SAE INTERNATIONAL

UPDATE

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Additive manufacturing continues its march through industry

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Technical Manager on Sensor Concepts, Scania CV AB

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VOLUME 39 ISSUE 7

On the cover

DEVCOM in Michigan is all about improving military ground vehicles, partially by using additive manufacturing.

U.S. Army

SAE Industry Technologies Consortia establishes SAE Government Technologies to solve mobility challenges

Building on the success of its Defense Automotive Technologies Consortium (DATC), The SAE Industry Technologies Consortia (SAE ITC®) announces the establishment of the new SAE Government Technologies (SAE GT). SAE GT aims to to solve mobility challenges government agencies face as they seek to modernize. By leveraging the SAE ecosystem of mobility expertise, key industry partnerships, and extensive knowledge delivery capabilities, SAE GT will drive innovation and technology transfer between government and industry.

SAE GT offers opportunities for government to stay abreast of emerging technology and move collaboratively with industry toward efficient acquisition solutions. Industry will be able to engage with the government through SAE GT and other relevant programs such as DATC and the concurrently announced Advanced Manufacturing Commercialization Center (AMCC™) advancing its mission to serve the community. The purpose of the AMCC™ is to develop production process solutions as well as inform and drive transition of advanced manufacturing parts to defense programs of record.

"As part of SAE, SAE GT has untapped capabilities and expertise to address a broad spectrum of mobility challenges," said Brandon Card, president, SAE Government Technologies. "We will continue our collaboration with government and industry to remove barriers and quickly advance innovation."

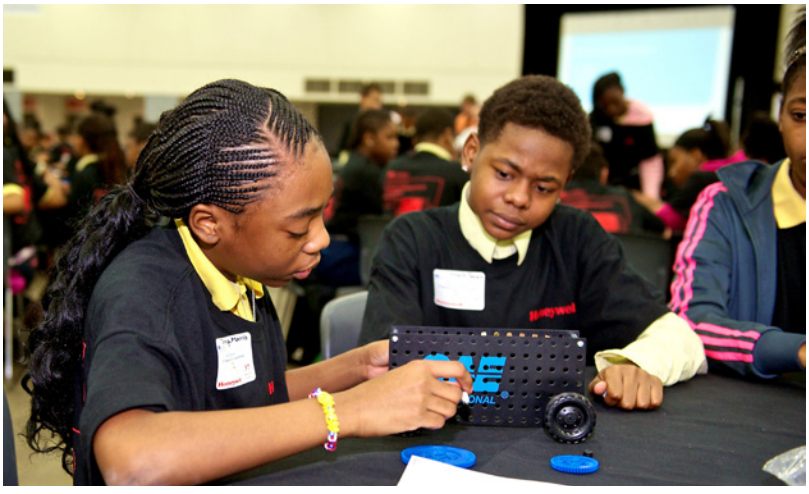
SAE GT technology focus areas include Cybersecurity; Vehicle Safety; Vehicle Light Weighting; Autonomous Vehicles and Intelligent Systems; Civil Roadway Infrastructure; Connected Vehicles; Advanced Energy Storage; Propulsion; Active Suspension; Advanced Manufacturing; Additive Manufacturing; Modeling & Simulation.

As an affiliate of SAE ITC, SAE GT enables visionary collaboration to define solutions, advance technology and effectively address new challenges and innovation trends with government customers in the United States. ■

SAE International's A World In Motion STEM program named finalist for 2 prestigious EdTech awards

SAE International announces that the A World In Motion® (AWIM®), Information Technology (IT) Series has been named a finalist for two of The EdTech Cool Tool Awards in both the "Curriculum and Instruction Solution" and the "Coding, Computer Science, Engineering Solution" categories. The EdTech Awards from EdTech Digest are the largest education technology recognition program in the world and recognize outstanding contributions in transforming education through technology to enrich the lives of learners everywhere.

SAE's AWIM program is an inquiry-based learning experience that brings Science, Technology, Engineering, and Math (STEM) concepts to life, setting students on a path of lifelong learning and discovery. Starting with the youngest learners, from preschool through 8th grade, AWIM combines practical, experiential learning with mentorship from industry volunteers and university students as well as ongoing training and support for educators to provide equitable access to STEM.



SAE International

Middle-school students participating in an AWIM program.

"Through our STEM education programs, SAE strives to help today's students become tomorrow's engineers and scientists. We are excited and honored to be recognized by The EdTEch Awards for the second year in a row," said Amy Smith, Pre-college manager PreK-12, SAE International.

In 2021, SAE's AWIM PreK-8 STEM education program was named "Best Foundational Technology/ Engineering (STEM) Instructional Solution" as part of the annual SIIA CODiE Awards and a 2021 EdTech Awards Cool Tools finalist for "Best Skills (21st Century Skills) Solution."

"As events unfold on the world stage that seem to inch ever closer to a precipice unknown, we are reminded that the leaders and innovators of education technology have always worked on the edge," said Victor Rivero, who as Editor-in-Chief of EdTech Digest, oversees the program. "The future-focused work they do is inspired by the infinite potential of all people to learn and thrive."

To learn more about SAE's AWIM program, visit: https://www.sae.org/learn/education.

To see a full list of award finalists and winners, visit https://www.edtechdigest.com/2022-finalists-winners. ■

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:

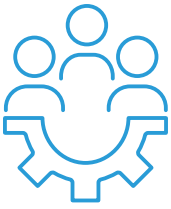
- Advance your career or gain career experience
- Provide inspiration and guidance to the future generation
- Connect to the engineering community

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:

Call for Content: Share your knowledge on new and developing technologies on the SAE blog



Seeking Volunteers for SAE Corporate Taxonomy Update

Enroll in the SAE Mentor Program

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

Featured volunteer

Randall Duchesneau III knows the value that standardization brings not only to the mobility industry, but to its users—the millions of every day people trying to get from point A to point B.

As an Accessibility Specialist at the United States Access Board, Duchesneau is uniquely positioned to consider a specific group within those users, people with disabilities, and how industry developments can help these folks gain back some of their independence when it comes to transportation.

For over a year, Duchesneau has been volunteering with SAE International as Vice Chair of the Automated Driving Systems Dedicated Vehicle, User Issues for Persons with Disabilities task force, lending his expertise to standardization efforts around automated and unmanned vehicles. As a volunteer with SAE, he's been a part of a working group that is developing an SAE J Document that will clearly outline the needs of users with disabilities.

"Autonomous vehicles have the potential to completely revolutionize transportation for people with disabilities," Duchesneau said. "Twenty-six percent of adults living in the United States have a disability, which includes people who are blind or have low vision, have mobility

disabilities and may use mobility devices, such as wheelchairs, are deaf or had of hearing or have a cognitive disability."

Would you like to briefly tell Update readers about your SAE volunteer activity? Contact update@sae.org.

Announcements

Engaging with SAE is rewarding! Each month, individuals who opt into the volunteer pool, update their profile, or sign up for a volunteer opportunity have a chance to win a $50 gift card. Winners are drawn on the first business day of each month and notified via email. For more information, click here. ■

NEW MEMBER CONNECTION AND PROPEL REDESIGN

By now, you've probably (hopefully!) heard about the upcoming redesign of the SAE Member Connection online community, as well as the SAE Propel volunteer platform this summer.

As a reminder, Member Connection is an exclusive member benefit: it provides a virtual space for discussing technical content, managing your membership, building your network around the globe, and more. SAE Propel is an online platform that aggregates all of the SAE volunteer opportunities available to you. You can 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 area interests, etc.

This new redesign combines these two platforms together, complete with a new name (at the time of the July *Update* publication deadline, the name was still a work in progress!) As the SAE Membership and Engagement Team works toward providing a seamless, one-stop-shop experience for our members and volunteers collectively, a tangible change to our platform was necessary. Now you can access the member-only communities, as well as the volunteer opportunities, in one place. The navigation has been improved, the personalization has been improved, and most importantly, your experience will be improved!

We will be hosting webinars and tutorials on how to utilize the new platform. You can visit connection.sae.org for more information as these dates become available. ■

All this and so much more is available with your SAE Membership at an annual dues of $120.

