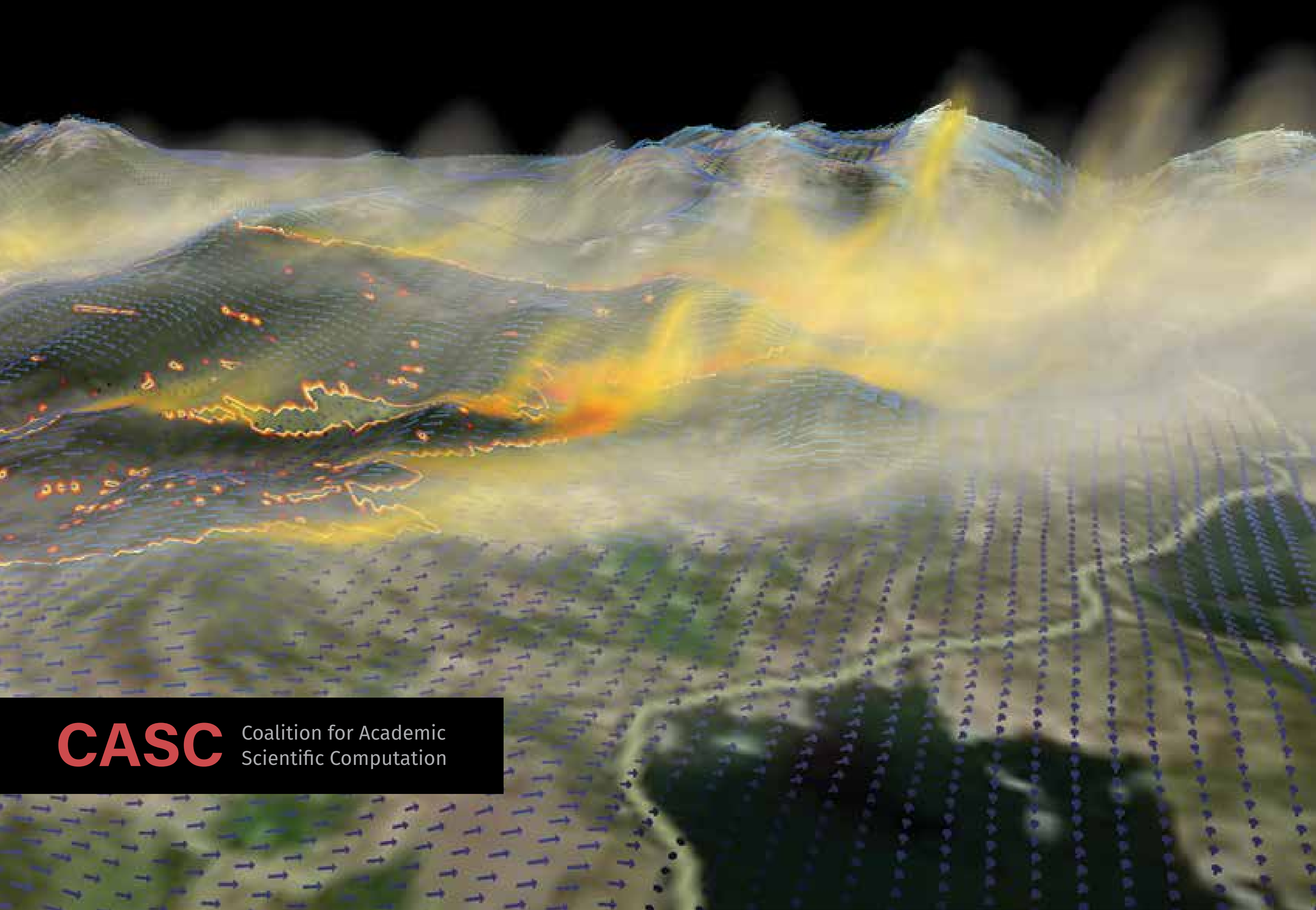
CASC

The Future Is Now

Research Computing for Today's Challenges and Tomorrow's Solutions



CASC Coalition for Academic Scientific Computation

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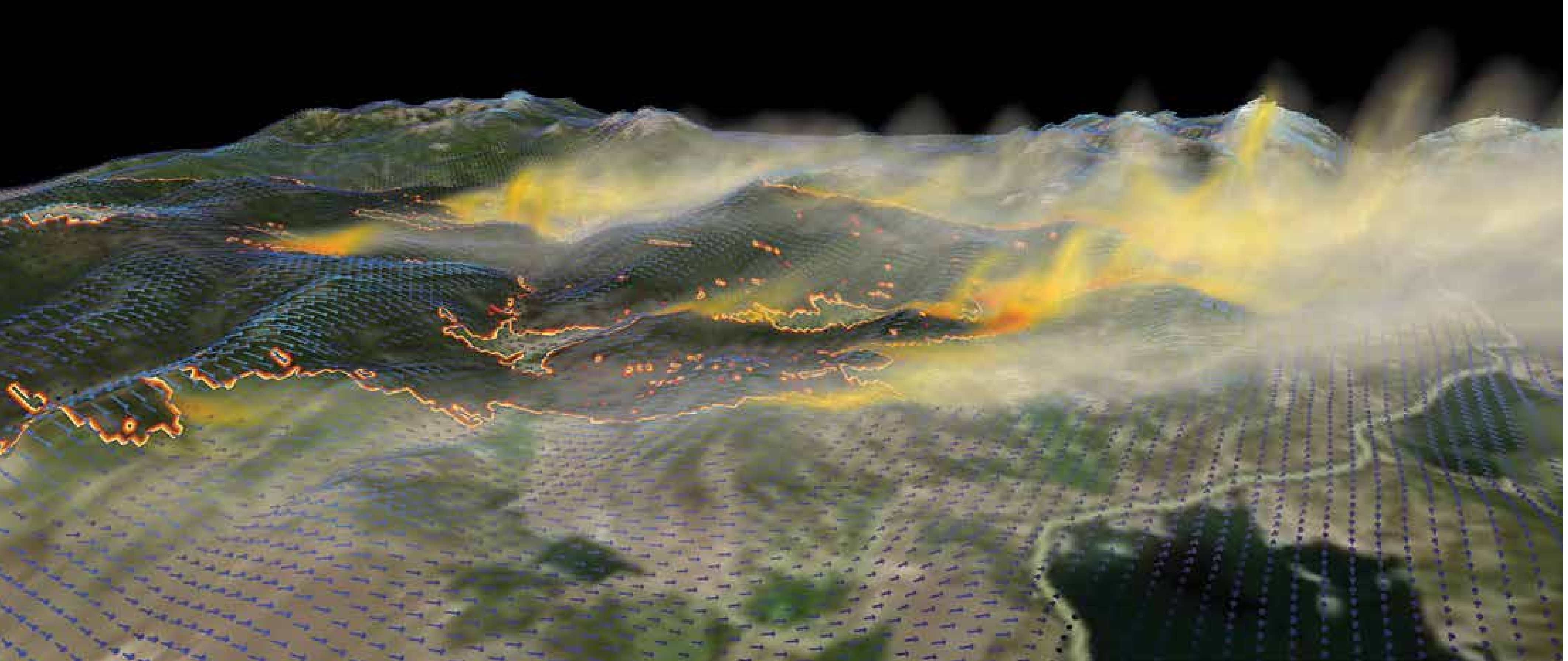

CASC Mission

- To advocate for the importance of and need for public and private investment in research computing and data services to support academic research.
- To serve as a trusted advisor to federal agencies on the direction of relevant funding programs.
- To actively engage in discussions of policies related to research computing and data services.
- To foster advancement of a robust and diverse community of current and emerging leaders in this field.
- To provide a forum for the community to share strategic ideas and best practices.

CASC Executive Committee

- Jim Wilgenbusch, University of Minnesota, Twin Cities (*Chair*)
- Rich Knepper, Cornell University (*Vice Chair*)
- Barr von Oehsen, Pittsburgh Supercomputing Center (*Secretary*)
- David Hart, National Center for Atmospheric Research (*Treasurer*)
- Kathryn Kelley, CASC Executive Director
- Carolyn Casler, CASC Operations Manager

Communications Committee

- Melyssa Fratkin, Texas Advanced Computing Center (*Chair*)
- Andrew Bell, University of Virginia
- Marisa Brazil, Arizona State University
- Brian Connelly, University of Pittsburgh
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- Lauren Gilmore, Southern Methodist University
- Kristin Lepping, Rutgers University
- Paul Redfern, Cornell University
- Stephanie Suber, Renaissance Computing Institute

Dear Colleagues and Friends of CASC,

I hope this letter finds you in good health and high spirits. For those who are new to CASC, our brochure is one of the ways that we highlight the great work taking place at our member institutions. For over 30 years, our members have helped to shape the research computing and data services ecosystem, and our brochures chronicle the truly amazing impact that this work has had on our nation's research enterprise.

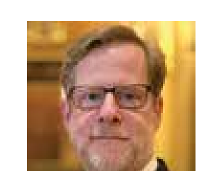
In these pages, you will learn how the world-class computing and data analysis resources developed and sustained by our members have helped to reveal the impacts we can expect from global climate change, giving decision makers information they need to get ahead of future crises. You'll see how massive computations are helping us to engineer new materials and design solutions to help people live longer and healthier lives. And you'll find out what our members are doing to address critical cybersecurity challenges and train the next generation of cyberinfrastructure experts.

This is indeed amazing work, but what inspires me most about the stories highlighted in this brochure is knowing that they are but a glimpse of the impactful efforts being made by our member organizations to accelerate discovery and foster a diverse community of leaders.

The CASC Executive Committee and member committees are hard at work advancing our strategic plan. I will take a stab at highlighting some of these activities here, but like our member stories, this is only the tip of the iceberg.

