December 2023

GEORGIA PATHWAYS

MAGAZINE

AI-Enhanced Robotics in Georgia

Central Georgia Technical College

Elevating Healthcare In Georgia

Cancer Moon-shot Initiative

TAG Technology Association of Georgia

TAG TAG-Ed Education Collaborative

The Technology Association of Georgia Education Collaborative (TAG-Ed) strengthens the future workforce by providing students with relevant, hands-on STEAM learning opportunities and connecting them to Technology Association of Georgia (TAG) resources. Formerly the TAG Foundation, TAG-Ed is a 501(C)(3) non-profit organization formed by TAG in 2000. Later, the organization's name was re-branded to TAG Education Collaborative to facilitate our role as the leaders for K-12 STEAM education in Georgia.

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As we approach the end of 2023 and eagerly anticipate the opportunities that lie ahead in 2024, the significance of training and professional development takes center stage. In a rapidly evolving landscape, staying ahead is imperative, making education and skill enhancement crucial pillars of success.

In the contemporary world, where technology evolves at an unprecedented pace, professionals across industries must equip themselves with the latest skills and knowledge. Training has become not only a tool for individual career growth but a necessity for organizational success. It's a dynamic process that adapts to industry changes, ensuring that individuals and teams remain relevant and effective.

A timely aspect to highlight is the recognition of the pivotal role played by cybersecurity training, particularly considering the upcoming release of the Cybersecurity Maturity Model Certification (CMMC). This impending certification poses new challenges for the defense industrial base, mandating compliance for manufacturers, defense contractors, and suppliers engaged with the Department of Defense (DoD). In response, TAG's Georgia Defense Industrial Task Force is taking proactive steps by hosting a CMMC summit on January 30th at Microsoft's Atlanta campus. This summit is designed to comprehensively address the needs of all those working for the DoD, ensuring they are well-prepared for CMMC requirements. For additional details visit www.tagonline.org

As we navigate the complex currents of an ever-changing professional realm, let us recognize the importance of training and education. It is not merely an investment in personal or organizational development but a commitment to resilience and adaptability.

We invite our readers to explore the diverse content in this issue and use it as a resource to enhance their educational and professional journeys. Whether you are seeking insights into cybersecurity, career growth tips, or the latest industry trends, Georgia Pathways Magazine is here to guide you. Engage with us, share your thoughts, and let this magazine be a companion on your path to continuous learning and professional development. Together, let's navigate the ever-evolving landscape of knowledge and opportunities.

Larry K. Williams
President
TAG / TAG-Ed

Larry K. Williams serves as the President and CEO of the TAG and the TAG Education Collaborative. TAG-Ed's mission is to strengthen Georgia's future workforce by providing students with relevant, hands-on STEM learning opportunities by connecting Technology Association of Georgia (TAG) resources with leading STEM education initiatives.

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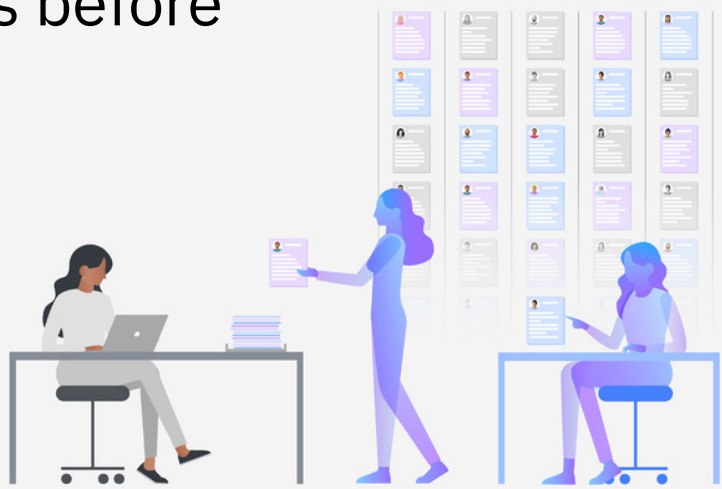

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1 Source: US Bureau of Labor Statistics

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Comments from the publisher -

Why is Georgia Pathways STEM Magazine important to every industry professional, parent, student, and educator?

The skills used day to day in any career field defines that career. The articles included in our monthly issues suggest a variety of career fields that all include STEM skills, but may not have been considered a STEM career by the reader previously.

Pick any career that comes to mind, from retail sales to robotics and AI design and the skills necessary for either are surprisingly aligned. Neither requires a STEM degree, but both use the very same STEM skills to be successful and innovative.

Any career you choose requires the systematic accumulation of knowledge, or continued learning about that chosen field, its tools, trends and innovations. This is the definition of "**science**".

All careers require the practical application of what you've learned via some form of technology that may include computers and software applications, apps or social media needs, cameras, drones, advertising venues and their requirements as well as emerging tech that does not currently exist.

I've yet to see any career field, volunteer effort or hobby that does not demand the ability to make informed decisions and solve problems. This is the definition of the Engineering Method, which is clearly a step by step process to achieve both, and we do it daily, at home and work, often without being aware.

The math of STEM ranges widely in applications, by simply measuring for a cooking recipe, to plotting the astronomical course of a space craft into the unknown. Both use the science of numbers, their operations, interrelations, combinations, generalizations, and abstractions. From a simple calculation for your discount coupon, successfully throwing a football to a receiver running their route, or to mapping the human genome, we use math dozens of times per day regardless of the activity we're involved in.

Everything has not been discovered or invented. Generations to come will pursue those unknowns using STEM skills without a STEM degree. These individuals will need inspiration, ideas, unrealized creativity and vast amounts of curiosity.

Who are these people? **Everyone** of all ages and interests. Georgia Pathways STEM Magazine will continue to offer career paths to consider, innovation needs to explore and the satisfaction of the journey.

Wayne Carley
Publisher

Innovative AI-Enhanced Robotics Brings New Opportunities to Veterans at CGTC, VECTR Center

Central Georgia Technical College (CGTC) recently made headlines by surpassing 10,000 students enrolled for the fall term, in part because of innovative programs and partnerships, and opportunities for veteran students, among other populations to explore new career opportunities.

Enrollment growth comes as the College and its leadership have partnered with key local and regional organizations to improve outcomes for all its students. In particular, active duty, veterans and their families are benefitting from innovative career training and education. CGTC is the operational arm of the Georgia Veterans Education Career Transition Resource (VECTR) Center and the development of AI-Manufacturing coursework under the GA-AIM Grant, is spring-boarding new and modern career opportunities.

The GA-AIM Grant, or Georgia AI Manufacturing Grant, is led by the Georgia Tech Research Corporation with the goal of serving as a national model for how to accelerate the transition to automation in manufacturing while diversifying the next generation of AI leadership.

Andrea Griner, the CGTC vice president for Economic Development oversees the implementation of the grant awarded in 2022, and says "local industries, particularly those at Robins Air Force Base have shown increasing interest in a workforce prepared with AI-enhanced skills."

To meet high-demand manufacturing needs, the College developed a Technical Certificate of Credit (TCC) for AI Enhanced Robotic Manufacturing Specialist, partnering as a GA-AIM coalition member through the 21st Century Partnership. CGTC and VECTR launched the new lab for the AI program housed at the VECTR center in October.

Courses leading up to the lab compo-

nents of the TCC have begun this Fall and students are on their way to obtaining their credits. In addition to the TCC, they will also earn two Robotic Industry Certificates from Fuji Automatic Numerical Control (FANUC). Upon successful completion, students can apply for jobs immediately.

According to Deryk Stoops, CGTC Industrial Systems Technology and Aerospace, Trade & Industry instructor, the AI Enhanced Robotic classroom-lab is attracting students and conversation.

Situated in the center of the Georgia VECTR Center the lab, with open windows designed to draw attention to state-of-the-art robotic lab equipment, people are taking notice of what the innovative career path can mean for Central Georgia.

"AI is basically the next generation of manufacturing," said Deryk Stoops. "We are at a time where we have all these devices communicating making decisions autonomously. As technology continues to roll out in manufacturing we are seeing a lot of companies coming back to the United States because automation is making them more competitive." As students enter the room they are greeted by an autonomous robot that circles the laboratory as if it was another student.

Student Andrew Gray explained that the autonomous robot was made by MiR (Mobile Industrial Robot), this company specializes in creating autonomous robots that help in different sectors of the industry. Stoops shared how the programming works for the MiR 100 as the robot continues to circle around. He said this particular model is employed by hospitals to perform many tasks, one of them is the transportation of sterilized medical equipment and this specific model can handle up to 200 pounds.

