TANGO@SC25 Annual Report, June 2, 2026

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In early 2025, John Gustafson asked if STEM-Trek would consider collaborating with the **C**onference **o**n **N**ext-**G**eneration **A**rithmetic (CoNGA) to join our annual pre-conference workshop ahead of the Supercomputing Conference, SC25. I enthusiastically said, "yes!" Since 2019, I've closely followed activity in Dr. Gustafson's realm. It's exciting that next-generation arithmetic is found to process artificial intelligence/Machine Learning (AI/ML) and other data-intensive computational workloads with greater accuracy and fewer bits which addresses both energy and storage challenges found with traditional platforms.

Dr. Gustafson is chiefly known among mathematicians as the father of Gustafson's law.[1] He currently serves as Visiting Scholar at Arizona State University and Chief Scientist at Vq Research, Inc. Prior roles include Chief Graphics Product Architect and Senior Fellow at AMD, Solutions Architect at Intel Labs-SC, CEO of Massively Parallel Technologies, Inc. and CTO at ClearSpeed Technology. Historically, CoNGA was hosted by the **A**gency for **S**cience, **T**echnology **a**nd **R**esearch (A*STAR) in Singapore where Dr. Gustafson worked for eight years prior to returning to the U.S. in 2022. COVID prevented in-person assemblies for a few years, and CoNGA has been slow to gain traction with him this side of the pond. In 2022, Dr. Gustafson introduced "posits" as a replacement for IEEE 754 standard as it alleviates issues found with floats.[2] Posits use a variable number of bits for the fraction and exponent fields, which offers a larger dynamic range and higher accuracy than IEEE floats of the same size.

Adhering to a dance theme, we established the "TANGO" moniker for this year's workshop – a celebration of non**T**raditional **A**rchitecture and **N**ext-**G**en Computational **O**rchestration. Also in

collaboration with Texas A&M University, STEM-Trek hosted TANGO@SC25 [3] at the America's Center in St. Louis, Missouri. While a TANGO dance demonstration was performed by Horst Severini (U-Oklahoma) and Liwen Shih (U-Houston – Clear Lake), dancing shoes were not required to learn how Compute eXpress Link (CXL), RISC-V and Next-Gen Math are driving a revolution toward more efficient supercomputers.

While the math was new to most attendees, several CoNGA papers were presented that explained why it's important, and how it's being implemented. As research workflows become more data-intensive and complex, there is a need for greater acceleration (NVIDIA GPUs being the popular choice). Federated GPU-heavy systems are fully-subscribed, and the community demands more. The practice of adding more and more acceleration is costly. However, innovation that employs next-generation arithmetic (Posits, Takums, etc.), CXL [4] and RISC-V technologies is tackling both power and storage challenges for AI/ML workflows, while paving the way for quantum computing which will invariably rely on all of the above plus alternate standards. TANGO acquainted participants with basic steps; all enjoyed meeting others from around the world who work in similar roles. Having coalesced over two days, the TANGO cohort felt more comfortable jumping into the deep end of the SC25 conference that drew 16,500 attendees and 650 exhibitors.

TANGO convened November 14-15 ahead of SC25, November 16–22. Our traditional "jetlag day" was Friday, November 14. This year it was open to all who wanted to join, and travel awards included an additional two days' coverage. Even so, it's difficult for some to take ten days away from their day job. Therefore, Saturday's gathering was larger – 50 attended from eight countries – our largest cohort to date. Twenty-five were supported (wholly or in part) by NSF funds. Two missed the group photo, and two others who aren't in the photo had joined from Calligo Tech (India). Calligo produced the first Posits-based accelerator; Posits was developed by Dr. Gustafson with decades of effort.

Each participant brought unique skills, experience and insights to the cohort. Interesting discussions were had during breaks and meals. It's always gratifying when they remark that our workshop was the highlight of their SC experience, which several have done in their blogs. While Leon Pollock (Dell Solutions Consultant/AI) had a business case to attend ART@SC24, he returned on his own this time because he found it to be so beneficial last year. He was front-and-center at every session!

Pollock wrote: *"Thank you for welcoming me to your program again this year. I bought Dr. Gustafson's book [5]; last night I set up a Jupyter Notebook so that I can gain practical knowledge of Takums in the coming year. I created a learning plan with accountability check-ins and milestones that will deliver the foundation of my portfolio development. I'm truly inspired and grateful to STEM-Trek for hosting this event!"*

Leon made arrangements with *Sauce on the Side*, the restaurant that hosted Saturday's group dinner, to serve decorated cakes that he brought to celebrate cohort birthdays. He is always welcome in our community!