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Mentor Community	Share your expertise and provide inspiration to the next generation or seek guidance from a mentor yourself.
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* Enewsletter**	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!

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TECH FOCUS: **ADDITIVE MANUFACTURING**

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"As an industry, we need to make sure we have the data that demonstrates we understate that risk and mitigate that risk...to make sure engineers are comfortable designing for additive."

-Melissa Orme, Ph.D.

IN THIS SECTION

GE Additive laser powder bed fusion process.

ABOUT THE AUTHOR

Bill Bihlman, President of Aerolytics LLC, wrote this article for *Update*. He has a Ph.D. in industrial engineering from Purdue University, starting his career as a mechanical engineer at Raytheon Aircraft in 1995. He has been actively involved with SAE ASM AM standards development and is the chair of the materials committee for SAE AeroTech.

AM FORWARD PROGRAM AND SAE AMS-AM STANDARDS

GE Additive

Just last month, U.S. President Joe Biden announced a program that could profoundly enhance the adoption of additive manufacturing (AM) in the United States. Although the exact details of the program are unclear, it targets small and medium enterprises (SMEs) that supply the aerospace industrial base.

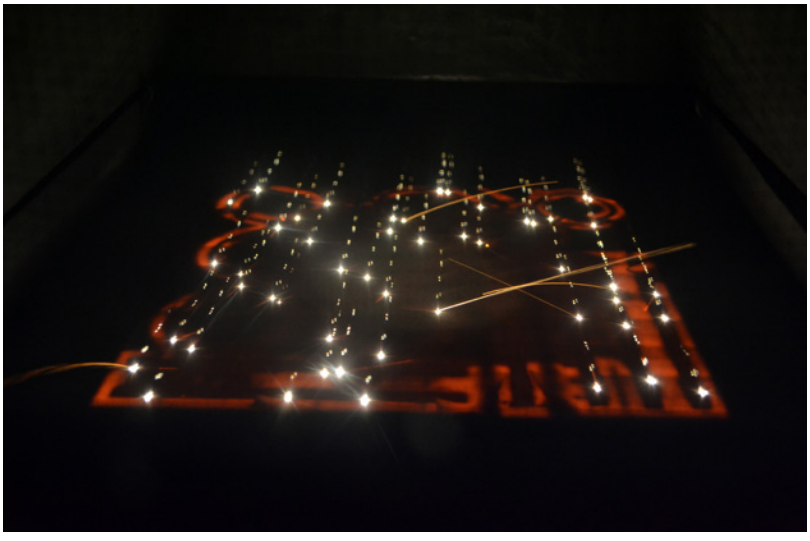
Backing this effort are commitments from some of the nation's largest aerospace original equipment manufacturers (OEMs), including GE, Lockheed, Raytheon, Honeywell, and Northrop Grumman.

Aerospace is considered one of the principal end markets for additive manufacturing, along with the medical industry. Parts are being printed with

metals, such as titanium and nickel-based superalloys, for complex parts for new(er) designs, or in low volumes, as replacement parts for maintenance, repair, and overhaul (MRO). Thus, applications span non-critical but essential parts in the interior (e.g., nylon clips for a wiring harness) to flight-critical parts in the engine (e.g., the low-pressure turbine blades made from titanium aluminide powder for the GE LEAP and GENx).

The business case for newer designs centers on the ability to print parts that could not be conventionally manufactured. Most often the goal is to lightweight a part. Typically, additive manufacturing targets castings due to their complex geometry, as compared to forgings or extrusions. For MRO, the value proposition is creating parts without tooling that, for older designs, is often unavailable.

In either scenario, aerospace demands extensive empirical evidence — a requirement not necessarily shared with other industries. For this reason, aerospace parts can easily exceed 10 times the costs for similar parts used in automotive, for example. This can be prohibitive for SMEs that have a concentrated customer base and highly variable cash flow.



GE Additive

GE Additive electron beam melting process.

So what does the AM Forward program entail? According to the Biden Administration, it is a "public compact" where these OEMs commit to source from the supply chain and provide more apparent "demand signals." On average, OEMs source roughly 70% of their final artifact from their supply base. In the case of AM Forward, these OEMs are targeting from 20 to 50% to be sourced from SMEs for AM parts (1).

SAE International's Aerospace Material Specifications (AMS) for additive manufacturing will likely play an important role in this process. To date, the AMS-AM Committee has produced over 30 documents — mostly material and process standards — that help demystify the AM-build process. For instance, one of the seminal documents, AMS7003, identifies 34 key process variables in a typical powder-bed fusion process, of which 12 require statistically process controlled (SPC). This level of transparency helps ensure a controlled, fixed process required by aerospace.

HRE Wheel

EBM 3D printed titanium wheels.

At the same time, AMS AM standards provide flexibility to accommodate the disparate organizations that comprise the global aerospace ecosystem. Thus, larger companies that have significant intellectual property (IP) can withhold this information from the general public concerning the actual process. These data are captured in a document known as the Process Control Document (PCD). Alternatively, a public PCD can be published to ensure that small companies without the same level of engineering endowment have the exact receipt to consistently produce aerospace-grade parts. The discretion of the level of specificity ultimately depends upon the document sponsor.

Finally, the process of developing these specifications is reassuring in its own right. AMS AM standards are developed under the aegis of consensus from a broad collection of industry stakeholders, including regulatory agencies, therefore ensuring the quality and continued safety of AM parts. Indeed, it takes a village...

There are no public financial commitments to date associated with the AM Forward program. Nevertheless, for AM enthusiasts, this is a powerful sign that Washington is mindful of: a) the utility of this technology for aerospace, and b) the fragility of the AM supply chain, most of which consists of SMEs. The industry is at a mid-level Technology Readiness Level (TRL).

Standards will continue to play a critical role in this industrialization process — the ultimate goal is to increase the TRL, reduce costs, and ensure "near perfect" quality. Aerospace, in particular, needs this level of scrutiny afforded by the AMS AM community. These specifications will continue to shape the industry and provide invaluable direction to OEMs and SMEs alike. In fact, the AM Forward could be just what the industry needs to take additive to the next flight level. ■

Boeing

The Chinook aircraft remains a key part of enduring heavy-lift fleets around the world.

Chinook flies first flight-critical, 3D-printed part on rotorcraft

A T408 engine demo proved that the Chinook can leverage more powerful engines. But that wasn't the demo's only achievement, according to the aircraft's manufacturer, Boeing. The company was also able to use its advanced manufacturing expertise by 3D-printing an aluminum, flight-critical part for the effort, the first time that's been done on a rotorcraft.

The newly-built transmission housing enabled a critical test effort for the joint team, and established a path toward expanded use of additive manufacturing.

Boeing is continuing to invest in the future through cutting-edge, additive manufacturing technology to unleash possibilities and accelerate innovation that can drive quality improvements in its products, enhance efficiency and safety in its operations, and enable collaborative AM solutions for customers.

"AM allows a level of creativity in design

that is not possible with traditional methods, and is being used to optimize the design of better aerospace products," said Melissa Orme, vice president of Boeing Additive Manufacturing. "We're continuously looking to identify opportunities where we can employ additive manufacturing to improve product performance through streamlining the vehicle, reducing its weight, and providing more durability."

In this case, using AM technology for the gearbox housing reduced the long lead time needed with traditional manufacturing and enabled design enhancements that improved quality.

As far as the Chinook program is concerned, this effort is another example of why the aircraft remains a key part of enduring heavy-lift fleets around the world.

"The Chinook is still an innovative platform," said Todd Harder, Chinook drive systems engineer who led the team that developed the housing. "We're looking at a lot of other available areas to get us to the next 50 years of flight. There's a lot of capability within the Chinook platform that's going to be valuable to our customers in the future."

Boeing

Using AM technology for the gearbox housing reduced the long lead time needed with traditional manufacturing and enabled design enhancements that improved quality.

For Orme, "light on wheels" and "wheels off ground" were two phrases she had been waiting years to hear. A Chinook drive systems engineer, she led the team that developed the additive-manufactured transmission housing, took flight in multiple Chinook tests after years of development and bench testing to prove its airworthiness before it ever left the ground.