- **Promoting Team Science**: CASC facilitates dynamic collaborations among diverse groups and disciplines. One example is the strong presence of CASC and its members at the National Science Foundation Research Infrastructure Workshop; in addition to presentations on "Different Models of Data Governance," we highlighted CASC priorities at the poster session and our CASC colleagues led a session dedicated to advancing understanding in this area as part of the Regulated Research Community of Practice.
- **Advancing Computational Research**: CASC promotes research papers and other scientific outputs highlighting groundbreaking discoveries and technological advancements that have the potential to reshape our understanding of the world. A sampling of this exciting work fills the pages of this brochure.
- **Engaging Policymakers**: We are proud to actively engage with policymakers and stakeholders to advocate for the importance of scientific computation in academia. Through strategic advocacy efforts, we have worked to secure funding and support for computational research initiatives with the potential to drive significant societal impact. Earlier this year, I participated on behalf of CASC at an HPE-sponsored Congressional briefing on the need for expanded U.S. investments to win the global race in supercomputing and AI, advocating for the need for a prepared workforce and urging for additional government investment and partnership with academic institutions to speed discovery.
- **Supporting Emerging Leaders**: CASC is dedicated to nurturing the next generation of computational research and data leaders. We provide grants, scholarships, and mentorship opportunities to support a robust training pipeline and help professionals grow into leadership roles, with a special focus on fostering women and groups who are underrepresented in STEM.
- **Sharing Best Practices**: To promulgate best practices, CASC facilitates knowledge-sharing sessions across the research computing community, not only at our own member meetings but also at annual PEARC and SC Conferences, helping institutions learn from each other's experiences and implement effective strategies to enhance their capabilities and impacts.
- **Providing Thought Leadership**: Widely recognized as a thought leader in the field of scientific computation, CASC actively participates in international conferences, panel discussions, and symposia, sharing our expertise and helping to shape the future of computational research. One example is our presentation on the "ABCs of Research Computing" to higher education and research center Chief Information Officers at the annual EDUCAUSE conference.
- **Impacting Policy**: Galvanized by the 2021 "Missing Millions" report and other developments, our Positions Committee and workgroup on Research Ecosystem Inclusivity have worked hard to broaden our reach and foster a more inclusive and equitable sense of community within research computing and data. In addition, our Research Data Management workgroup outlined the major scope and potential navigation paths that research computing and data centers can take, and during our biannual CASC membership meetings we regularly invite thought leaders and federal agency directors and managers to share their latest insights and most pressing issues.

I hope that you are inspired by the stories contained in this brochure, and I also hope that these stories help you to imagine what may come next.



Warm regards,

James "Jim" Wilgenbusch

Chair, Coalition for Academic Scientific Computation (CASC)

CASC leadership and staff at the Fall 2023 CASC meeting

Member representatives at the Fall 2023 CASC meeting

Images here and on cover copyright Scott Pearse, National Center for Atmospheric Research

The Future Is Now

In the past, we tended to talk about realizing the full potential of computational science in the future tense. We envisioned bigger, bolder scientific questions and workflows – things that scientists could do in the future if we made the right investments today.

We imagined exciting technologies that could transform daily life – a sci-fi future with personalized medicines, all-seeing sensors, helpful robots, and self-driving taxis.

We talked about climate change and other environmental upheavals as impending threats – real, but somewhat distanced from our lives, a troubling trajectory that may yet be avoided.

For better and worse, the future has arrived.

The impacts of climate change are at our doorstep, with seemingly every corner of our nation facing dangerous wildfires and smoke, searing summer heat, unprecedented storms and floods, and other environmental strains.

At the same time, thrilling futuristic technologies are finding their way into our health clinics, cities, businesses, cars, and more, bringing opportunities to transform the way we live and work.

And our investments in computational research are paying rich dividends. Computational science is how science is done – no longer on the fringes but integral to the research enterprise. Research computing and data professionals are vital to scientific teams and a vital source of expertise and best practices to solve problems and move research forward. Probing vast data troves, often with help from AI copilots, we uncover surprising solutions to stunningly complex problems.

Even as we look ahead to the many challenges that stand before us, let's take a moment to celebrate the fruits of our labor – to recognize the investments of the past that have enabled so many of the gains that we reaping today. And let's pay it forward by continuing to invest in the computational research infrastructure and workforce that will be needed to make new discoveries, solve tomorrow's problems, and propel the future economy.

Better Simulations to Save Lives

Wildfires have become a distressingly regular part of our lives as they grow both stronger and more frequent with climate change. In order to direct response teams and guide evacuation orders, decision-makers rely on wildfire simulations and forecasts, but these are only as good as their input data. For example, model predictions for a 2020 Colorado wildfire that burned more than 200,000 acres in 9 days were inaccurate because they failed to account for recent insect infestations and storms that had significantly increased the number of dead or downed trees.

To produce more accurate simulations and improve fire response efforts, a computational science team at the National Center for Atmospheric Research utilized a new tool called WRF-Fire, whose outputs are shown above and on the cover. The tool uses AI to model fire growth using current data on factors such as terrain slope, fuel characteristics, atmospheric conditions, and dynamic atmospheric feedback. Researchers are studying how WRF-Fire visualizations can benefit first responders and the public to help protect people, homes, and ecosystems.