Jetlag Day [6] was held Friday, November 14; we were guests of T-Kartor, Esri, T-Rex, and others. The venue was a short walk from the America's Center; the Post Building [7] once housed the Pulitzer-prize winning newspaper, and is now home to a variety of startups, including geographic information system (GIS) research labs that exist within the orbit of the National Geospatial-Intelligence Agency (NGA) based in East St. Louis. While NGA work is classified, those who contribute were happy to share highlights of their work with the TANGO/CoNGA cohort. They are interested in expanding their GIS ecosystem and are always recruiting.

CoNGA co-General Chair Himeshi De Silva enjoying the Post Building paper slide (Image courtesy STEM-Trek Community)

The Post Building houses remnants of the old press operation and production line including a slide once used to move papers from the press down one level to be loaded onto delivery trucks. Today, it serves as a human slide. Everyone, including Himeshi De Silva (Singapore) featured in this photograph, had huge smiles on their faces when they tried it out!

After the GIS presentations at the Post Building, 20 from the cohort visited Top Notch Axe-Throwing and enjoyed a pizza party. Vasilka Chergarova (AmLight), Senzo Mpungose (U-Witwatersrand), and Sean Feeney (Texas A&M University) demonstrated their skills (from left, below; photos by Liwen Shih, U-Houston).

On Saturday, we gathered at the America's Center. CoNGA kicked off with a talk by Dr. Gustafson, and a keynote by Jeffrey Sarnoff (IEEE). Sarnoff talked about his work with IEEE P3109 Standard for Machine Learning Arithmetic. With more than 40 years of experience at the forefront of computer science, software engineering and digital innovation, Sarnoff is well qualified to lead this effort. He pioneered early 3D graphics in the 1980's and currently leads IEEE high-impact initiatives in numerical computing and software standards. Early in his career, he taught one of the first college-level courses that bridged art and computing at the Rhode Island School of Design. More recently, he has been recognized for exceptional contributions to IEEE technical standards, open-source communities and industry-leading organizations.

Sarnoff combines deep technical expertise in floating-point arithmetic, computer graphics and high-performance computing with proven leadership in cross-functional teams and industry

consortia. As an open-source evangelist, he has authored numerous Julia programming language packages, including: DoubleFloats.jl (extended precision arithmetic), NamedTupleTools.jl, Saferintegers.jl, RollingFunctions.jl, ArbNumerics.jl and more. Sarnoff holds an MBA from Cornell University, attended Stanford University as an undergraduate and graduated from Bennington College with majors in Computer Science and Psychology.

Physical activity helps expedite jetlag recovery, so we always plan something fun and active. Stem-Trek SC25 participants from left: Vasilka Chergarova (AmLight), Senzo Mpungose (U-Witwatersrand), and Sean Feeney (Texas A&M University) demonstrated their skills (photos by Liwen Shih, U-Houston).

A call for papers had been released by CoNGA [8] in May. Several authors were on hand to present their papers, from as far as Singapore. Participant blogs [9] are available on the STEM-Trek website. A two-hour hands-on Julia training session was led by Jeffrey Sarnoff, with Texas A&M HPRC trainers Wesley Brashear and TAMU Faculty Member Jian Tao. From the Julia website [10]: *Julia is a high-level, high-performance programming language designed for technical computing, especially in areas like scientific computing, machine learning and data analysis. It aims to combine the ease of use of Python with the speed of languages like C and Fortran. Julia is dynamically typed and supports interactive use, making it suitable for both prototyping and deploying complex applications.*

While all were welcome to apply for the TANGO@SC25 workshop, this series has historically served participants from NSF EPSCoR regions in the U.S. and Southern African Development Community (SADC) member states that participate in the African High Performance Computing (HPC) Ecosystems project led by the South African Centre for HPC. All who are involved with or curious about next-generation arithmetic, CXL and RISC-V innovation were welcome to apply this year.

On Sunday, all engaged with the full SC conference. Most wrote about the technical sessions they attended in their blogs. On Wednesday evening many attended Dell's customer appreciation event at FanDuel Sports Live at Ballpark Village. A caricature artist drew portraits; this is my favorite photo from the week (below). These four young women roomed together in a shared AirBnB. They used the buddy-system when walking in downtown St. Louis, which can be rough as any urban environment can be. Among them were a USAF Academy Cadet (majoring in cybersecurity), a TAMU undergraduate scholar (majoring in CS and Math and works with Leake on the TAMU High Performance Research Computing team), the General Co-Chair from Singapore (majoring in mathematics at NUST, and presenting CoNGA author), and a PhD Student (CS) from The Ohio State University. Each blogged about their experience, and/or presented about it at their home institution. The cadet's efforts will help pave the way for future cadets to attend SC. This is the second year we've hosted cadets. It's not easy for them to attend conferences otherwise, but it's important that they learn the skills they need to become technically proficient in the latest innovation.

