllers in ICE psgr vehicles & BEVs, using MATLAB, Simulink & C, on vehicle architecture-based Electronic Control Modules & Vehicle Integrated Control Modules. Perform embedded ECU testing in vehicle & on test bench, using dSPACE HIL, ETAS INCA, Vector CANap/CANoe tools, & Lauterbach HW, to verify functionality at Function, Controller & System levels prior to production release. Set technical objectives & tasks to implement production intent SW for infrastructure & platform SW components supporting communication for embedded ECUs in Embedded C, using Git, Gerrit, Jenkins, Eclipse, RTC tools, & following MISRA CERT C standards. Master, Electrical, Software, Automotive Systems, or Electronics Engrg. 12 mos exp as Engineer, testing or verifying that system or subsys meet OEM Function, Controller & System levels reqmts using dSPACE HIL, INCA, & CANape tools, on test bench, or related. Mail resume to Ref#38302, GM Global Mobility, 300 Renaissance Center, MC:482-C32-C66, Detroit, MI 48265.

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