Changing Minds with Communication

Prescribed burns are an important tool for maintaining healthy forests. They help to clear flammable vegetation from the forest floor, keep pests in check, and recycle nutrients into the soil. Crucially, regular prescribed burns – performed by trained experts under specific weather conditions – can reduce the risk of uncontrolled, highly destructive wildfires.

Despite the benefits, prescribed burns are not well understood, posing barriers to their use. To find creative ways to improve public understanding of prescribed burns – and give students a chance to apply design and communication skills to address a real-world need – the San Diego Supercomputer Center (SDSC) and the Design Lab at UC San Diego co-hosted the Mindshifts on Megafire Design Challenge with leadership from SDSC Chief Data Science Officer İlkay Altintaş and Melissa Floca of SDSC's CICORE division. The event's finale (pictured below) showcased working prototypes of seven concept designs ranging from virtual reality experiences to board games.

Copyright Jake Drake, San Diego Supercomputer Center, UC San Diego

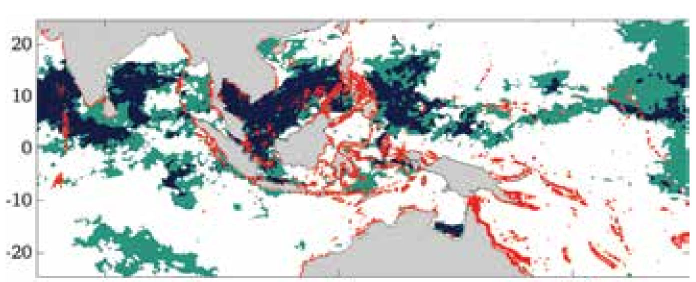
Adapting to a Changing Climate

Pointing the Way to Coral Conservation

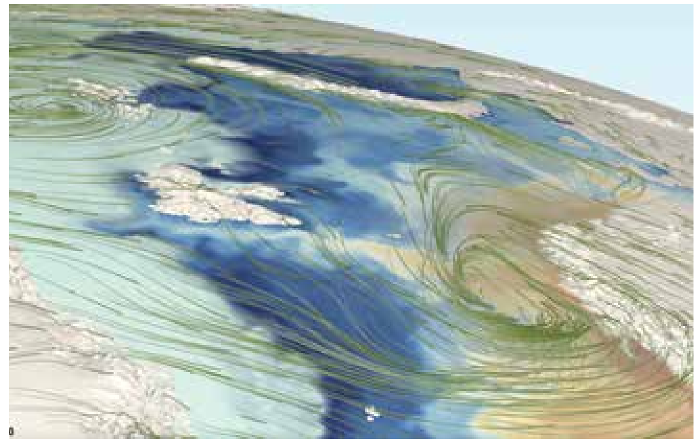
Even the most optimistic climate scenarios predict that rising ocean temperatures will have dire effects on coral reefs. Corals are hotbeds of marine biodiversity and support the global food supply through their role as nurseries for many commercially fished species. Their loss could devastate key ecosystems and economies – but the situation is not yet beyond repair.

To develop effective strategies to manage and rebuild coral reefs, we need to understand how water characteristics, ocean currents, and climate variability shape reef connectivity, biodiversity, and resilience. But this data is currently difficult to gather, and modeling of ocean circulation and larval transport is also quite limited.

At the Georgia Tech Partnership for an Advanced Computing Environment, researchers Lyuba Novi and Annalisa Bracco developed a framework to fill this critical knowledge gap via a machine learning approach that uses the dynamic relationship between sea surface temperature and ocean current anomalies to create a biodiversity score and recovery metric for coral ecosystems. The results, shown below, can be used to prioritize coral monitoring and restoration efforts in order to maximize the return on global investments in conserving this critical – yet fragile – shared resource.



Copyright Lyuba Novi, Georgia Institute of Technology



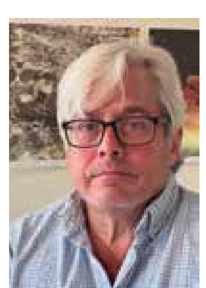
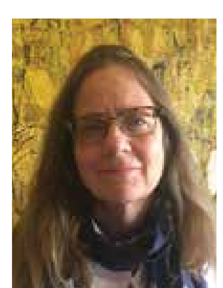
Copyright Francesca Samsel and Greg Abram, Texas Advanced Computing Center, University of Texas at Austin