Matthieu Snow, Air Force veteran and student, explains why he decided to enroll in the AI- Enhanced Robotic Manufacturing Specialist program. “As a 20+ year Air Force veteran my body has endured so many stress over the years and my bones and joints can not handle a lot of weight anymore, so I decided to get a career where I can maximize the use of my mind by programming AI Robotics and making industries more efficient while making it easier on my body as well.”

Georgia VECTR Center serves as a gateway for veterans’ re-entry into Georgia’s public postsecondary educational systems and workforce. The center was established by the state and is designed to serve veterans and their families through career counseling, educational coaching, workforce training, and more.

The VECTR Center provides unique, accelerated programs in high demand and strategic industries tailored to abbreviate the process of receiving post-secondary certificates and degrees by recognizing the extensive training veterans receive during their military service.

It is a one-stop model for veterans seeking benefits, educational opportunities, employment services, entrepreneurship, and links to community resources.

AI-Enhanced Robotics is just one more innovative approach to that mission. "Across all the programs we offer, we want to fill seats with anyone who is serious about earning a great wage in a high-demand career field," said U.S. Air Force Col. Don Layne, chief operating officer for the Georgia VECTR Center.

Learn more about the Georgia VECTR Center at, **www.gavectr.org**

To understand STEM...

...you must DEFINE STEM, but you cannot define an acronym using the words it stands for; you must define the words the acronym represents.

Universities and organizations around the world continue to debate what a STEM career is. There is no doubt that "every career" uses STEM skills and this observation remains the focus of STEM Magazine.

Science: "The systematic accumulation of knowledge" (all subjects and careers fields)

Technology: "The practical application of science" (all subjects and careers)

Engineering: "The engineering method: a step by step process of solving problems and making decisions" (every subject and career)

Math: "The science of numbers and their operations, interrelations, combinations, generalizations, and abstractions" (every career will use some form[s])

For a moment, set aside any preconceived notions of what you think a STEM career is and use the above dictionary definitions to determine the skills used in any career field you choose.

These definitions are the "real" meaning of STEM and STEM careers.

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OAK RIDGE National Laboratory

Light-activated acid drives energy-efficient, on-demand release of captured CO2

By Dawn Levy / ORNL

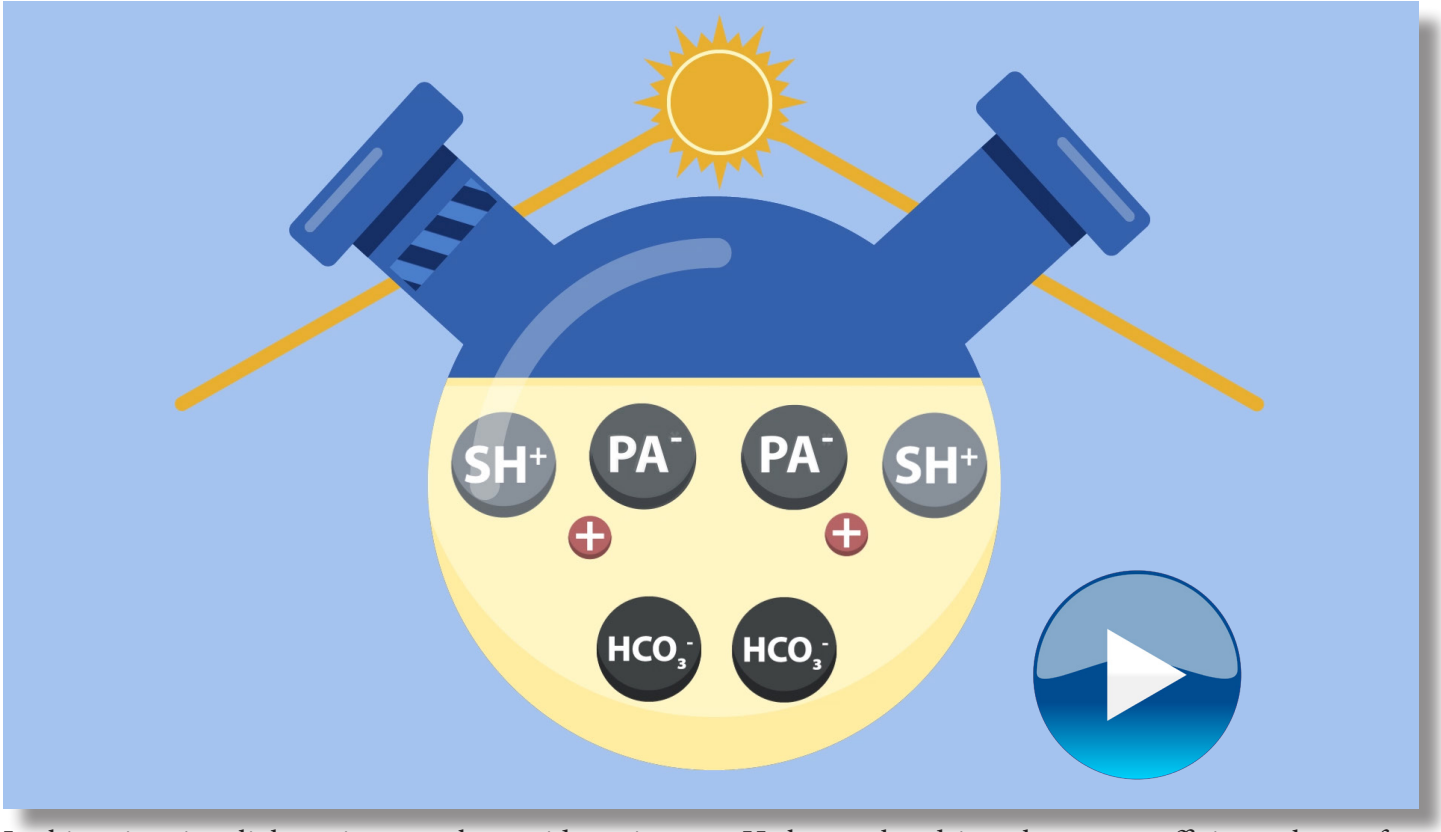
Using light instead of heat, researchers at the Department of Energy's Oak Ridge National Laboratory have found a new way to release carbon dioxide, or CO2, from a solvent used in direct air capture, or DAC, to trap this greenhouse gas. The novel approach paves the way for economically viable separation of CO2 from the atmosphere.

The on-demand release of carbon dioxide is possible because the long-lived excited state of a novel acid controls the solution's proton concentration using ultraviolet light, creating conditions that lead to CO2's energy-efficient release. By contrast, current DAC technologies filter air through an aqueous solution containing a sorbent material, such as an amino acid, that takes up atmospheric CO2 and holds it.

Heating the solvent releases the CO2 and regenerates the amino acid for recycling. The CO2 can be either stored or converted into value-added products, such as ethanol, polymers or concrete.

"In the existing direct-air-capture technologies, CO2 release and sorbent regeneration are the most energy-intensive steps," said ORNL chemist Yingzhong Ma, who led the study published in Angewandte Chemie International Edition with ORNL colleagues Radu Custelcean and Uvinduni Premadasa, both chemists. "The goal here is to use the amino acid sorbent, which is recyclable and has a lot of attractive properties, combined with a more energy-efficient approach to release the CO2 and regenerate the sorbent."

The National Academy of Sciences concluded that DAC technologies have a role in removing billions of tons of CO2 from the atmosphere annually



In this animation, light activates a photoacid to trigger a pH change that drives the energy-efficient release of CO2 from a recyclable sorbent. Credit: Jacquelyn DeMink/ORNL, U.S. Dept. of Energy

to help limit the rise in average global temperature to less than 2 degrees Celsius (about 4 degrees Fahrenheit). However, the intensive energy cost associated with sorbent regeneration and CO2 release at a scale that would mitigate climate change makes such a massive deployment a grand challenge necessitating the development of new DAC processes. The ORNL-led approach provided a proof of concept for using irradiation with ultraviolet light under ambient conditions instead of heating the solution to release the CO2 and regenerate the sorbent.

"Heating aqueous solutions is a common regeneration method, but it is extremely energy intensive," said Custelcean, a pioneer in DAC. "We wanted to take heat out of the equation."