Additive manufacturing lowered lead times and machining time plus enabled design improvements that improved quality for these Chinook test flights. In the future, additive manufacturing could also help improve component costs and component weight and enable production of spare parts in the field, not just in a factory.

She reports to Boeing's chief engineer and senior vice president of Engineering, Test & Technology, and is responsible for continuing to grow and scale additive manufacturing capabilities and helping to rapidly expand understanding of

the unique features that 3D printing can bring to Boeing factories and production lines.

Orme's organization is also driving application scalability for existing products, and maturing technology for future franchise platforms across Boeing Commercial Airplanes, Boeing Defense, Space and Security and Boeing Global Services.

Prior to joining Boeing in 2019, Orme worked at MORF3D, where she served as the chief technology officer since 2015. Over the span of her career, Orme held senior leadership roles at start-up technology companies, including chief scientist and head of clinical research. She began her career in academia, rising to the rank of Full Tenured Professor in the Department of Mechanical and Aerospace Engineering at the University of California, Irvine. While at UC Irvine, she said she did work "in what we now call additive manufacturing. But at the time, it was called solid free-form fabrication or net form manufacturing."

An early pioneer of additive manufacturing, Orme's work has resulted in 15 U.S. patents. Her research and technology

SAE International

Melissa Orme, Vice President of Boeing Additive Manufacturing, spoke at SAE's AeroTech conference in Pasadena earlier this year.

developments have received international recognition and numerous awards. As an author and technical advisor, she serves on several advisory and professional committees for additive manufacturing and aerospace. Orme has doctorate, master's and bachelor's degrees in aerospace engineering from the University of Southern California

In a presentation she gave at SAE's AeroTech conference earlier this year, Orme emphasized that AM technology is a viable one, offering "repeatable, reliable conformance to a very high fidelity" in the design and manufacture of parts.

Unfortunately, AM's capabilities, are not well understood, she opined, noting that engineers are inclined to design parts amenable to manufacture with "easy, comfortable," and long-proven manufacturing methods with tons of data backing up their reliable, "low-risk" performance.

On the downside, such inclination also leads to

relatively excessive waste resulting from the material-removal character of many traditional technologies.

"It's on the additive manufacturing community to make sure we have the data that demonstrates we can mitigate that risk and that we understand that risk … to make sure engineers are comfortable designing for additive, to start that mind-shift.

Makers of AM equipment would be wise to alter their approach to the market. Their machines, she said at AeroTech, "need to be made in a highly industrialized setting, not in a one-off setting." Some makers are "better than others" in that regard. ■

Boeing

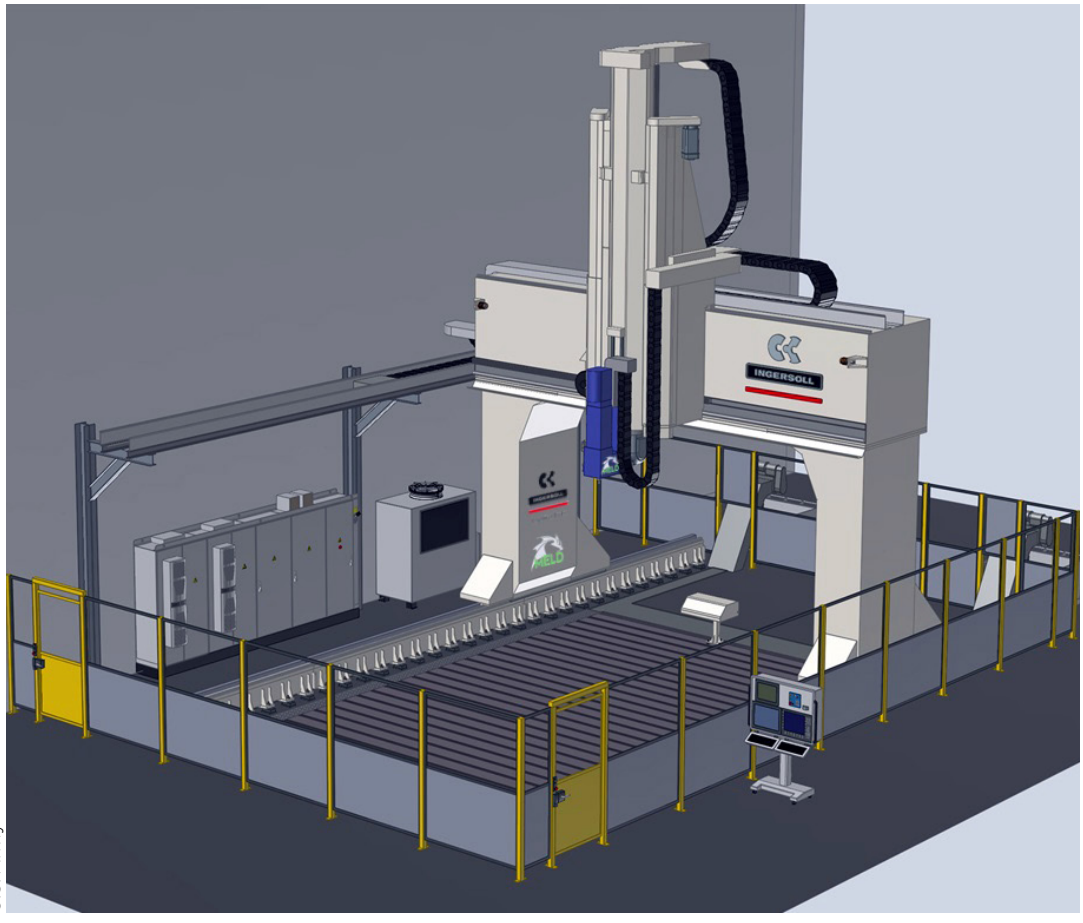
The upper Y bracket is one of three 3D-printed parts on the deployable ion engine mount for a recently launched Boeing satellite. Additive manufacturing optimized the design — printing material only where needed — resulting in an overall 28-pound reduction.

U.S. Army

The center's mission is to research, develop, engineer, leverage and integrate advanced technology into ground systems and support equipment throughout the lifecycle.

SAE Government Technologies Establishes AMCC in Southeast Michigan

The U.S. Army Combat Capabilities Development Command (DEVCOM) Ground Vehicle Systems Center (GVSC) Materials Division is working with SAE Government Technologies (SAE GT) to establish the Advanced Manufacturing Commercialization Center (AMCC). The AMCC will develop production process solutions and inform and drive transition of advanced manufacturing parts to defense programs of record. This effort is contracted through the Commercial Technologies for Maintenance Activities (CTMA) cooperative agreement and the National Center for Manufacturing Sciences (NCMS).



U.S. Army

The U.S. DEVCOM Army Ground Vehicle Systems Center (GVSC) plans to build the world's largest metal 3D printer that will have the capability of printing large parts for military ground vehicles.

"In addition to providing production process solutions for Rock Island Arsenal and other facilities, the AMCC will support materials research and commercialize additive manufacturing processes," stated Brandon Pender, associate director - materials division, Ground Vehicle Systems Center.

Brandon Card, president of SAE GT, added, "The AMCC will promote collaboration across government, commercial technology leaders and academia and is a key milestone for the SAE GT mission of serving the community."

The AMCC is located at 6775 Center Drive in Sterling Heights, Michigan, and contains state-of-the-art, government-owned metal additive manufacturing and post-processing capabilities. Additionally, the center will be an incubator for small business and leverage business partnerships to enhance future GVSC collaborations and commercialization of advanced manufacturing standards, training and data management. With economic development funding from the City of Sterling Heights, the facility will also develop effective relationships with additional process partners, commercial industry leaders and academia.

DEVCOM is the Army's technology leader and largest technology developer. DEVCOM

ensures the dominance of Army capabilities by creating, integrating, and delivering technology-enabled solutions to soldiers.

The command provides the Army with an organic research and development capability. More than 13,700 Soldiers, civilian employees and direct contractors form this world-class team. As part of that team, there are more than 10,000 engineers and scientists, many of whom are the Army's leading experts in their fields. The fundamental characteristic of the DEVCOM workforce is the focus on the Soldier.