Understanding the Arctic's Accelerated Warming

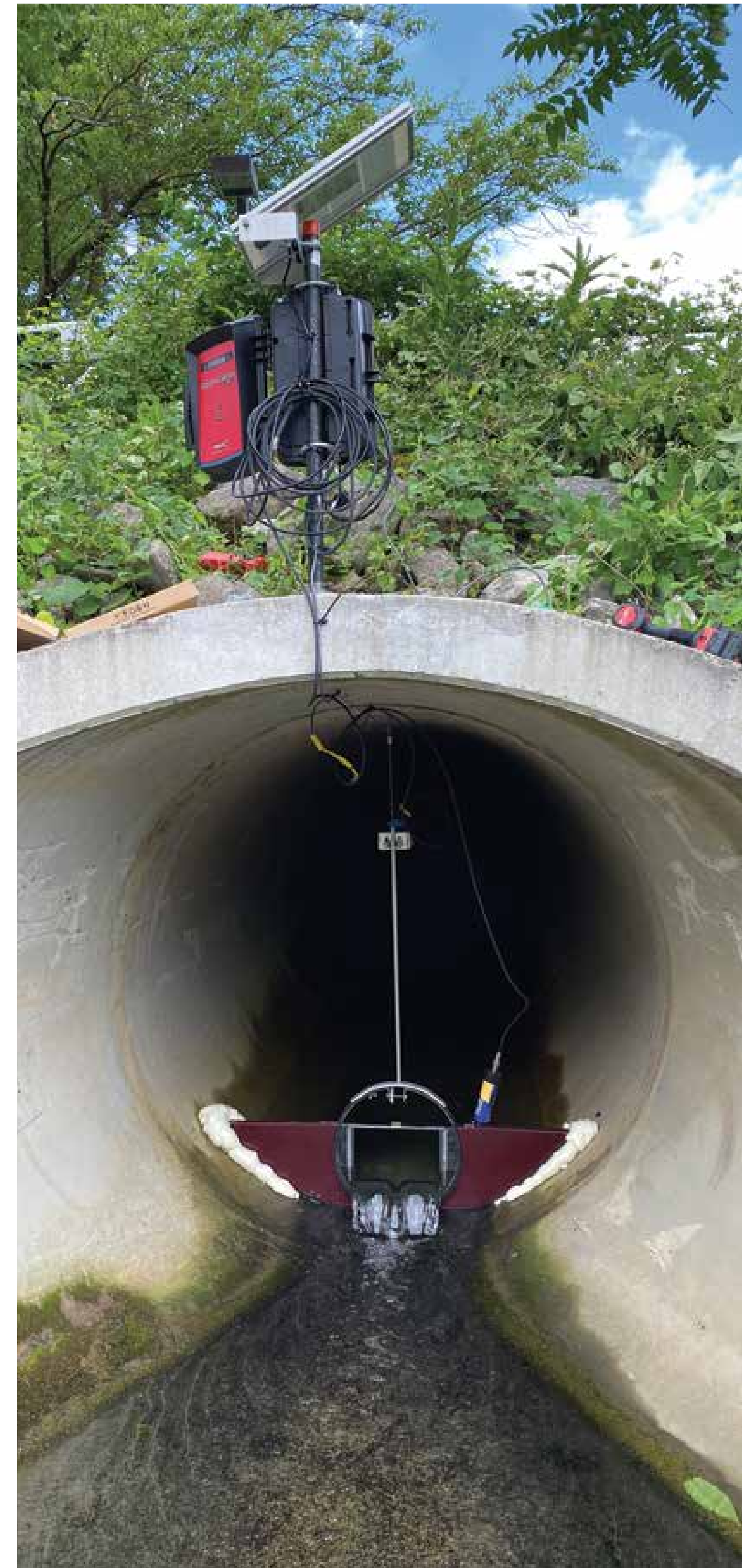
Rising ocean temperatures are fueling stronger and more frequent storms that put millions of people's lives and livelihoods at risk each year. At the poles, water temperatures are warming four times faster than in the rest of the planet, with dramatic implications for global weather patterns.

To understand what is causing this accelerated warming, researchers Greg Abram and Francesca Samsel of the Texas Advanced Computing Center (TACC) at the University of Texas at Austin partnered with scientists at Los Alamos National Laboratory to examine atmospheric rivers – flows of water vapor high in the air that carry moisture and heat from the tropics to the poles.

The scientists of the HiLAT-RASM (High-Latitude Application and Testing of Earth System Models combined with the Regional Arctic Systems Model) team are using the U.S. Department of Energy large-scale climate model to investigate the impacts of atmospheric conditions on polar sea ice. The results have illuminated how atmospheric rivers delay Arctic ice formation, trapping heat and warming Arctic water and land, even in winter. These visualizations are an invaluable resource for understanding climate models, enabling scientists to interactively explore data, discover new knowledge, and convey it to the world.

Greg Abram and Francesca Samsel, TACC



Copyright Marccus Hendricks, SIRJ Lab, University of Maryland

Smarter Stormwater Management

The area surrounding the University of Maryland (UMD) is a highly developed landscape dominated by impervious surfaces that funnel rainwater through the streets and frequently overwhelm stormwater infrastructure. While the resulting flooding is increasingly encroaching into homes and neighborhoods – which will likely have disproportionate impacts on low-income communities – it is not an easy problem to solve.

One key challenge is a lack of data on where the weakest points in the stormwater system lie. With advances in Internet-connected "smart" devices, sensor technology, big data analytics, and real-time monitoring, researchers at UMD's Stormwater Infrastructure Resilience and Justice (SIRJ) Lab, led by Marccus Hendricks and Priscila Alves, are partnering with local municipalities and communities to explore potential solutions. SIRJ lead Graduate Assistant Pranav Parab, in partnership with Sam Porter and Sheila Zellner-Jenkins of the UMD Research Computing team, created a cloud-based tool that collects data from smart sensors for continuous monitoring of stormwater flows around the UMD campus. Visualizations shared publicly via real-time dashboards can help communities understand where stormwater management is falling short and advocate for improvements.