Custelcean led a study in 2017 that proved a guanidine sorbent could directly capture CO2 from air. In 2018, he and colleagues demonstrated a practical, energy-efficient DAC method using solar heat to drive the release of the greenhouse gas from an amino-acid sorbent. This year, Knoxville-based startup Holocene licensed the technology to prepare it for industrial deployment.

In this new development, the key to releasing CO2 at ambient conditions is a photoacid, which is a molecule that becomes more acidic when it absorbs light. Shine a light on an acid such as vinegar and nothing happens. By contrast, expose a photoacid to ultraviolet or visible light, and a chemical group in the middle of the acid rotates from

the opposite side of a bond to the same side. A subsequent reaction forms a ring, leading to transfer of a proton, or hydrogen ion, to the water solvent. This transfer dramatically increases the acidity of the solution, producing a change called a "pH swing." The excess protons can now interact with bicarbonate, or HCO3-, which was made when CO2 reacted with the sorbent. The bicarbonate accepts a proton to become carbonic acid, or H2CO3, which is just one energetically favorable step away from carbon dioxide and water.

"This paper describes the first time where the macroscopic pH swing lasting from minutes to hours has been demonstrated using light as an external trigger to initiate the CO2 regeneration reaction," said Vyacheslav "Slava" Bryantsev, leader of ORNL's Chemical Separations group and a co-author of the paper.

"You can easily turn light on and off to control the reaction reversibly," Ma said. "You can capture CO2 in the dark and then simply turn on the light when you want to release CO2 for storage or for making value-added products. It gives you a way to easily control the process on demand."

That said, the researchers needed an additional trick of the light. Conventional photoacids would not work because the lifetimes of their excited states are very short — mere nano seconds. They lose protons but then stay mostly in the same configuration. "Then you only change the acidity for a short time," Bryantsev said. Ma and Custelcean, who conceived the idea of using a photoacid to trigger CO2 release in DAC applications, ran into this problem when they began experiments using a commercially available photoacid.

"When carbonic acid decomposes, it has a short lifetime in water, on the order of a few seconds. But that's an infinity compared to the lifetime of a regular photoacid, which is nanoseconds, or billionths of seconds," Custelcean said. "That's why you cannot do this chemistry with a regular photoacid: It takes seconds to release CO2 from carbonic acid, but it takes only nanoseconds for the photoacid to take the proton back."

Bryantsev came up with the idea to try a different class of photoacid with a long-lived excited state. Called a metastable-state photoacid, it has a structure that persists in solution from seconds to hours. That means the pH change driven by the photoacid's structural change also lasts a lot longer.

The scientists invited an expert in photoacid design and synthesis to join the

team. Florida Institute of Technology's Yi Liao had pioneered the new class of metastable-state photoacids around 2015 but for purposes other than DAC.

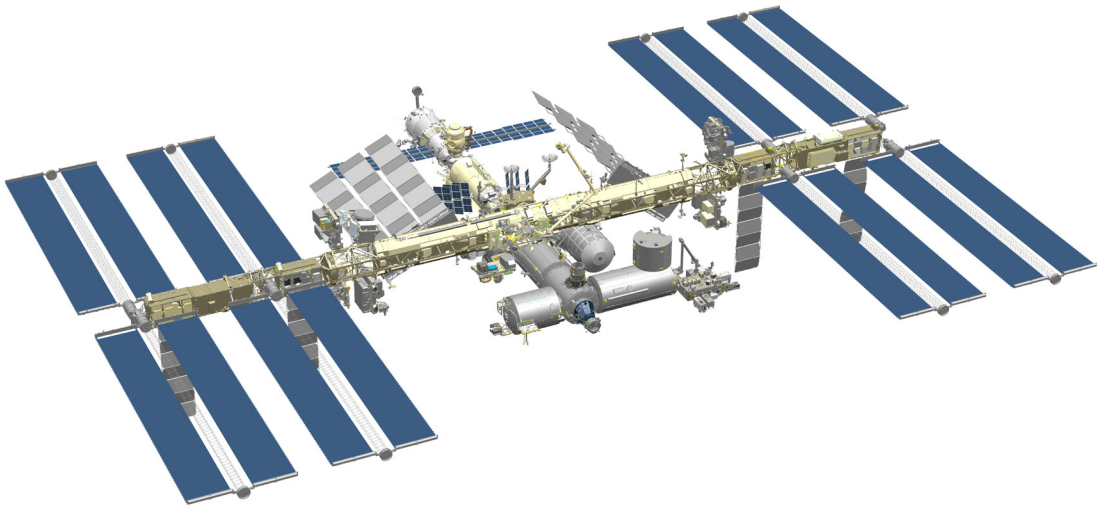
"We really made a breakthrough after we got this photoacid from our collaborator," Ma said. Custelcean agreed. "Having a metastable-state photoacid gave us plenty of time to release the proton and form the carbonic acid. Then the carbonic acid had time to release the CO2 in water. Once that happens, CO2 leaves the solution," he said. With Ma, first author Premadasa designed and conducted the experiments for the proof-of-concept study using a metastable-state photoacid synthesized by Liao and Florida Tech colleague Adnan Elgattar, with subsequent spectroscopic characterization by ORNL's Benjamin Doughty and Vera Bocharova.

"Once we baselined the photochemical properties of the acid itself, our next step was to test its applicability for CO2 release with various DAC sorbents," Premadasa said. "We can easily manipulate chemical compositions and intensities and colors of light to drive the photoreaction for efficient CO2 release." Audrey Miles from the University of Notre Dame and Stella Belony from the University of Florida, who were DOE Science Undergraduate Laboratory Internships students at the time of the study, tested the photoacid under different conditions for its CO2-releasing abilities. Then ORNL's Michelle Kidder, Diana Stamberga and Joshua Damron measured the amount of CO2 released under those different conditions. Many challenges remain to develop ORNL's light-activated DAC technology. One is understanding the dynamics by which the photoacid forms a chemical complex with the amino acid sorbent. Another is improving the solubility of compounds in water. Yet another is optimizing the absorption of light from the visible spectrum. Moreover, the scientists would like to decrease the time required to regenerate the photoacid and improve understanding of its long-term stability.

Regardless, the future is bright for metastable-state photoacids. "Our study paves the way towards photochemically driven approaches for CO2 release and sorbent regeneration using solar light," Premadasa said.

Paper title -"Photochemically-Driven CO2 Release Using a Metastable-State Photoacid for Energy Efficient Direct Air Capture." The DOE Office of Science supported the research.

UT-Battelle manages ORNL for DOE's Office of Science. The single largest supporter of basic research in the physical sciences in the United States, the Office of Science is working to address some of the most pressing challenges of our time. For more information, please visit energy.gov/science



Reigniting the Cancer Moon-shot Initiative

The International Space Station (ISS) National Laboratory enables researchers, physicians, engineers, and other innovators from a broad spectrum of public and private organizations to access to the unique environment of space. Leveraging this one-of-a-kind research platform provides a valuable opportunity to identify new solutions to complex problems on Earth, including technologies and products to prevent, diagnose, and treat cancer and other diseases.

Multiple projects sponsored by the ISS National Lab and supported by NASA, other U.S. government agencies, and private industry focus on cancer, other disease-related research, and biomedical technologies. These studies not only advance our understanding of the causes of human disease but also accelerate the translation to disease diagnostics, therapeutics, and biomanufacturing.

Findings from space-based research inform disease prevention, promote earlier disease detection, and promise safer, more effective treatments.
The International Space Station (ISS) and its unique environment enables research and technology development not possible on Earth. The ISS National Laboratory provides researchers with access to a permanent microgravity environment, a powerful vantage point in low Earth orbit, and the extreme and varied conditions of space.

Crystallization

Microgravity has been used for three decades to improve the production of crystalline forms of molecules. Space-based crystallization yields higher quality crystals that in turn provide higher-resolution structural images of important drugs, therapeutic molecules, and their targets to accelerate drug development.