DEVCOM is a major subordinate command of the U.S. Army Futures Command, which assesses and integrates the future operational environment, emerging threats, and technologies to develop and deliver concepts, requirements, future force designs and the delivery of modernization solutions.

GVSC is one of the command's eight major competency areas.

As an affiliate of SAE ITC, SAE GT enables visionary collaboration to define solutions, advance technology and effectively address new challenges and innovation trends with government customers in the United States. SAE ITC 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 in highly engineered industries globally. ■

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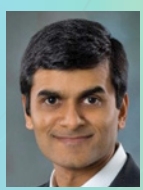

Ameya Joshi
Director Emerging Technologies & Regulations, Corning Inc.

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Participating companies will showcase new technologies and infrastructure that are driving the industry forward — from mid-size through Class 8 autonomous and electric vehicles to off-highway equipment.

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3DEO

3DEO plans to install 125 next-gen printers in its Torrance, Calif., facility over the next three years, capable of producing more than 20 million parts per year.

3DEO launches new metal 3D-printing platform

California-based 3DEO unveiled in February its new metal 3D printing platform and patented technology, Saffron. The proprietary platform has been in development for the past five years. "Until now, we have revealed very little about our patented technology, and for good reason – we felt we had a tiger by the tail and wanted to gain as much advantage as possible," said Matt Sand, 3DEO's co-founder and president.

Using a hybrid additive manufacturing (AM) process that leverages binder jetting and CNC machining, the next-generation printer achieves superior results in terms of surface finish, material properties and dimensional accuracy, Sand said. The build area is 81 sq. in. (523 sq. cm), covered by eight spindles operating at 60,000 rpm with micron-level positional accuracy.

Depending on part geometry or print speed required, the printer can automatically vary layer thickness anywhere from 50 to 500 microns.

The technology creates new possibilities in 3D printing, the company claims. It can define many layers at the same time and can cut upward-facing geometries in three dimensions, eliminating layer lines. "The printer is actually only a small piece of the puzzle when it comes to mass production," Sand added. "So, we gradually expanded scope from being focused only on the metal 3D printing technology to innovating up and down the entire production line."

This holistic approach resulted in 3DEO's digital end-to-end platform, the Manufacturing Cloud, with its new Saffron machine representing "the mass production breakthrough the industry has been waiting for," the company claims. The Manufacturing Cloud is based on Jarvis OS, 3DEO's proprietary software backbone. Jarvis takes in customer digital models and uses in-house computational geometry to convert them into digital work instructions. Its computer vision and machine learning modules provide feedback to monitor and control the platform.

"Imagine a world in which new products can be launched at the speed of software – in months, not years; and for thousands of dollars, not millions," Sand said. "This manufacturing capability will level the playing field for all engineers. This exciting vision for the future of manufacturing will become a reality through 3DEO's Manufacturing Cloud that we are building in Torrance, California."

3DEO has more than 20 patents granted or pending across a range of applications including 3D printing, robotics, software and automation. To accommodate its accelerated growth, 3DEO more than doubled its facility in Torrance, spanning 80,000 sq. ft (7,432 sq. m) of manufacturing and office space. The company currently has 37 printers in production with plans to add 44 additional printers into production in 2022.

3DEO plans to install 125 of these next-gen printers in Torrance over the next three years, capable of producing more than 20 million parts per year in its initial factory. "We are in an exciting position for continued scale," Sand said. "3D printing is a tiny fraction of manufacturing overall, which means we basically have unlimited room to run in the coming years."

Accelerated growth in 2022

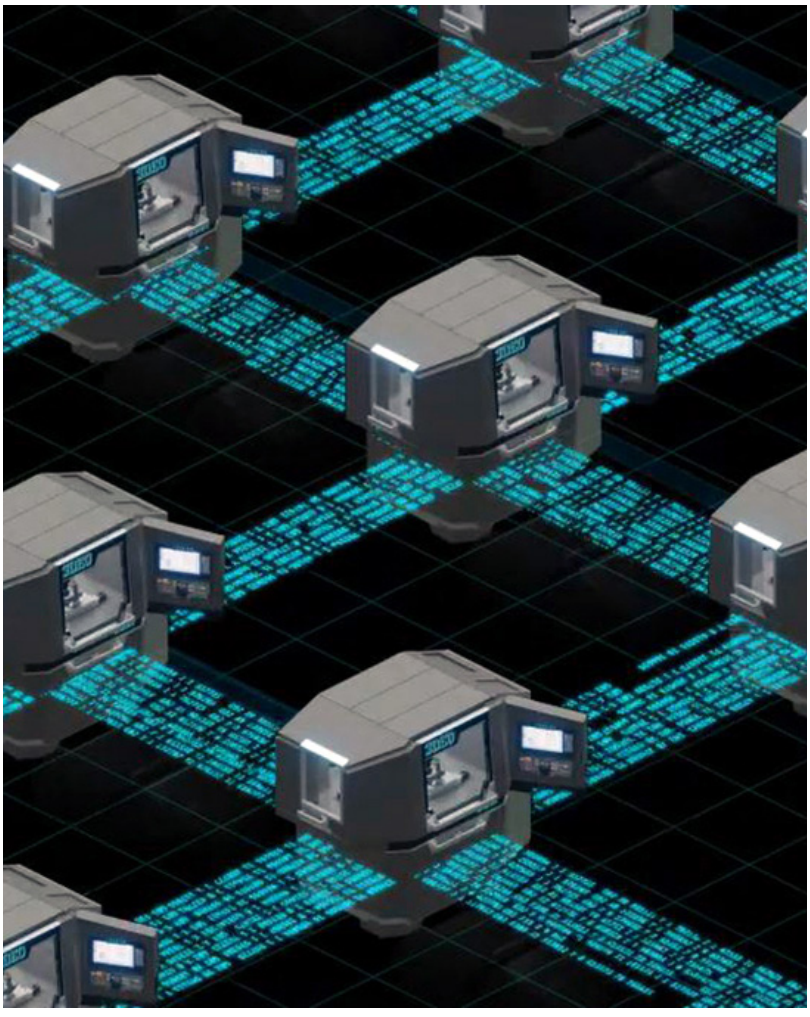
3DEO expects to triple its growth this year from 2021, with medical and aerospace companies largely driving the increase along with other industrial sectors. A significant driver is the continued global supply-chain disruption, which makes a strong case for increasing domestic production.

Metal-printing parts suppliers are helping companies regain control over the manufacturing process, according to Sand. He has cited MIT analysis that suggests 3D printing could

reduce total supply chain costs by 50% to 90% as production shifts from make-to-stock offshore facilities that heavily rely on freight to make-on-demand facilities located closer to the final customer. Digital manufacturing allows OEMs to scale up or down as needed, enabling real-time responses to fluctuations in demand or disruptions in the supply chain, Sand added.

3DEO announced it had shipped its millionth customer part in July 2021. The company reports that the average order size across its customer base is 10,000 parts over a nine-month commitment period. It also executed shipments of more than 150,000 parts of a single component, accounting for the increase in average deal size by about 90% year over year.

"Shipping parts in these volumes allows 3DEO to compete with traditional manufacturing such as metal injection molding and CNC machining," said Jim Golden, 3DEO's VP of sales. An average uptime of 89% for its printers was achieved in 2021. The company says this ramped-up uptime has been key to 3DEO becoming the highest-volume metal 3D printing company in the world, citing 3dpbm Market Research.



3DEO

The Manufacturing Cloud allows flexibility to update designs at any time and scalability in real time.

The company's team also expanded last year, by 91% to 175 total employees, with the engineering group growing by about 120% to a total of 33 engineers. "Beyond our headcount growth, 3DEO's technological advantage continues to rise as we have the data and IP to create a powerful flywheel," said Payman Torabi, 3DEO's co-founder and CTO. "The possibilities for continued digitization and technology implementation in manufacturing are infinite." ■

This article by SAE Media editor Ryan Gehm was originally written for *Truck and Off-Highway Engineering* magazine.

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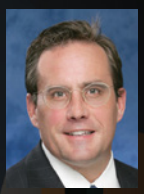
In this first of its kind Roundtable for the Colloquium, experienced automotive investors and deal-makers discuss the following questions:

- How should OEMs and suppliers balance investments between legacy assets vs. growth bets?
- How do you see capital and resource allocation shifting?
- What are today's key factors in value creation in an automotive related business?
- What is your role in supporting these changes?