At the Dell customer appreciation event: Honggao Liu (far left), Executive Director of the High Performance Research Computing Team at Texas A&M University, along with Leake (foreground) and four students (Image courtesy Steve Tran, TAMU Systems Engineer)

By November 21 most had departed. With government shutdown-related issues that week, many flights were canceled. Seven who remained joined me at the Marriott Courtyard Downtown for another dinner from *Sauce on the Side*, located just around the corner (sponsored by Google). All found St. Louis merchants to be accommodating and of great value!

The CoNGA workshop drew several from Germany this year, including Laslo Hunhold [11], Senior AI Accelerator Engineer at Openchip & Software Technologies (Barcelona). He said, *"Ultimately, human connections are the true value of attending a conference in person, and I am deeply grateful for the opportunity to attend TANGO/CoNGA and SC25. Much like the Gateway Arch in St. Louis, such gatherings serve as a portal to the unknown: the uncharted territory of computing and scientific progress. What makes the journey worthwhile is knowing that, on this frontier, there are capable and passionate people alongside you, ready to explore, experiment and push the limits together."*

Planning committee

Elizabeth Leake, Director, (Texas A&M University; Founder and Director, STEM-Trek Nonprofit [12]; Texas A&M HPRC Project Manager of Advanced CI IV). Leake served as general Co-Chair for the Conference on Next-Generation Arithmetic (CoNGA) in 2025 and 2026.

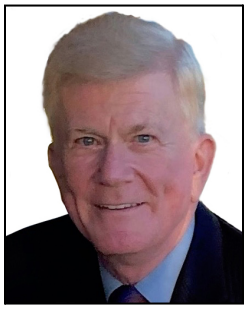
Bryan Johnston, Senior HPC Systems Technologist II, (CHPC South Africa)[13]
John Poole, Center for Human Genetics, Clemson University
Kurt Keville, SemiconDX/Somerville Dynamics

TANGO@SC25 Agenda:

1. **Jet Lag Day** [6]: On November 14, we visited a number of NGA/GIS-related labs located downtown within walking distance of the convention center. The labs represent the public face of geospatial innovation surrounding the nearby NGA. We were hosted by Simon Bailey [14] (CEO, T-Kartor and board member - St. Louis Science Center). St. Louis Area Community of Interest - USGIF[15].

2. Saturday workshop: CoNGA in the morning, and CXL/RISC-V in the afternoon.

CoNGA Welcome, John Gustafson (Arizona State University)



John Gustafson is an American computer scientist and businessman chiefly known as the father of Gustafson's law.[1] He currently serves as the Chief Technology Officer (CTO) at Ceranovo, Inc. Prior roles include Chief Graphics Product Architect and Senior Fellow at AMD, Solutions Architect at Intel Labs-SC, CEO of Massively Parallel Technologies, Inc.and CTO at ClearSpeed Technology. Gustafson holds applied mathematics degrees from the California Institute of Technology and Iowa State University.

Keynote, Jeffrey Sarnoff (Editor in Chief, IEEE P3109 Standard)

With more than 40 years of experience at the forefront of computer science, software engineering and digital innovation, Jeffrey Sarnoff is well qualified to lead the P3109 Standard for Machine Learning Arithmetic. He pioneered early 3D graphics in the 1980's and currently leads IEEE high-impact initiatives in numerical computing and software standards. Early in his career, he taught one of the first college-level courses that bridged art and computing at the Rhode Island School of Design. More recently, he has been recognized for exceptional contributions to IEEE technical standards,

open-source communities, and industry-leading organizations. Sarnoff combines deep technical expertise in floating-point arithmetic, computer graphics and high-performance computing with proven leadership in cross-functional teams and industry consortia. As an open-source evangelist, he has authored numerous Julia programming language packages, including: DoubleFloats.jl (extended precision arithmetic), NamedTupleTools.jl, Saferintegers.jl, RollingFunctions.jl, ArbNumerics.jl and more. Sarnoff holds an MBA from Cornell University, attended Stanford University as an undergraduate and graduated from Bennington College with majors in Computer Science and Psychology.