CASC Priority Area: Team Science

Team science – in which professionals with expertise in different fields collaborate to address scientific challenges – has become a prevalent approach to conducting research. This has made research computing and data organizations a critical nexus for multidisciplinary collaborations. CASC helps our members navigate this shift with best practices for facilitating end-to-end workflows and advocates for the funding and policies to reduce barriers and support this essential work.

From Imagination to Innovation

Dancing Polymers

In the field of biomimicry or soft robotics, researchers create synthetic materials that behave similarly to living creatures, with multiple materials interacting in cooperative and coordinated ways. In an innovative example of this, researchers led by Anna Balazs from the University of Pittsburgh and colleagues from Princeton University used computational modeling to design polymer sheets that self-assemble into spiral patterns that appear to dance in a circle without any outside power source.

Inspired by the dancing figures in Henri Matisse's famous La Danse painting, Balazs wanted to see if synthetic materials could be coaxed to replicate the dancers' poses. To do this, Post-doctoral Research Associate Raj Kumar Manna simulated how synthetic polymer sheets would behave if arrayed in a series of T-shaped structures encircling a patch designed to kick-start a chemical reaction within a fluid-filled chamber. The model showed that although a single sheet would not spin in the solution, when multiple sheets were used, they would self-assemble into an interlocked structure and move in a way resembling a coordinated circle dance. Such self-powered structures could be useful for developing low-energy devices for applications in medicine, environmental monitoring, and more.

Copyright Anna Balazs, University of Pittsburgh

Henri Matisse, La danse

Driving the World's Largest AI Traffic Experiment

Many traffic jams are caused by human driving behavior rather than an actual hazard. To see if AI-powered cruise control might help reduce these cascading traffic disturbances, the CIRCLES Consortium carried out the largest traffic experiment ever conducted using autonomous vehicles on a real highway. The consortium is led by the University of California Berkeley and the Institute of Transportation Studies Berkeley, in coordination with Rutgers University-Camden, Vanderbilt University, Temple University, the Tennessee Department of Transportation, Toyota North America, General Motors, and Nissan North America.

To study AI-powered cruise control under real-life conditions, the consortium tested a fleet of 100 specially equipped cars on the recently opened I-24 MOTION testbed. This one-of-a-kind smart highway testbed is located outside of Nashville and has 300 4K digital sensors that can log 260,000 vehicle-miles of data per year. The experiment aimed to replicate results from an earlier, closed-track study where just one AI-equipped vehicle was able to reduce human-caused traffic congestion, leading to substantial fuel savings of 40%. The image shows researchers tracking live interstate traffic during the experiment.

The Rutgers project team, part of the CIRCLES Consortium. Copyright Benedetto Piccoli, Rutgers University-Camden

CASC Priority Area: Alignment

As exemplified by several of the projects in these pages, cutting-edge work often lies at the confluence of government goals and priorities, academic research expertise and resources, and industry interests and opportunities. CASC advances the alignment of institutional and community needs through processes to bolster communication channels within institutions and facilitate productive dialogue among CASC members, federal agencies, and industry.

Courtesy of Vanderbilt University

Making Materials

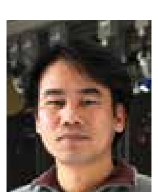
A diver's watch that uses a luminescent pigment to make it readable in low light conditions.

The Glow that Keeps Going

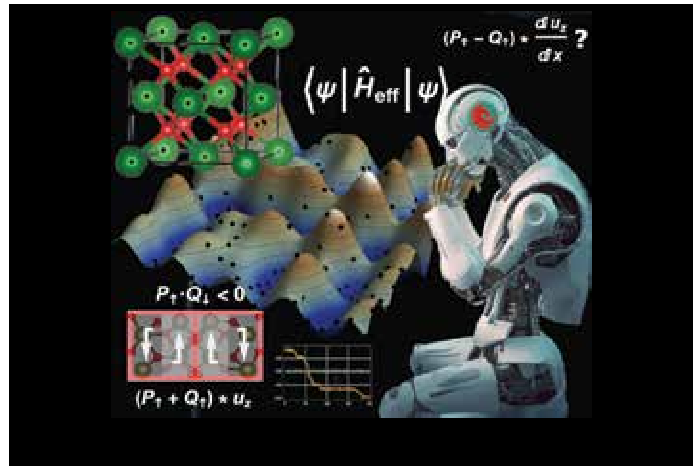
In 1993, scientists from Nemoto & Co. Ltd in Japan developed a breakthrough material that emitted extremely bright green light for many hours in the dark. Thirty years later, Khang Hoang from North Dakota State University (NDSU) cracked the code on the science behind the long-lasting glow, known as persistent luminescence.

The material developed by Nemoto is made from strontium aluminate doped with the chemical elements europium and dysprosium. Ten times brighter than traditional glow-in-the-dark pigments and holding its glow for up to 30 hours, the material has found its way into paints and coatings for products such as diving watches, exit signs, and outdoor pathways that produce bright light without any external power source.