James C. Penman
Managing Director, Automotive & Truck, DPP

Mark Gottfredson
Director and Founder, Bain & Company, Inc

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SAE a rich source for insights into additive manufacturing

As one of its primary focus areas, SAE International provides engineers access to a larger portfolio of relevant tools and learning opportunities.

Professional development

"Design for Additive Manufacturing: Towards End-Part Production Web Seminar RePlay" gives designers the information needed to start designing for AM at all levels - identifying and justifying use of AM technology for a particular part, selecting the right process and material for the application and ensuring it is designed with the advantages and considerations of AM in mind. The course is not intended to serve as a software-training class or as a deep dive into any specific AM process, but rather to draw connections between design and AM from a designer's perspective.

By participating in this course, learners will be able to:

- List the different polymer and metal AM process technologies and materials and identify which of these are being used for functional part production
- Select the optimum AM material and process for a particular application
- Predict how design decisions impact manufacturability for the selected AM process and apply design rules and guidelines to your design process
- Quantify the expected properties of the AM parts you are designing
- Discover how topology optimization, cellular structures and other disruptive design techniques can be leveraged with AM and associated software tools
- Identify the different drivers for adopting AM for a particular part, with regard to cost, lead time, supply chain and performance risks
- Relate to the challenges and ongoing research efforts to be able to move forward with AM implementation in the presence of rapid change in the field
- Develop a comprehensive strategy to bring AM for functional part production into your organization that addresses both the benefits and impacts

Click here for more information about all of SAE's professional development courses. This link is for a special "bundle" of SAE PD courses on additive manufacturing in specific.

Webcasts/webinars

Additive manufacturing (AM) techniques are quickly replacing conventional "subtractive"

machining for producing low volumes of complex parts. While some of these parts may be used for safety-critical functions, their complex nature means they are less suited to conventional inspection techniques, for example, eddy currents or ultrasonics. X-ray micro-computed tomography (µCT) is the only technique that gives a full three-dimensional quantitative picture of the structure of a part, both internal and external, showing density variations, dimensional mismatches, voids, and inclusions, and allows accurate measurements of these to be made.

A 30-minute On Demand webinar called "Using High-Resolution X-ray Computed Tomography to Inspect Additive Manufactured Parts" will explain how µCT works and how the full 3D inspection of complex AM parts can give users confidence in this exciting new technology. Speakers for the webinar are Andrew Ramsey, X-ray CT Consultant, Nikon Metrology; and Chris Peitsch, Business Development Manager, X-ray/CT Systems, Avonix Imaging.

Andrew Ramsey

Chris Peitsch

The webinar will be available until November 11, 2022.

Click here for more information about webcasts and webinars.

Journal

The SAE International Journal of Materials and Manufacturing publishes peer-reviewed, authoritative, and in-depth research in the areas of materials, design, testing, and manufacturing. In addition to analytical findings, the journal addresses integration and implementation of scientific and engineering practices that advance the state of the art and benefit society. The journal presents and promotes wide-ranging research in the four broad areas of materials, design, testing, and manufacturing.

Insights into additive manufacturing may be found in some other 13 SAE journals. Click here for the full list of them.

Podcasts

From U.S. aircraft parts to medical implants, additive manufacturing is a

nearly 30-year-old process that's finally having its moment.

By definition, additive manufacturing is the technology used to build 3-D objects layer-by-layer, no matter if the material is metal, plastic, concrete or even human tissue. From an industrial production perspective, it's a transformative approach that reduces energy, cuts waste, decreases production time, and allows for greater design flexibility.

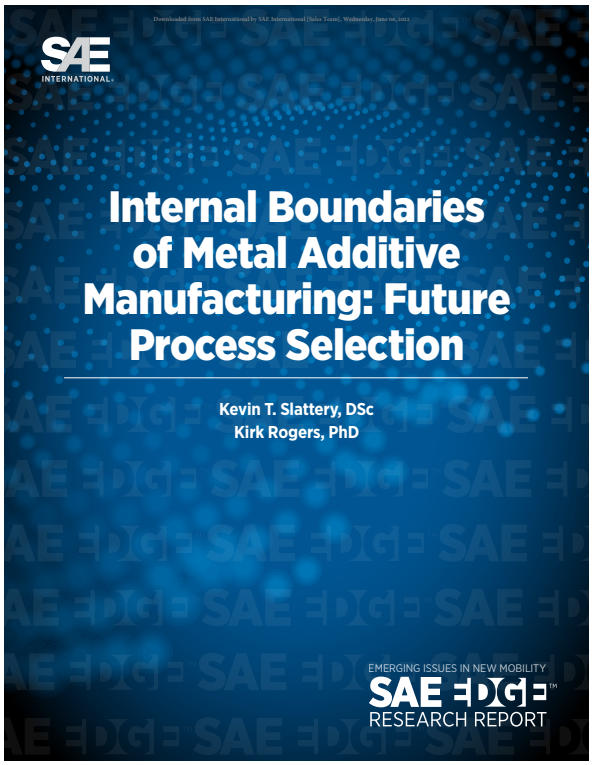
John E. Barnes, Founder & Manager Partner of The Barnes Global Advisors, sat down to discuss the evolution of additive manufacturing, including Pittsburgh's Neighborhood 91, the first development in the world to connect and condense all components of the 3-D printing supply chain into one powerful production ecosystem. Click here to listen to the episode, titled "Accelerating the Adoption of Additive Manufacturing," conducted as part of SAE's Tomorrow Today podcast series. You can use the same link to find Tomorrow Today podcasts on other topics. This link takes you two the list of past podcasts on additive manufacturing.

The evolution of standards related to additive manufacturing will play a key role in accelerating its adoption. SAE is building expert committees to address this need. If you'd like to get involved, please contact us at podcast@sae.org.

Other SAE publications

A recognized experts in additive manufacturing, Kevin Slattery of The Barnes Group has written several SAE EDGE Research Reports on the topic. His most recent, co-authored by Kirk A. Rogers, is titled "Internal Boundaries of Metal Additive Manufacturing: Future Process Selection." examines the overlap between three prominent powder-based technologies and outlines an approach that a product team can follow to determine the most appropriate process for current and future applications.

"In the early days," he writes, "there were significant limitations to the build size of laser powder bed fusion



(L-PBF) additive manufacturing (AM) machines. However, machine builders have addressed that drawback by introducing larger L-PBF machines with expansive build volumes. As these machines grow, their size capability approaches that of directed energy deposition (DED) machines. Concurrently, DED machines have gained additional axes of motion which enable increasingly complex part geometries—resulting in near-overlap in capabilities at the large end of the L-PBF build size. Additionally, competing technologies, such as binder jet AM and metal material extrusion, have also increased in capability, albeit with different starting points. As a result, the lines of demarcation between different processes are becoming blurred."

Click here for a list of all SAE EDGE Research Reports.

This is just small sampling of SAE's offerings on additive manufacturing. Visit sae.org and use the search box to find all of them.

TECH FOCUS: ADDITIVE MANUFACTURING

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

AUGUST 2022
Quantum computing

SEPTEMBER 2022
Vehicle interiors

OCTOBER
Sustainable energy technology

NOVEMBER
Smart cities/IoT

Scania

SAE J3271 MCS inlet, similar in size to CCS inlet with 10x (3000 A) charging capability.

Launch of SAE J3271-AIR7357 Megawatt Charging System Standards (MCS) for all large-battery vehicles that roll, fly, or float

By Theodore Bohn, Argonne National Laboratory

Commercial electric vehicles have moved from concepts to prototypes and now into production with ever increasing battery capacity. Larger-capacity batteries to support longer-range and load capability up to class 8 vehicles require higher charging power to keep the recharge time manageable. Some commercial vehicles have a long dwell time, allowing use of existing SAE J1772 based DC charging systems, up to 350kW. Many commercial vehicles have a short time available for battery recharge, with a goal to recharge the vehicle nearly as fast as present liquid refueling. A current example is the desire to replace 80% of the vehicle range in 20 minutes while the load is being transferred or concurrent with a driver break. For a 500-kWh battery, that is 3C rate or 1.5MW.