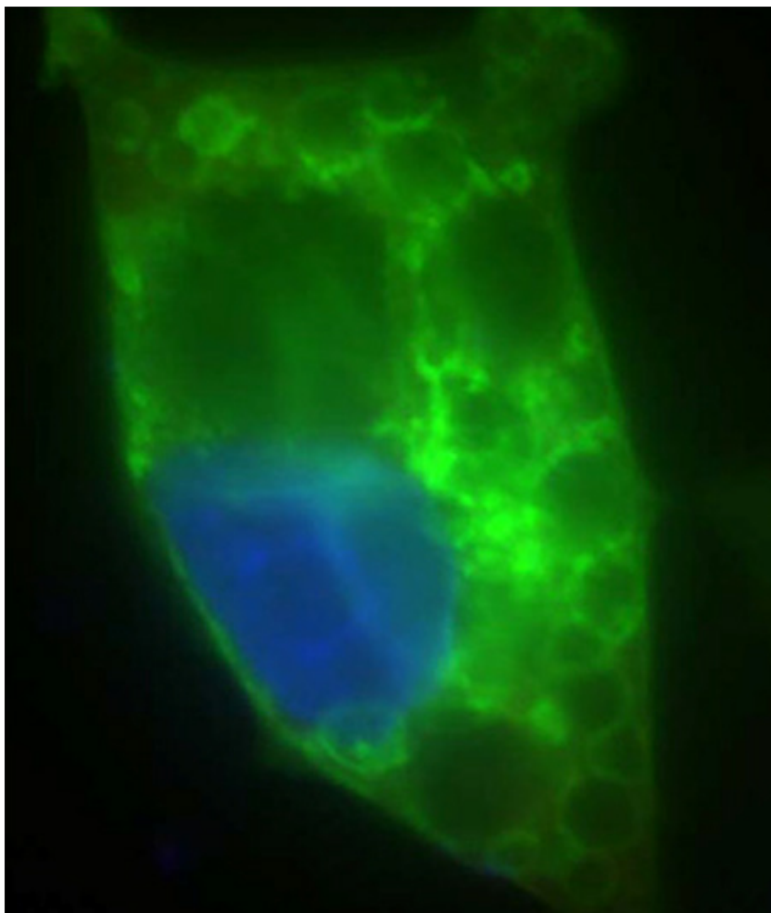
Tissue Models

In microgravity, human stem cells are able to assemble into complex three-dimensional structures that more closely resemble and function like tissues and organs in the human body. This enables the manufacture of biological products with fewer defects for clinical application. It also allows for the development and testing of organoid and tissue chip models for use in accelerated disease modeling and the testing of therapeutic treatments.

Micro- and Nanoparticles:

Advanced Manufacturing and Biomanufacturing

Advanced manufacturing in microgravity can result in improved biomedical products. This includes the production of drug-targeting vehicles like micro- and nanoparticles with improved performance in the body, resulting in safer and more effective therapies for the treatment of disease. It also includes bioprinted tissues for regenerative medicine applications and the production of therapeutics. Regenerative medicine includes gene therapies, cell therapies, and tissue-engineered products intended to augment, repair, replace, or regenerate organs, tissues, cells, genes, and metabolic processes in the body.



Human space exploration missions quickly revealed that microgravity, or weightlessness, had profound and unique effects on physical and biological phenomena. Understanding these effects is critical for human exploration and pioneering space—but the study of these effects also advances knowledge on Earth. The International Space Station National Laboratory is a permanently crewed research facility, observatory, and engineering test bed that can provide powerful insights into fundamental and applied scientific investigations.

These advantages of the ISS National Lab benefit a wide variety of R&D focus areas.

For example, spaceflight R&D allows the long-term study of underlying biological and physical processes whose effects are masked by dominant gravity-dependent forces. These advantages of the ISS National Lab benefit a wide variety of R&D focus areas, including pharmaceutical development, biotechnology, nanotechnology, materials science, tissue engineering, disease modeling, agriculture, Earth observation, atmospheric research, energy source generation, combustion, fluid dynamics, student educational initiatives, and many more.

Specific features of the space environment include:

- Microgravity, or weightlessness, which alters many observable phenomena within the physical and life sciences. Systems and processes affected by microgravity include surface wetting and interfacial tension, multiphase flow and heat transfer, multiphase system dynamics, solidification, and fire and combustion. Moreover, microgravity induces a vast array of changes in organisms ranging from viruses and bacteria to humans, including global alterations in gene expression and three-dimensional aggregation of cells into tissue-like architectures.

- Extreme environmental conditions, including exposure to extreme heat and cold cycling, ultra-vacuum, atomic oxygen, and high-energy radiation. Testing and qualification of materials, sensors, and component sub-systems exposed simultaneously to these extreme conditions have provided data to enable the manufacturing of long-life reliable components used on Earth as well as in the world's most sophisticated satellites and spacecraft.

- A unique vantage point, based on the location of the ISS within low Earth orbit. The ISS orbits at an altitude of approximately 250 miles (400 km), and its path covers more than 90% of Earths

population. Observations from this orbiting platform can provide unique spatial resolution and variable lighting conditions compared with the sun-synchronous orbits of typical Earth remote-sensing satellites, allowing insight into diverse fields ranging from atmospheric modeling to agriculture.

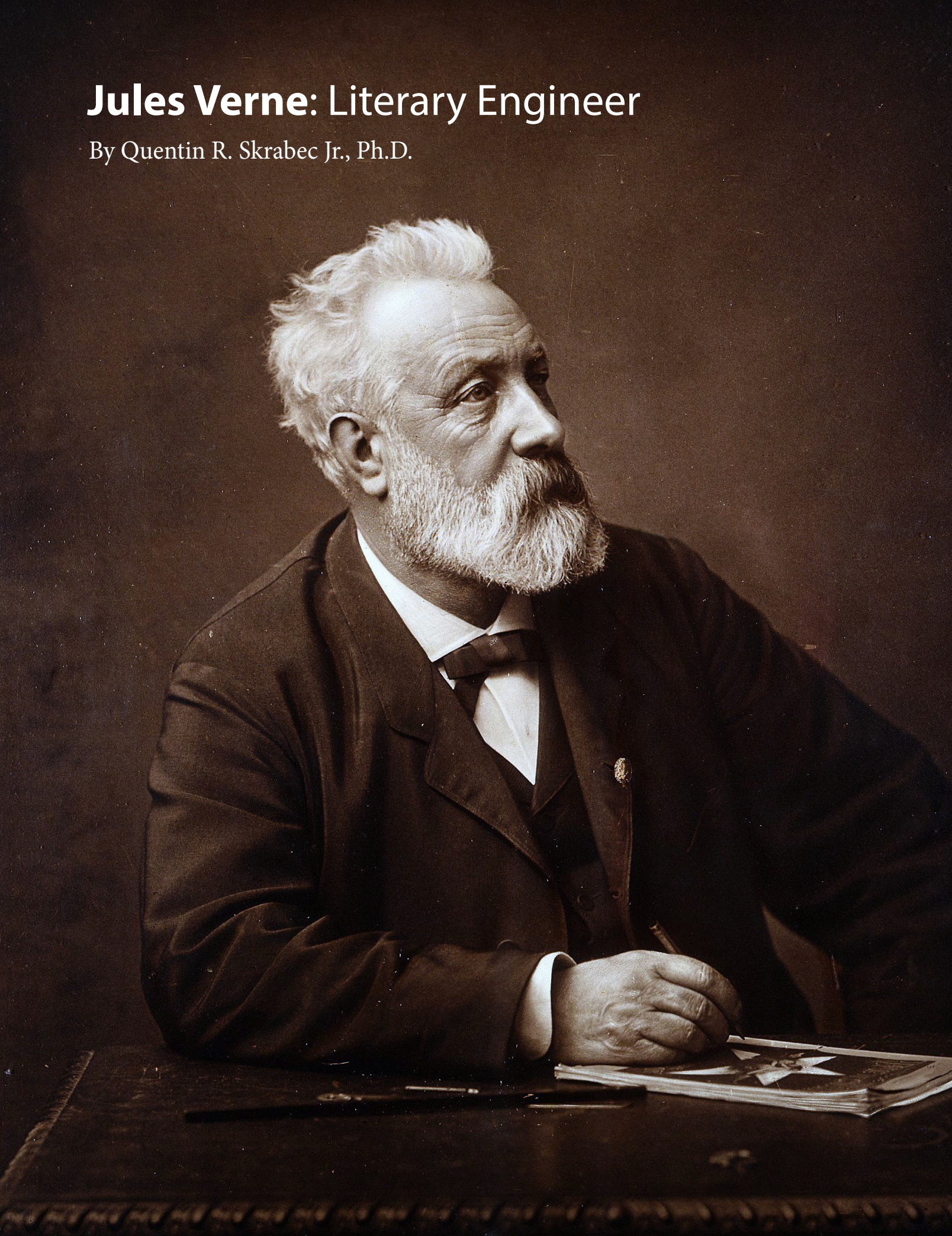
The ISS National Lab is committed to changing how the world accesses, understands, and participates in space-based R&D, supporting nontraditional users from academia, industry, and government institutions in addressing real-world issues, from healthcare crises to consumer product improvement to educating our youth about cutting-edge science, technology, engineering, and math.