Using a new supercomputing cluster at NDSU, Hoang performed complex quantum mechanical calculations that revealed how atomic-scale imperfections in the material trap and release electrons to create the bright and long-lasting light emission. The computational approach developed for the study together with the new scientific insights could help facilitate the design of new or improved persistent phosphors for a variety of applications.



North Dakota State University physicist Khang Hoang. Copyright North Dakota State University

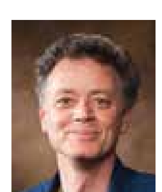


Copyright Peng Chen, University of Arkansas

Harnessing AI as a Research Copilot

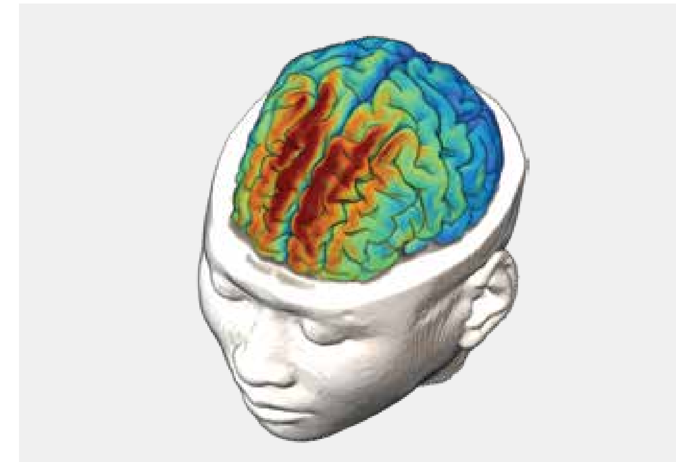
Many cutting-edge technologies are based on functional materials – materials designed with unique properties such as magnetism or energy storage capabilities. However, discovering new functional materials is an extremely complex and time-consuming process because of the limitless combinations of elements that can be used to create materials, and countless modifications that can be performed to tweak their properties.

Peng Chen and Laurent Bellaiche from the University of Arkansas High Performance Computing Center are working to develop an AI copilot that can assist in modeling candidate designs and characterizing the interactions that drive material properties. Rather than relying solely on machine learning models, which require training with existing data, their approach is based on a physics-based framework that uses well-defined mathematics and the laws of physics to explain a material's characteristics. The new AI co-pilot complements material investigations and ML-based models to speed up and simplify the simulation and discovery of new functional materials for advances in computing, energy storage, light-based technologies, and more.

Peng Chen and Laurent Bellaiche, University of Arkansas High Performance Computing Center Copyright Peng Chen, University of Arkansas (left) and Laurent Bellaiche, University of Arkansas (right)

Advancing Medicine

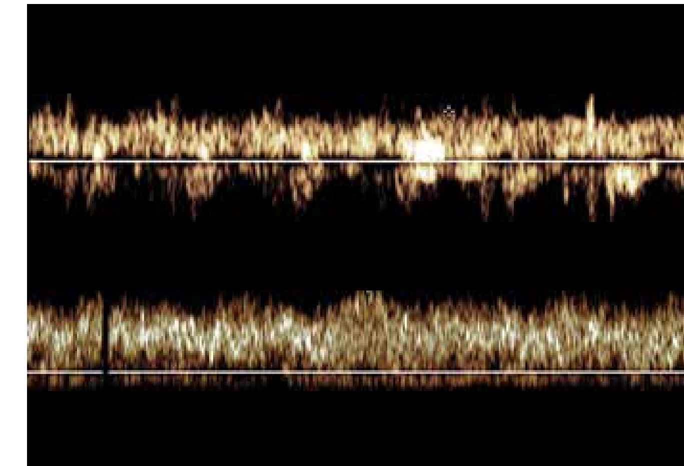


Copyright Aprinda Indahlastari, University of Florida

Making it Personal

Transcranial direct current stimulation, which delivers electrical current to the brain through electrodes on the scalp, is a promising technology for improving brain function without the need for invasive procedures. The technique is being studied as a possible treatment for depression and other mental health problems. Typically, the same dose of electrical current is used for all patients, but since every person's brain has a unique shape and size, this can lead to varying responses. To create a more personalized therapy, Aprinda Indahlastari, Adam Woods, and Ruogu Fang from the University of Florida are using MRI images and a numerical technique known as the finite element method with machine learning to model how the electrical current is distributed across the brain during the procedure. By observing how this model output relates to measured behavioral changes, doctors can adjust treatment parameters to achieve the best results for each patient.

Aprinda Indahlastari, University of Florida

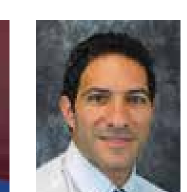


Ultrasound waves measured in a person with (below) and without (above) liver cancer. Copyright Jose Debes, University of Minnesota

Listening for Liver Cancer

Liver cancer is among the leading causes of cancer deaths worldwide, accounting for more than 700,000 deaths each year. To diagnose it, doctors often use ultrasound imaging to look for a mass in patients who are at high risk or show symptoms of liver cancer. However, this approach catches less than 50% of small tumors.