A task force of industry stake holders and subject matter experts was launched in 2018 as the CharIN Megawatt Charging System (MCS- https://www.charin.global/technology/mcs/). As an industry group it developed documents and specifications that can be used by Standards Developing Organizations (SDOs). The task group was comprised of mostly members of SDO work groups that developed current DC

Theodore Bohn is a Principal Electrical Engineer at Argonne National Laboratory and the chair of SAE J3271, J2953, AIR7357, IEEE P2030.13 and vice chair among other standards work group activities.

REMA

SAE J3271 MCS connector.

charging standards with the intent of creating standards in parallel with industry led discussions of requirements. The white paper of MCS specifications is due to be released in summer of 2022.

SAE International's Hybrid-EV Committee's Megawatt Charging System Task Force was formed in 2021. Its first Work in Progress (WiP) is J3271: Megawatt Charging System for Electric Vehicles. It is a system level standard that covers the charging equipment and control elements from the point of utility interconnection to the vehicle battery terminals. It leverages other standards that are under development, such as IEC TS63379 which just covers the MCS coupler/inlet. The three charging levels, tied to cooling methods are; Level 1 non-cooled connector/inlet, Level 2 cooled connector + non-cooled inlet, Level 3 cooled connector and cooled inlet. The coupler is designed for 1500v/3000A peak operation. The SAE J3271/2 Technical Information Reference (TIR) document includes three physical layer communication methods- CAN, PLC, and 10BaseT1S Ethernet.

Cord handling and automated connection systems are covered in J3271 section 3. SAE J3271/4 covers use cases, especially microgrid coupled charging systems, bi-directional power flow, and auxiliary low-voltage support for black start and other resiliency based scenarios. SAE J3271/5 covers compliance and interoperability.

SAE AIR7357 is a similar Megawatt Charging System standard specifically for electric aircraft. IEC 60008 covers existing marine AC shore power requirements, now leveraging SAE J3271 content. Rail, mining, construction, Dept of Defense and other non-road electric vehicle application stakeholders are actively participating in J3271 weekly meetings.

The role of SAE J3271 is to support charging of any large battery vehicle/vessel/craft that "rolls, flies, or floats." The J3271 TIR document is expect to be released in 2022-Q3, with revisions to follow as prototype couplers and charging systems are put into the field. This will help to refine and validate assumptions in the work-in-progress document.

If you would like to know more about this document, or if you are interested in learning more about the work of the Megawatt Charging System Task Force, contact SAE International's Dante Rahdar, Ground Vehicle Committee Manager, at Dante.Rahdar@SAE.org. ■

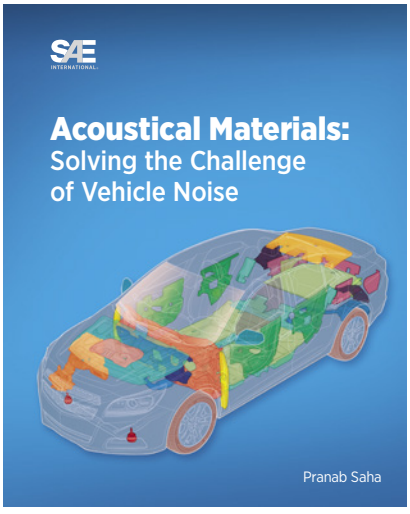
Award-winning books abound at SAE

Acoustic Materials: Solving the Challenge of Vehicle Noise is the third "editorial excellence" award so far this year for SAE Books.

Pranab Saha, Ph.D., received the gold medal in the 34th annual IBPA Benjamin Franklin Award™ program's Professional Reference category. Celebrating excellence in book editorial and design, the IBPA Benjamin Franklin Awards™ are administered by the Independent Book Publishers Association (IBPA) – the largest book publishers association in the US with over 4,000 members.

His book represents over 40 years of experience by Pranab Saha, a world-recognized authority on automotive noise, body interior systems, and sound package materials. As a lifelong contributor to SAE International, Saha received the 2021 SAE International Medal of Honor as well as the 2021 SAE International Ralph K. Hillquist NVH Lifetime Achievement Award. He also is an SAE Fellow (2017).

"I am very excited about receiving the Benjamin Franklin Award," Pranab told *Update*. "This is incredible! The book was



SAE Fellow Pranab Saha, Ph.D.

labor of love, and it is what I want as my legacy. The book itself is my award and without Sherry's Nigam's help it would have never happened. I sincerely hope the book will find its own place in the acoustics world and that present and future acoustics engineers will be able to use it to develop better products.

I never dreamed of receiving any award for the book, neither did I know that the Benjamin Franklin award exists. So, for me, this award is the icing on top of the cake. I am very happy for the recognition, but this is really a Team Effort! Sherry Nigam worked with me throughout the whole process and her help was essential. Thank you, Sherry!

Said Nigam: "It's always a privilege when someone trusts me to help them turn their life's work into a book. Pranab and I spent almost five years discussing and working on this book. His vision and passion inspired everyone involved in making his dream a reality. The Benjamin Franklin Award is a particularly important honor to me personally because the recognition comes from my publishing peers for Editorial Excellence. I'm proud to say we've won three Benjamin Franklin Awards since I joined SAE but this is our first gold!" ■

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“ Nowhere else will you find such a mix of OBD technical experts, global regulators, suppliers, and OEM’s. The content is always rich, and the interactions are priceless. This event balances the breadth and depth of OBD history, current issues, and future technological challenges.”

Justin Owen
Product Compliance, Director
Cummins Inc.

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SAE Foundation

STEM winners – and future leaders.

SAE announced STEM Innovation contest 2022 winners

When you're trying to solve complex real-world issues, the best place to start is to look for problems–ideally problems with which you have a personal connection. From traffic congestion, to global food insecurity, and climate change, winners of the Chowdhury STEM Innovation Contest 2022 did just that and more.

On his way to school with his mother, sixth grader John Tewolde found himself frustrated waiting at a red light which ultimately made him late for school all while there was no traffic coming in the other direction. He immediately started brainstorming. What if there was a smart traffic light solution that would use artificial intelligence and machine learning to make traffic more efficient and environmentally responsible?

After researching different smart technology options, John soon realized there wasn't a great way for traffic signals to recognize vehicles on both sides of the road. He also found vehicles idling unnecessarily at intersections waste 6 billion gallons of gas per year,

contributing to climate change. TrafficSmart, a smart traffic light that can reduce commute times for potentially millions of commuters, took home first place.

"I really liked working with my older brother. Talking to him about my project and working with each other. I also had a chance to work with my dad" added John, whose father and brother served as mentors for the contest.

Fourth grader Nicole Haragutchi also used personal connections to help identify her real-world issue. Having successfully organized fundraisers for students with special needs throughout the world, she soon realized they also often times need access to clean water and a reliable food source.

Nicole worked with her father who was also serving as her mentor for the contest to develop Scalable and Fertilizer-Free Energy Self-Sufficient Carbon Neutral Aquaponics. As part of her presentation, she developed a fully functional solar-powered aquaponic system to raise edible fish and grow vegetable plants. Nicole and her father hope to scale the solution, producing 40 tilapia fish and growing lettuce beds to prove the technology can be used at scale.

"If we can help people grow their own food, it can help their community too. We can help the whole world to do it and that helps the environment," said Nicole.

Being in different grades and at different schools didn't stop the third-place team of Arthur, Malachi, Ephraim, and Zachary from working together to explore the use of drones to provide food and resources to landlocked countries. Even though they were virtual, they still worked creatively to find ways to combine their ideas.

"Being on a team really helped because it was better to gather all the parts you were working with. Whenever you were stuck or didn't know what to do, you always had a teammate to help you or give ideas to finish the product," added Malachi.

Now in its third year, more than 46 registrants in grades 4-8 in the U.S. and Canada, participated in this year's competition to come up with a real-world issue to research, imagine, and design their own STEM solution, then create a digital presentation to share their ideas in a fun, engaging way.

In addition to being recognized for their efforts, winning registrants also earned prizes for themselves and their classroom along with a donation to a charity of their choice.