Recent investigations include R&D from academic institutions such as Harvard, Stanford, Emory, and MIT—as well as payloads from Fortune 500 companies such as Procter & Gamble, Merck, and Eli Lilly and Co. These organizations are improving our quality of life here on Earth by using space to advance product development, improve drug design, study human health, and support educational programs.

NASA astronaut **Kate Rubins** working on the cool flames investigation preparation.

Jules Verne: Literary Engineer

By Quentin R. Skrabec Jr., Ph.D.

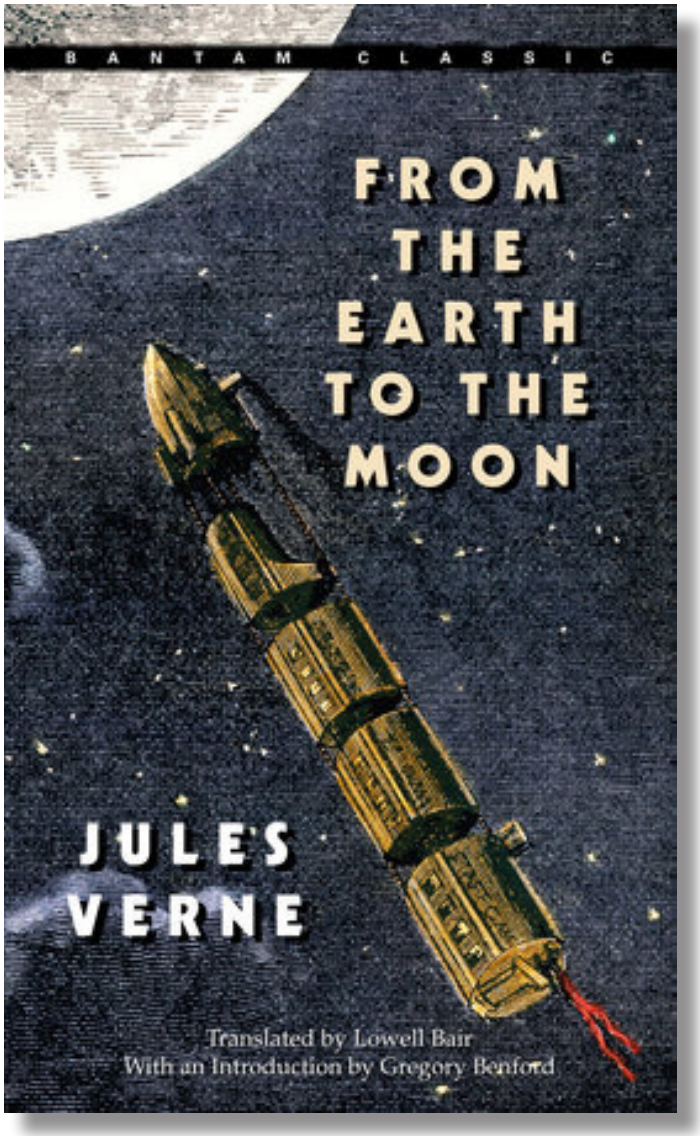


While not a scientist, Verne was an engineer[1] using literature as his drafting board and design medium. Science to him, like to the engineer, was a resource, and he used science to craft his novels and extraordinary adventures. Verne often approaches his technical stories like an engineering project.

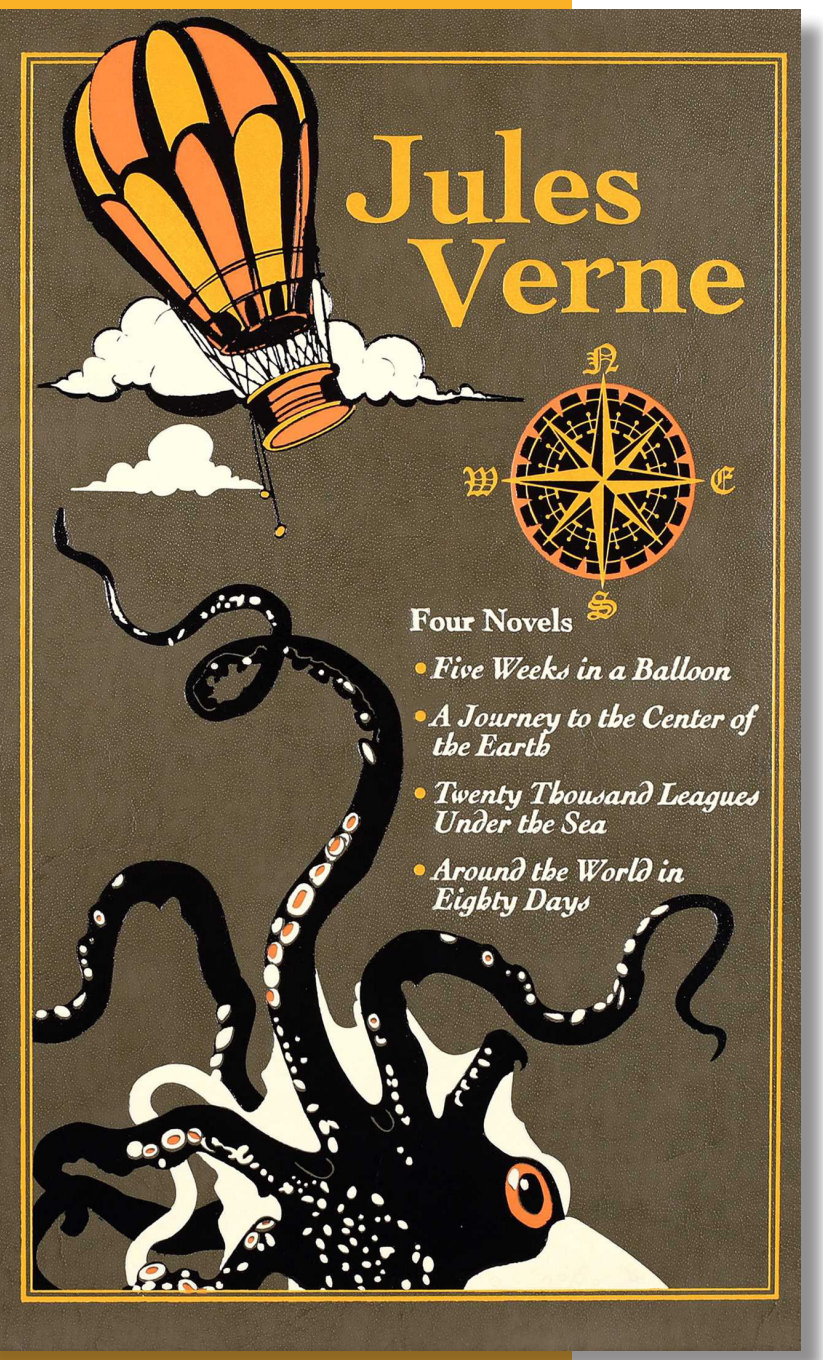
For Verne, engineering is not just part of the story's background but an integral core of the storyline. He devotes entire chapters to his step-by-step design using scientific principles, as illustrated in *From the Earth to the Moon* and *20,000 Leagues Under the Sea*. Verne uses words to build engineering prototypes and direct needed research to advance technology. Much of the time, Verne is not trying to predict the future as much as applying emerging science to his literary engineering projects. Verne uses engineering design methodology and design thinking in his technical novels.

Verne's engineering problem-solving is based on the founding principles and early rudiments of today's engineering methods, such as design thinking, project management, combinational innovation, reverse engineering, Failure-Mode-Effect Analysis, and exponential thinking.

Verne's engineering methodology is every bit as futuristic as his machines. Verne also anticipates the need for engineering as a profession and a formal problem-solving curriculum to advance innovation. Most important, Verne approaches problems like an engineer.



Verne saw the need for a new Victorian profession of engineer. This profession would be the bridge between scientist and inventor, architect and builder, and professor and applied scientist.



This new profession would require unique skills and an educational problem-solving curriculum. During Jules Verne's lifetime (1828-1905), the definition of engineering and the idea of different engineering professions was evolving[2]. The earliest need for engineers was road and bridge building in the military and urban centers.