- Authors of the four (or more) best CoNGA papers [8] were invited to present.
- Lunch was sponsored by T-Kartor.
- In the afternoon, we heard a series of talks on CXL and RISC-V innovation. Those who presented at the PEARC24 CXL Meetup [16] were invited to present.
- Georgia Tech Rogues Gallery (also supported by NSF) overview was presented by Aaron Jezghani.
- A two-hour hands-on Julia training session was led by Jeffrey Sarnoff, with Texas A&M HPRC trainers Wesley Brashear and TAMU Faculty Member Jian Tao.
  Julia is a high-level, high-performance programming language designed for technical computing, especially in areas like scientific computing, machine learning, and data analysis. It aims to combine the ease of use of Python with the speed of languages like C and Fortran. Julia is dynamically typed and supports interactive use, making it suitable for both prototyping and deploying complex applications.

Evening social activity - Sponsored by Google.

Participants were invited to attend an Axe-Throwing Extravaganza at Top Notch Axe Throwing. Axe-throwers were required to sign a second indemnification form, and proof of US-based medical insurance was required.

Sponsors:

The SC25 General Chair Lori Diachin (Principal Deputy Associate Director, Computing Directorate at Lawrence Livermore National Laboratory) donated 18 full tech program registrations including workshops and tutorials. These will be to applicants who most need them. South African Airlink Airlines - sponsored delegate flights for participants from Bots, Nam, Zim, Zam, Moz and Tanz flights to JNB (from airports they serve on the continent). We were awarded a grant from the US NSF (23-1 Program for Education and Workforce Development), and carried over funds that weren't used the previous year. Additionally, donations to STEM-Trek supported international participant costs, our affinity garment (black with red trim and the TANGO graphic), and some group meals.

Looking forward - CoNGA-Q@SC26

The eighth in this pre-conference series will be held in Chicago, November 13-15, 2026. Funds remaining from the TANGO@SC25 workshop were extended and will be applied to support participants who attend CoNGA-Q@SC26 (the government shut-down, flight cancellations, newly-imposed university policies against travel of any kind, and other problems resulted in some unused funds). The SC26 General Chair donated 18 technical program registration passes, and one media pass for Leake. Additionally, donations to STEM-Trek will support US and international delegate participation costs. We hope to accommodate 50 participants again in 2026. Most who attend SC via this pre-conference opportunity would not be able to attend SC if it were not for this program.[27]

History

This was the seventh in a series of SC co-located workshops that STEM-Trek [17]has hosted since 2015. The previous six were supported by the U.S. National Science Foundation (NSF; supplements to existing grants, or individual awards), and donations to STEM-Trek. The first, in collaboration with Executive Director Dan Stanzione at the Texas Advanced Computing Center (TACC)[18], was for systems administrators and research facilitators. The second: “HPC On Common Ground@SC16,” [19] in collaboration with the University of Oklahoma and Oklahoma State University, focused on food security science. URISC@SC17 [20] provided cybersecurity training and was co-facilitated by Indiana University and the NSF Trusted-CI program. Funding lapsed in 2018-19, and activities were less communal at SC20-21 due to COVID (ScienceSlams were held online).[21] In 2022, we held the first in-person workshop in five years titled, EarthSci@SC22.[22] NRG@SC23 [23] was a convening to discuss energy-related challenges in resource-constrained environments. ART@SC24, [24] in coordination with Texas A&M University, home of the novel National Science Foundation (NSF)-funded ACES (Accelerating Computing for Emerging Sciences) composable testbed, had an artificial intelligence theme and drew our largest cohort to date (43). ART@SC24 explored the benefits and pitfalls of AI, and complexities associated with AI/ML workflows. Participant blogs [25] from past events, and TANGO@SC25, are available on the STEM-Trek website.

Jetlag Day - time to adjust to the new time zone and altitude. In 2024 the international delegation attended a jetlag day at Georgia Tech.[26] They enjoyed presentations that showcased the resources and services hosted there, and more. The 2023 jetlag day was held at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado (photo above). The TANGO@SC25 jetlag day was open to all who wished to learn more about the National Geospatial Intelligence Agency (NGA), geographic information systems (GIS) technology and St. Louis, in general.

Forty-three attended the ART@SC24 event in Atlanta, Georgia.

Thirty-five attended the NRG@SC23 workshop in Denver, Colorado.

While several were self- or institutionally-supported, most were funded, fully or in part, by the US NSF (US delegates), South African Council for Scientific and Industrial Research (South African delegates), STEM-Trek and the SC Conference General Chairs. Each year more attend who are supported by their institutions - they have found this workshop to be very beneficial. Some have mentioned that it is the highlight of their entire SC experience.

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