Congratulations to our 2022 winners and all of the students who participated this year. We can't wait to see what real-world problems you tackle next.

For any young learners interested in starting their STEM journey, be sure to take a look at these free SAE STEM@Home resources supported by the SAE Foundation.

Stay tuned for the next SAE STEM Innovation Contest! ■

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JOB OPPORTUNITIES

ASSISTANT PROGRAM ENGINEERING MANAGER, Warren, MI, General Motors. Responsible for Medium Duty Truck program in JV w/ Navistar/Isuzu. Facilitate physical integration of vehicle via CPIT &VAPIR Teams. Conduct VAPIR meetings to review medium duty truck program goals from an overall vehicle standpoint. Provide vehicle-level tradeoffs to meet program goals, review program schedule status, &resolve all engrg issues, using GM engrg &cmpt checklists. Define medium duty truck Vehicle (VTS), Subsystem (SSTS), & Component (CTS) Technical Specifications , &Statement of Requirements (SOR), using engrg appendices. Collaborate w/ DREs &Engrg Teams to ensure EWOs &plant support reqmts are met. Initiate engrg Change Requests (CRS) &Decision Notices (DNS), using the Engrg Change Mgmt tool. Assure engrg deliverable status at PET &PQRRs. Work w/ Vehicle Sys Engrs &DREs on change breakpoints to maintain build stability, using engrg tracking tools. Apply DFSS &DOE engrg methodologies to optimize designs &reduce sensitivity to variation, using control plans. Required travel to vehicle assy plant in Springfield, OH to review mfg processes &facilities layouts, &assure installation &improvement facilities &plant warehousing syss, &support engrg meetings at JV technical center in Lisle, IL, up to 9 wks P/A. Bachelor, Mechanical, Mechatronics, or Electrical Engrg. 24 mos exp as Engineer, providing vehicle-level tradeoffs to meet program goals, reviewing program schedule status, defining truck VTS, SSTS, CTS, &SOR, &initiating engrg CRs &DNs, or related. Mail resume to Ref#434, GM Global Mobility, 300 Renaissance Center, MC:482-C32-C66, Detroit, MI 48265.

VEHICLE INTELLIGENCE PLATFORM (VIP) ARCHITECT, Warren, MI, General Motors. Evaluate &execute control functions blocks partitioning, allocation to electronic control modules &interfaces designs to fulfill passenger vehicle autonomous driving &Active Safety (AS) features such as Hands Free Steering, Forward Collision Warning, Threat Assessment, Vehicle Health Management, Lateral Impact Mitigation, Vehicle Video Viewing, &Adaptive Cruise Control &subsys performance requirements. Review vehicle functional requirements documented in Subsystem Technical Specs (SSTS) using IBM DOORS/DNG. Analyze diagnostic, serial data, safety &security impact of signals transmitted &received on networks including CAN, LIN, &Automotive Ethernet communication protocols. Define high level partitioning of feature &subsys by creating &update &model relevant assets for functional domains, using IBM Rhapsody to applicable Function Components. Define &model &allocate subfunctions to applicable System Components. Collaborate w/ automotive domain experts &Network Design teams to identify network signals required to be communicated betwn different electronic control units (ECUs) on electrical architecture topology. Master, Electrical Engineering. 12 mos. exp as Engineer, evaluating passenger vehicle electrical topology, &analyzing diagnostic, serial data, safety &security impact of signals transmitted &received on networks including CAN &LIN communication protocols, or related. Mail resume to Ref#8271-5, GM Global Mobility, 300 Renaissance Center, MC:482-C32-C66, Detroit, MI 48265.

SENIOR SOFTWARE ENGINEER-INFOTAINMENT SOFTWARE DEVELOPMENT, Warren, MI, General Motors. Gather new technical requirements as Product Owner (PO), &design, using IBM DOORS & Rhapsody tools, ICE passenger vehicle &Battery Electric Vehicle (BEV) embedded SW for Instrument Panel Cluster (IPC) apps (gauges/indicators/driver information menu pages, chimes, alerts &Open Display Interface inter-processor communication), vehicle interface processor infrastructure SW, &infotainment syss state &HW interface layer SW for infotainment audio, phone, &navi cmpnts in infotainment Virtual Control Unit. Integrate vehicle network AUTOSAR XML config files. Configure AUTOSAR Standard Utility Modules (State of Health, Startup Shutdown, Partial Network Configuration, Error Handling, Security Services Coordination, Signal Status Monitoring, UDS diagnostics) with Davinci into ECU builds. Collaborate w/ various internal teams &Tier I HW supplier to support cadence based continuous integration &ensure development &availability of automotive embedded Basic Software (BSW) products including CAN, LIN, Partial Network, Automotive Ethernet, Microcontroller Abstraction Layer (MCAL) &MICROSAR OS. Bachelor, Electrical, Computer, or Electronics &Communication Engrg, or related. 60 mos exp as Engineer, Engrg Manager, or related, designing or leading team to design of embedded SW for IPC or IPC display apps, &collaborating w/ stakeholders to ensure development of automotive embedded BSW products including CAN, LIN, Automotive Ethernet, MCAL &MICROSAR OS, or related. Mail resume to Ref#156, GM Global Mobility, 300 Renaissance Center, MC:482-C32-C66, Detroit, MI 48265.

DETROIT DIESEL CORPORATION SEEKS PROJECT MGMT. DETROIT ENGINES in Detroit, MI, position is responsible for new DDC ERP system Purchasing & Supplier Management/Finance & Controlling, among other duties. Requires Bach in Environmental Engineering or a Related Technical Engineering field. Position also requires 5 yrs of exp. with Commercial Vehicle Trucks (Trucks/Buses/Powertrain), which must include exp. in: Project Management, Lead Manufacturing, and Engine Components. To apply email resume to Rachel Rawson at rachel.rawson@daimler.com; reference job number: DT-178

VEHICLE INTELLIGENCE PLATFORM BODY CONTROL MODULE (BCM) / EXTERIOR LIGHTING MODULE (ELM) SOFTWARE STRATEGIST, Warren, MI, General Motors. Design, test, &verify BCM/ELM SW to ensure all reqrmnts &deliverables are met for ICE passenger vehicle &Battery Electric Vehicle, using Tc, Vismockup, E2, ECM, Git, Gerrit, Jenkins, Bitbucket, Artifactory, &Selenium tools, in Agile methodology, for future MY vehicle prgrms &global markets (China/NA/SA/RoW), to meet vehicle specific electrical architecture, system, security, safety &encoding requirements. Engineer &release BCM/ELM SW calibrations &prepare SW timing plans to ensure prgrm requirements &Material Release Dates are met. Test &validate BCM/ELM apps to support creation of tasks &triggers to collect data on vehicles. Perform build, sanity, smoke, functional, regression, performance, &test build testing on major, minor &break-fix BCM/ELM SW releases. Analyze &collect data from CAN &LIN logs using vSpy &Vehicle Data Recorder. Bachelor, Electrical, Electronics &Communication or Computer Engrg, or Computer Science, or related. 24 mos exp as Engineer, creating test environment for BCM Electronic Control Unit, &testing &verifying passenger vehicle body domain features such as Exterior Lighting, &Charging or Energy Power Management subsyss, or related. Mail resume to Ref#4415, GM Global Mobility, 300 Renaissance Center, MC:482-C32-C66, Detroit, MI 48265.

DAIMLER TRUCK NORTH AMERICA LLC SEEKS MANUFACTURING DEVELOPMENT ENGINEER in Portland, OR, position is responsible for specifying, planning, and implementing the integration of robotic Cab In White assembly line with Paint Shop and E-coat systems to meet all technical designs specifications for heavy duty vehicles, among other duties. Requires Bach deg. in Industrial, Manufacturing, Mechanical, Electronics, or Electrical Eng., or any closely related Engineering degree. Position also requires 5 yrs of exp. in heavy duty truck manufacturing assembly operations, which must include exp. in: leading the planning and implementation of automated cab in white assembly line/cells; integrating Henrob riveting technology into cab in white assembly cells; specifying, planning and implementing Paint shop assembly lines; leading the planning and implementation of E-coat systems; assembly robotics (FANUC, Durr, ABB) including mechanical, controller, gripper and work cell integration; and 3D-CAD experience with NX. To apply email resume to Rachel Rawson at rachel.rawson@daimlertruck.com; reference job number DT-234.