The National School of Bridges and Highways, founded in 1747, evolved into France's premier engineering school, École Centrale Paris, in the 1800s. Napoleon's engineering graduates of Ecole Centrale were behind his battlefield success, and he envisioned civilian engineering[3] for the building of his empire. Napoleon proposed a unique role and application for civil infrastructure and industry engineers. The Ecole Centrale would be the first college in engineering and science financially supported by Napoleon to build his empire. Verne noted Ecole Centrale's leadership in educating the engineers of Europe in several of his novels.

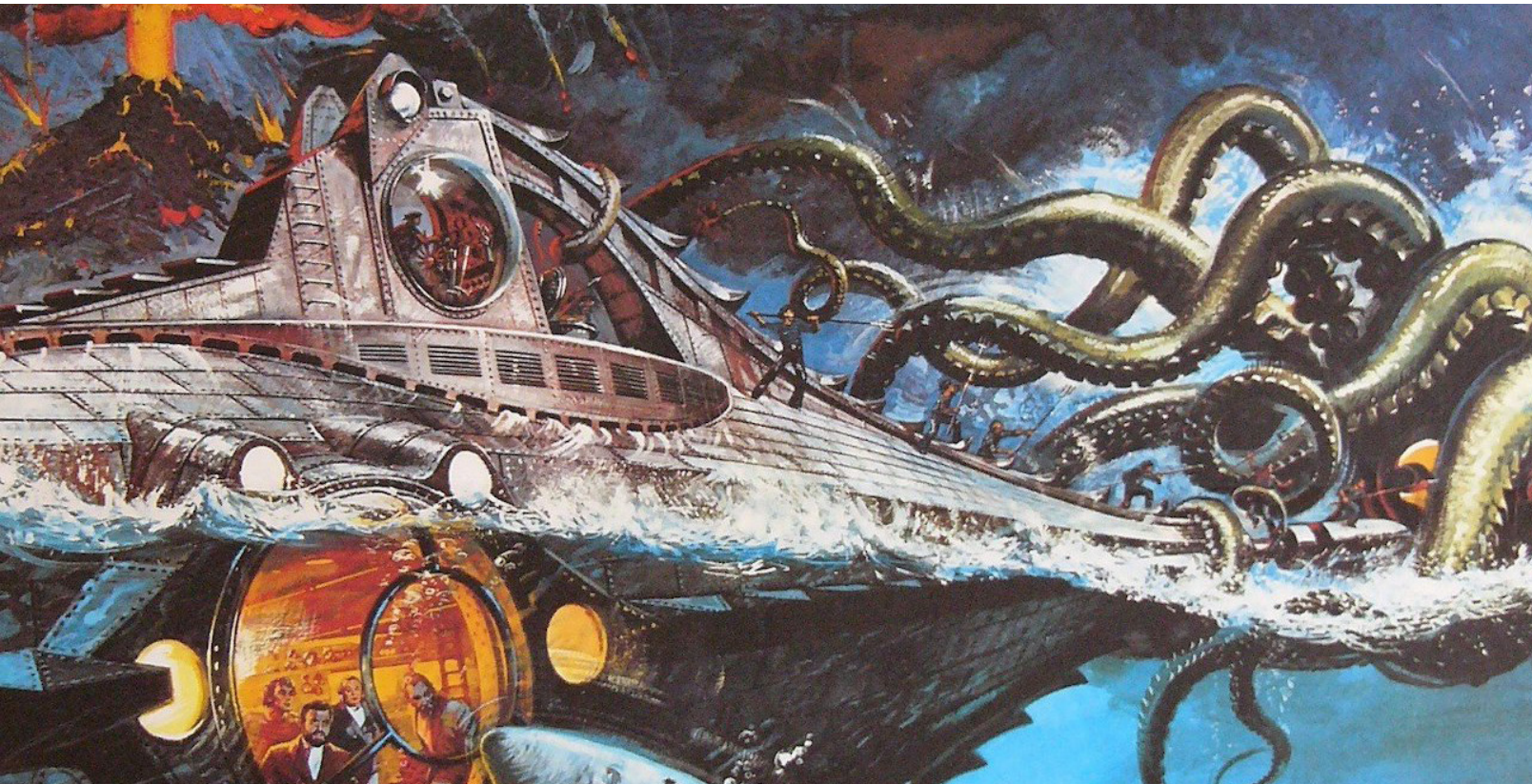
In Victorian England, The Institution of Civil Engineers, the first civil engineering society in 1818,[4] defined a civil engineer as: "An Engineer is a mediator between the Philosopher and the working Mechanic, and like an interpreter between two foreigners must understand the language of both.

The Philosopher searches into Nature and discovers her laws and promulgates the principles and adapts them to our circumstances. The working Mechanic, governed by the superintendence of the Engineer, brings his ideas into reality. Hence the absolute necessity of possessing both practical and theoretical knowledge."

As an engineer, I find this the most eloquent and insightful definition of engineering ever written because it understands that engineers are mediators between two very different occupations, the scientist and the mechanic. In *The Underground City* (1877), Verne uses several chapters to delineate this relationship between his engineering protagonist James Starr and his coal head miner Harry Ford, exemplifying the Institution's definition as a mediator.

The engineer was loosely defined in the mid-1800s, but "engineer" was not listed as an occupation in the 1850 United States census. Verne, however, saw the need for the new occupation of an engineer in his scientific adventures. Verne's protagonists in the 1860s, such as Captain Nemo (*Twenty Thousand Leagues Under the Sea*) and Impey Barbicane (*From the Earth to the Moon*), were prototype engineers.

Most early Victorian engineers received engineering training in military schools before the 1870s. Cyrus Smith (Cyrus Harding in some translations) is the archetype of a Vernian engineer in the novel *The Mysterious Island* (1874). Cyrus Smith received his engineering knowledge as a Union officer. Later in his *Voyages Exordinararie* series[6] of novels, Verne applies engineering to broader fields of the corresponding



scientific disciplines, such as mining, mechanical, electrical, chemical, and metallurgical engineering.

Verne also realized how the very nature of an engineer was developing. France of the late 1870s followed a variation of Napoleon's idea of the engineer functioning in society. The German concept of an engineer was different, seeing the engineer not as a mediator but as welding of the scientist and mechanic. The German Victorian view was one of being focused as a technical specialist with no concern for society or the environment. Verne's engineering protagonists are often the antithesis of the socio-oriented engineer he believed in. Verne saw the application of technology as a struggle between good and evil. The decision of which Verne believed was the responsibility of the engineer.

In Begum's Millions, Verne contrasts the German idea of engineering to that of the societal-oriented engineer of the French. In one of Verne's earliest novels, Paris in the Twentieth Century (1863)[7], Verne worries that the rise of science and technology in colleges would result in the decline of the fine arts, literature, and classical studies. In Verne's Propellor Island (1895), he illustrates more shortcomings of technology in urban design. Verne foresaw technological utopias that were more dystopian and unbalanced.

In *Begum's Millions* (1879), Verne contrasts different industrial city designs with the problem of industry damaging the environment and harming the health of city dwellers. In Begum's Millions, Verne's French Alsatian engineering student, Marcel Bruckmann, faces the contrast of technology applied in the ideal German city (Stahlstadt) versus the perfect French city (France-Ville). Marcel graduated from Europe's premier engineering school, École Centrale Paris, and was the epitome of a Vernian engineer.

The combination of excellence in science and mathematics with the arts and classical study gave the character Marcel the proper balance to challenge the technological-based society of Stahlstadt.

In *The Barasc Mission* (1905), Verne's protagonist engineer raises a city and farmlands out of the desert with technology, ignoring the societal improvement needed for such a utopia. Verne commonly portrayed advances in technology moving faster than society's ability to adapt and advance.

He warned that the arts, humanities, and liberal studies would be needed to counter the propensity of technological societies toward war, environmental destruction, and authoritarian rule.

Verne augured the holistic approach of "Design Thinking"[8] of today. Verne realizes that engineering is a combination of man and machine. The holistic approach brings society and the environment into design methodology. We see Verne's holistic engineering approach in the building of Verne's enormous moon-shot cannon (From the Earth to the Moon). Verne notes the lack of concern for fatal construction accidents in America. In From the Earth to the Moon (1865), project engineer Barbicane puts in a safety program to ensure the "accident rate did not exceed that of countries overseas noted for their extreme precautions."[9]

Unfortunately, American and most European engineering schools regressed by the 1900s into demanding technical curriculums to advance technology above the humanities. The German model of the engineer won out with the exponential growth of technology, just as Verne predicted. Interestingly, as Verne's popularity resurfaced in the 1960s, engineering schools sought to integrate the social sciences, literature, and the arts into the curriculum. Today we are returning to the socio-oriented engineer that Verne favored.

This type of holistic engineer can function beyond the single-minded mechanical expert. For Verne, the broader education of a socio-oriented engineer made for the perfect engineering project manager.

This 3 part series on Jules Verne will be continued in the spring issues. Be sure and follow up as we cover the amazing life and literary works of this great author.

Elevating Healthcare Delivery with Oracle CPQ

By Srilakshmi Tella

Configure, Price, Quote (CPQ) software's ability to adapt to the dynamic nature of healthcare services makes it an indispensable operational layer for healthcare providers (HCPs) striving for excellence in both patient care and business efficiency.

In the Healthcare and Life Sciences (HLS) industries in Georgia and across the nation, where precision and speed are valued and vital, Oracle CPQ has proven to be an invaluable business tool. Let's dive into its multifaceted applications, including exploring how it reorganizes complex business processes, enhances integration across systems, and upholds accuracy in critical areas like patient care planning and billing. Moving into a detailed examination, we'll explore how Oracle CPQ's ability to automate processes and integrate systems ultimately enhances patient care and organizational efficiency.

Srilakshmi Tella, Vice President of Technical Product Management at McKesson, leads transformative initiatives in digital technology. Based in Alpharetta, Georgia, she specializes in upgrading legacy systems and shaping strategic technology goals.

Oracle CPQ's Role in Healthcare Services Organizations

Automation and Streamlining of Processes

Oracle CPQ simplifies the management of configurable products and complex pricing models by automating the quote generation process, helping to effectively bridge the gap between sales and engineering departments. This automation is pivotal in minimizing manual errors (a critical factor in healthcare where mistakes can affect lives). Moreover, it accelerates service delivery, enabling healthcare providers to respond swiftly to patient needs. This boosts operational efficiency and fosters a more collaborative and cohesive company-wide workflow.

Integrations: Usability Across Systems

Oracle CPQ's integration capabilities shine particularly brightly regarding its seamless operation with Salesforce (SFDC) and Business Management (BM) systems. When maintaining multiple platforms—this interoperability proves crucial. For example, the ability to raise quote requests directly from opportunities in a unified interface streamlines both budgetary and firm quote management.

This integration reduces the time and effort required to navigate between systems, allowing healthcare professionals to focus more on patient care and less on administrative tasks.

The correct configuration of products is not just a matter of efficiency but of patient safety. Oracle CPQ's capability to quickly search for and add parts from a recommended list to the Bill of Materials (BOM) showcases its precision and agility. This feature is essential in scenarios where healthcare professionals need to configure products accurately and swiftly to meet the specific needs of patients. This level of precision in product configurations is crucial in maintaining high patient care and safety standards.

Commerce: One Platform for Pricing, Quoting, and Proposals

Oracle CPQ is a comprehensive solution for managing pricing, quoting, and proposal generation, all within a single platform. Its ability to synchronize quote details with SFDC opportunities and content sections streamlines the entire sales process in the healthcare sector. The ease with which proposal outputs can be shared, emailed, or forwarded to users and integrated systems exemplifies the platform's commitment to enhancing operational efficiency and communication within healthcare organizations.

Pricing strategies are vital to the dynamic nature of the healthcare market. Oracle CPQ rises to this challenge by allowing pricing to be flexible and accurate both internally and externally.

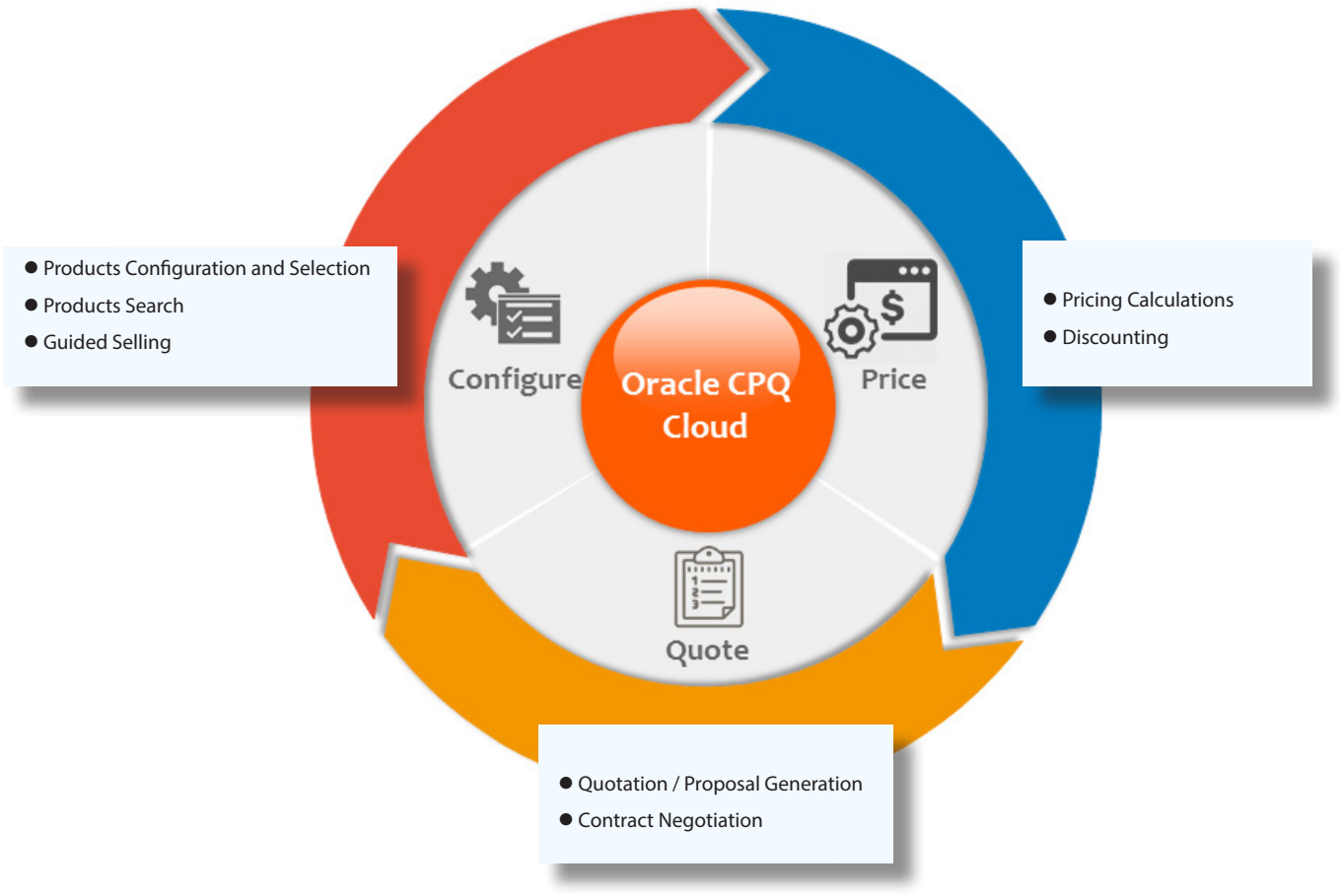
The platform's ability to define intricate pricing logic and fetch data directly from Enterprise Resource Planning (ERP) systems is invaluable in developing pricing strategies that are both competitive and compliant with healthcare industry standards.

Reports and Analytics: Data Insights for Sales Strategy

In the data-driven world of healthcare, having access to centralized sales process data, such as win rates and revenue generation, is crucial. Oracle CPQ provides sales operations leaders with these insights, enabling them to make informed decisions about pricing and selling strategies. The ability to track and analyze sales data and buying behaviors is particularly beneficial in healthcare, where understanding customer preferences and market trends is essential for developing new products and services that meet evolving patient needs.

Direct Impact on Healthcare Delivery

Oracle CPQ's extensive integration capabilities make it a cornerstone in the healthcare services industry.



Its interoperability with electronic medical records (EMR), customer relationship management (CRM), and patient billing systems streamline data flow across different departments. This seamless integration assists in swiftly creating personalized care plans. The platform's adeptness in synchronizing diverse data sources like medical records, imaging, laboratory results, and more enables healthcare providers to formulate comprehensive and tailored care plans with high efficiency. This enhances patient onboarding processes, care quality, and service delivery, making it an invaluable asset in the modern healthcare setting.