JOB OPPORTUNITIES

MAINTENANCE &CONTROLS TECHNICIAN-EQPMNT OPTIMIZATION, New Boston, MI, Brose North America. Design, program, &troubleshoot automated plant syss incldg PLCs &PLC-based machinery &eqpmnt syss incldg Siemens S7 PLC &SW modules, using &parameterizing SW to fit applications; Pascal base programming for Siemens PLCs; ABB robotics &robotic cells; Siemens, Bosch, SEW Motion Control syss; Bosch, Siemens, &Eurodrive Servo Drives &Motors; Cognex 3D machine visual inspection syss; plant &workstation cmptr syss using Windows; plant engrg, mfg, qlty &plant wide maintenance &group SW archiving syss; &Pilz Safety PLC, &Sick Safety devices, to optimize production output &QA of mechatronic latches, spindles, door modules, seats, Hands Free Access modules. Integrate new qlty &production support devices incldg cameras, scanners, printers, RF readers &writers, smart sensors &lights. Implement plant wide circuits &controls to ensure safety, product qlty, machinery &eqpmnt up time. Perform reprogramming while supporting team to optimize &tune EoL Testers &assy lines. 36 mos exp as Maintenance Technician or Supervisor, Programming Engineer, or related, programming or troubleshooting automated plant syss incldg Siemens S7 PLC, SEW Motion Control sys, &grouping archiving sys to optimize production output of mechatronic modules, or related. Mail resume to Ref#2500-A105, Brose, Human Resources, 3933 Automation Ave, Auburn Hills, MI 48326.

DETROIT DIESEL CORPORATION SEEKS AN ENTERPRISE RESOURCE PLANNING (ERP) OPERATIONS LEAD in Detroit, Michigan. This position is responsible for implementing new ERP system on engine component machining &turbo assembly line, among other duties. Masters degree in Industrial Eng., plus 4 years of exp. in the job offered or related occupation required. Alternatively, the employer will accept a Bachelors degree in Industrial Eng., plus 6 years of experience in the job offered or related occupation. Exp. must include 2 years of project management exp. Must have exp. with: 1. auditing business processes; 2. MRP systems; 3. manufacturing facility, quality and production systems planning and control concepts; and 4. engine components assembly and machining production processes. To apply email resume to Rachel Rawson at rachel.rawson@daimler.com; reference job number DT-2336.

VEHICLE MOTION EMBEDDED CONTROLS SOFTWARE ENGINEER, Milford, MI, General Motors. Gather architecture &software technical requirements from the architecture &calibrations team to analyze &formulate software requirements. Develop embedded software for conventional passenger vehicle transmission &Battery Electric Vehicle (BEV) Electric Drive Unit (DU) Electronic Transmission &Range Select (ETRS) system to enable users to select vehicle drive mode, using MATLAB, Simulink &C programming languages, on different 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 CANape & CANoe, &Lauterbach tools, to verify functionality at Function, Controller &System levels prior to production release. Debug software &troubleshoot low level C code issues using Lauterbach Trace 32 debugger. Perform peer reviews &unit level testing using RiBeTT, CppUTest &GMSim for Multiple Condition Coverage (MCC) to reduce rework requests &achieve zero software defects. Master, Electrical Engineering or related. 12 mos exp as Engineer, debugging software &troubleshooting low level C code issues using Lauterbach Trace 32 debugger, or related. Mail resume to Ref#23090-117, GM Global Mobility, 300 Renaissance Center, MC:482-C32-C66, Detroit, MI 48265.

DAIMLER TRUCK NORTH AMERICA LLC SEEKS AN AUTOMOTIVE DESIGN ANALYST III in Portland, Oregon. This position will create high quality conceptual 2D renderings as the start of the design process in order to visualize guide lines, among other duties. Bachelors degree in Materials Engineering, Industrial Engineering, or a related field required. 72 months of experience in the job offered or a related position required. Experience must include at least 3 years of experience in a global automotive company. Must have experience in: creative concept process and the design execution process of vehicle development and its components; computer aided design (CAD); 2D and 3D software. To apply email resume to Rachel Rawson at rachel.rawson@daimler.com; reference job number DT-2338.

PLASTICS ENGINEERING MANAGER, Bergstrom Inc., Rockford, IL. Plan, assure &lead technological advancement of plastic injection mold tooling, incldng planning, development, execution, &deployment of new tooling &changes &improvement of existing tooling to manufacture plastic parts, incldng heater unit assy/exchanger covers; cases; blend doors; blower unit &filter housings; structural frames for fan motors/recirculation chambers; ventilation doors; pans, guard fans; air/defrost ducts &frames assembled in HVAC units. Plan &lead new plastic injection mold tooling builds &ensure tools are delivered according to internal engrg specs &program timelines. Attend tryouts of molds set up in injection molding machines from 660 to 1000 tons clamping force. Define parameters of plastic injection molding processes to assure optimal part conditions incldng dimensional stability, shrinkage control, &cosmetic requirements, based on type of resins used &resin properties. Apply data-driven approach to tooling maintenance &repairs incldng tracking shot counts &maintenance history to predictively schedule necessary actions to minimize tooling cost per shot, scrap generation, machine downtime, &tracking of results of the daily OEE. Bachelor, Mechanical, Materials or Chemical Engineering, or related. 36 mos. exp as Engineer, Supv, Program or Tool Shop Manager, or related, performing or leading plastic injection mold tooling builds, defining parameters of plastic injection molding processes to assure optimal part conditions incldng dimensional stability, shrinkage control, &cosmetic requirements, based on type &properties of resins used, or related. Mail resume to Ref#5502, Human Resources, Bergstrom Inc., 2390 Blackhawk Rd., PO Box 6007, Rockford, IL 61125-1007.

DAIMLER TRUCK NORTH AMERICA LLC SEEKS A TECHNICAL PRODUCT OWNER in Portland, Oregon. This position will perform system analysis, data mining and data analysis to meet customer needs to derive connected vehicle service, among other duties. Bachelors degree in Engineering, Computer Science, Information Technology, Applied Technology or a related technical field required. 36 months of experience in the job offered or related position required. Experience must include experience with: Enterprise IT Systems, Application Programming Interfaces, Rest API's or similar application interface development technologies; and Eclipse; Anaconda Python & PyCharm. To apply email resume to Rachel Rawson at rachel.rawson@daimler.com; reference job number DT- 2335.

DECISION &DATA SCIENCE RESEARCHER, Warren, MI, General Motors. Analyze large-scale passenger vehicle sale datasets to assess marketing effectiveness of online customer touchpoints. Formulate problem of finding next best (optimal) marketing action to increase sales probability as sequential decision-making problem under uncertainty using stochastic programming. Research &develop solution techniques using advanced AI & reinforcement learning (RL) approaches such as Q-learning (Q-L) &deep Q-L &optimization techniques for stochastic problems such as progressive hedging algorithm, iterative diagonalization technique, gradient ascent/decent, &genetic algorithm. Contribute to development of highly detailed discrete-event simulation models designed to replicate daily operation of fleet of electric vertical take-off &landing (eVTOL) aircraft or air taxis under uncertainty using Simio simulation software. Work with the team responsible for the demand estimation to generate the desired trip tables &feed them into the simulation models along with a list of input parameters. Work with eVTOL engrg team to collect specific details of aircraft such as speed, battery capacity, &charge rate to use in simulation models. Master, Data Analytics Engrg, Civil Engrg, Applied Math, Machine Learning, or related. 12 mos exp as Graduate Research Asst, Research Assoc., Researcher, or related, developing solution techniques for proposed optimization problems using advanced AI &RL approaches such as Q-L &deep Q-L &optimization techniques for stochastic problems such as progressive hedging algorithm, iterative diagonalization technique, or genetic algorithm, or related. Mail resume to Ref#4090, GM Global Mobility, 300 Renaissance Center, MC:482-C32-C66, Detroit, MI 48265.

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