CPQ Healthcare Implementation Strategy

Process Simplification

In healthcare, where complexity is the norm, the simplification of processes is a breath of fresh air. Oracle CPQ excels in this regard, offering an intuitive user interface and streamlined workflows. This simplification extends beyond mere usability; it represents a paradigm shift in how healthcare organizations manage their sales and quoting processes. This impact is twofold: it enhances the user experience, making it easier for staff to adapt and use the system efficiently, and significantly reduces the time taken to complete tasks.

Productivity and Flexibility

The ability to scale and adapt to changing needs is a non-negotiable for today's healthcare organizations. Oracle CPQ, with its scalable architecture, meets this demand head-on. The system is designed to handle increased demand and complexity. High performance and availability are the cornerstones of Oracle CPQ, ensuring that the system remains reliable and responsive, even during peak periods. This reliability is particularly crucial in healthcare, where delays can seriously affect patient care.

Technology

Oracle CPQ's true power lies in its ease of implementation and reconfigurability. When tailored to meet the unique requirements of healthcare organizations, it integrates seamlessly with existing systems, maintaining the integrity and security of sensitive patient data. The platform's innate flexibility is a key feature, especially for complex configurations and business rules typical in healthcare settings. Efficient document generation streamlines the sales process, reducing the cycle time for quotes and proposal generation.

Data Management

Oracle CPQ should be configured with

a keen awareness of the stringent data laws and regulations within the healthcare sector. The platform's strategy involves minimal data migration, focusing instead on transaction-level data integration. This approach significantly reduces the risks associated with data migration, such as data loss or corruption. By pulling in only the necessary data from various applications, Oracle CPQ ensures compliance with healthcare data privacy standards.

Health Systems and Tools Integration

Oracle CPQ should not operate in isolation and is not designed to be an out-of-the-box solution for healthcare organizations. Its effectiveness is enhanced when integrated with a suite of complementary tools:

- ERP Systems: Essential to managing pricing, orders, invoicing, and logistics, providing a comprehensive view of the organization's inventory or catalog.

- CRM Systems: These serve as the backbone for account and product management, providing a centralized repository of customer and product data.

- DevOps Tools: Tools like GITHUB+ Gearset are crucial for automated deployments, ensuring that updates and changes to the CPQ system are implemented smoothly and efficiently.

- Project Management Tools: JIRA is most commonly used to track requirements and project progress, ensuring that all stakeholders have a clear understanding of the project's status at all times.

- Integration Layers: Platforms like MuleSoft facilitate the connection between CPQ and various other applications, ensuring smooth data flow and system interoperability.

Integrating these tools with Oracle CPQ creates a robust ecosystem that supports the complex needs of healthcare organizations, ensuring that all aspects of patient care and organizational management are seamlessly interconnected.

CPQ's Role in Aligning Sales, Marketing, and Operations

In the healthcare sector, Oracle CPQ's role in aligning sales, marketing, and service is to enhance the overall efficiency of these departments by facilitating faster and more accurate order processing. By enabling customer service teams to process orders swiftly, Oracle CPQ ensures that the focus remains on patient care. This is vital in a sector where timely and accurate service delivery directly impacts patient outcomes.

Case Study -Customization and Configuration Challenges

In a notable case involving a multibillion-dollar industrial conglomerate, Oracle CPQ solved for significant organizational challenges that required balancing rapid deployment with minimal disruption to operational productivity. The solution was to implement the system in phases, starting with a Minimum Viable Product (MVP) and gradually expanding its capabilities.

This phased approach ensured that the implementation did not disrupt their existing processes and allowed for timely adjustments based on stakeholder feedback. Ensuring collaboration between Engineering and Sales was essential in this scenario, as it was necessary to develop proposals across multiple departments. The success of this project highlighted Oracle CPQ's flexibility and ability to be tailored to meet the specific needs of large, complex organizations.

Oracle CPQ has emerged as an essential tool in the healthcare sector, driving significant improvements in operational efficiency and data accuracy that enhance patient care quality. Its ability to automate and streamline complex processes, coupled with its integration capabilities with various systems, make it an indispensable asset for healthcare organizations. The platform's customization and configuration flexibility address the healthcare sector's unique challenges, enabling providers to offer personalized care efficiently and accurately.

As the healthcare industry continues to evolve, the role of Oracle CPQ is expected to expand, becoming even more integrated into the CRM ecosystem and playing a pivotal role in aligning sales, marketing, and operations. The expertise and methodologies driving Oracle CPQ implementations underscore a commitment to innovation, collaboration, and continuous improvement.

Oracle CPQ's impact on the healthcare sector is a testament to the power of technology in transforming patient outcomes. With its ability to streamline care delivery through enhanced operational efficiency, Oracle CPQ is driving tremendous innovation within healthcare technology.

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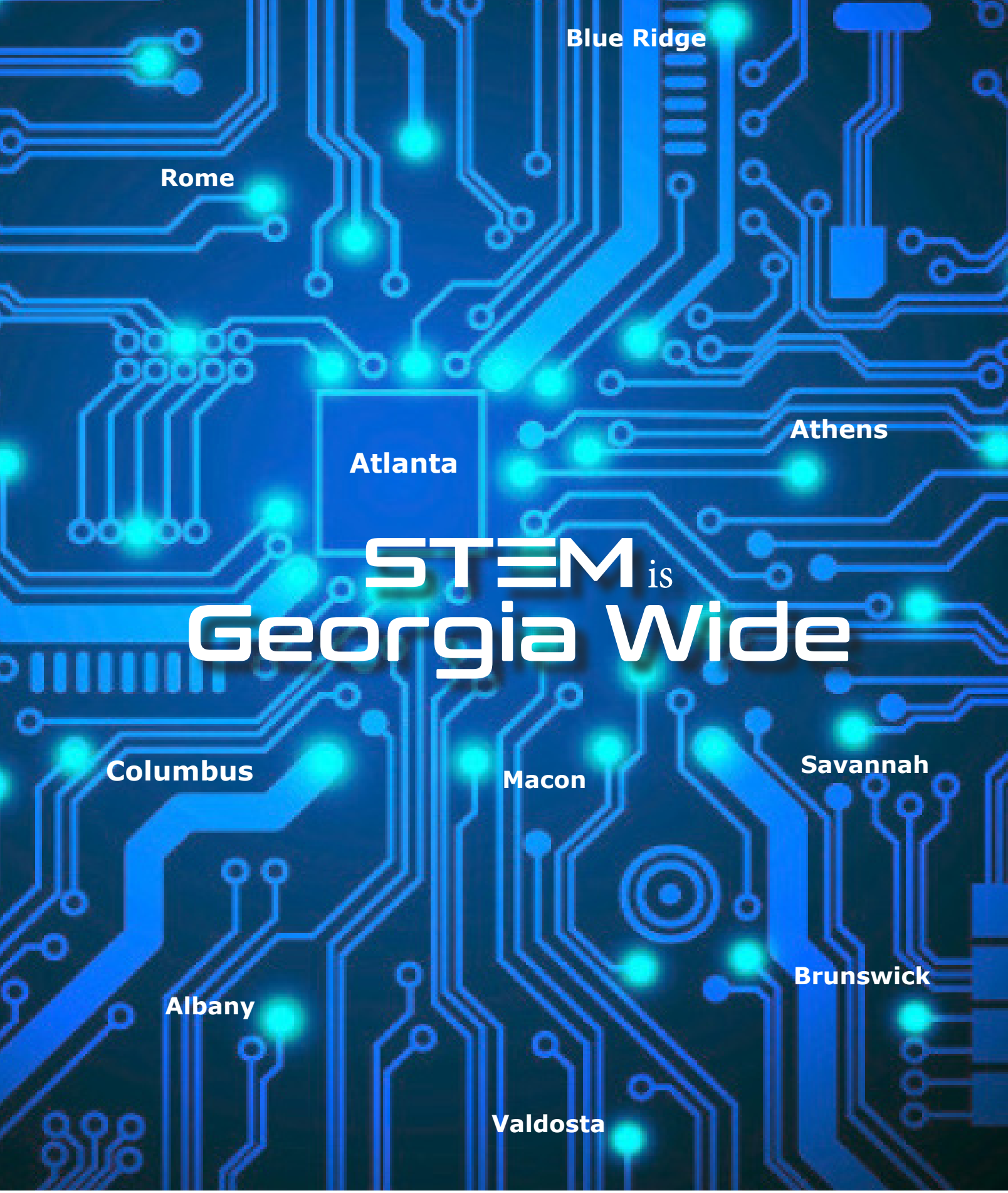

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