Jose Debes and Ju Sun from the University of Minnesota Supercomputing Institute for Advanced Computation are testing a radical new strategy. Rather than visually looking for a mass on ultrasound images, they developed an AI algorithm to analyze something that humans can't see: the ultrasound waves themselves. By homing in on sound waves coming from a particular blood vessel, this first-of-a-kind approach is designed to detect blood flow changes tied to cancer with a single measurement. In preliminary studies, researchers found that the technique detected small liver tumors with over 80% accuracy, which rose to over 95% when researchers combined the algorithm's results with information on the presence of a protein linked with liver cancer. If these results hold up in larger studies, the new approach could help doctors detect tumors when they are smaller and easier to treat.

Ju Sun and Jose Debes, University of Minnesota Supercomputing Institute for Advanced Computation. Copyright University of Minnesota

Strengthening Cybersecurity

CASC Priority Area: Cybersecurity

Everyone knows when cybersecurity fails, but what does success look like? CASC's vision of success in cybersecurity and compliance includes institutional buy-in into clear policies, a sustainable business model, and research productivity. To help make that vision a reality, we promote best practices among our member institutions and advocate for ways federal and state governments can support compliance.


Researchers Hafiz Asif, Jaideep Vaidya, and Sitao Min (left to right). Photo courtesy of Fred Stucker

Evolving Digital Immune Systems

Katherine Skocelas, a doctoral student at Michigan State University (MSU), is evolving biologically-inspired digital immune systems that help protect computer networks from cyberattacks. She became interested in this work after being diagnosed with the autoimmune disease lupus as an undergraduate. With the type of lupus Skocelas has, the immune system mistakes the body's own DNA for harmful intruders and produces antibodies against it.

Her work is based on host-pathogen coevolution, a biological process in which pathogens evolve novel attacks, pressuring host organisms' immune systems to evolve new forms of defense against them. By leveraging this process to coevolve computer networks and network attacks, she is working to create algorithms that keep distributed networks functioning effectively even when individual computers within the network become isolated or compromised. Skocelas uses the High-Performance Computing Center at MSU's Institute for Cyber-Enabled Research to carry out the complex computations necessary to iterate machine learning algorithms thousands of times to evolve their own immunity while also coevolving the attacks – and then replicate her experiments hundreds of times to ensure the results are valid and statistically significant.


Michigan State University doctoral student Katherine Skocelas. Copyright Zander Riggs

Fighting Financial Crime

Researchers from the Rutgers Institute for Data Science, Learning, and Applications (I-DSLA) won the U.S. first place in the "Financial Crime Prevention" track of the Privacy Enhancing Technologies (PETs) Prize Challenge. During the jointly sponsored U.S.-U.K. competition, experts from academic institutions, global technology companies, and privacy start-ups competed for a combined total of $1.6 million in cash prizes. The winners were announced at the Summit for Democracy hosted by the U.S. Department of State in March 2023.

The prize challenge focused on developing PETs solutions for two scenarios: forecasting pandemics and detecting financial crime. To detect financial crime, the Rutgers team – consisting of Hafiz Asif, Sitao Min, Xinyue Wang, and Jaideep Vaidya – developed a novel federated learning approach to flag fishy financial transactions. Federated learning enables multiple parties to collaboratively train a machine learning model without sharing actual data. The team's solution involved an initial step of feature mining for account-level bank data, augmenting the features to a messaging network's data, and then allowing the messaging network to learn a classifier from the augmented data – all while rigorously preserving privacy.

Seeing into Space

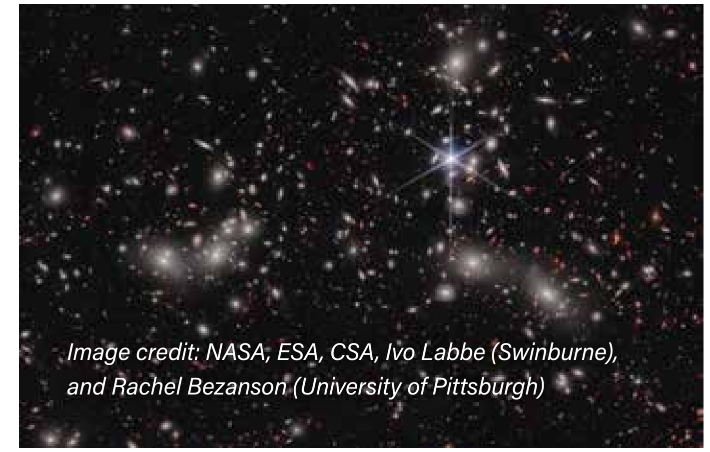


Image credit: NASA, ESA, CSA, Ivo Labbe (Swinburne), and Rachel Bezanson (University of Pittsburgh)


Copyright Aaron M. Geller, Northwestern CIERA and IT Research Computing and Data Services

A Cosmic Celebration

After the James Webb Space Telescope (JWST) launched in late 2021 — the culmination of decades of planning and $10 billion in NASA investments — scientists around the world waited with bated breath to see whether the mission would be a success. Just a few months later, the data and images began pouring in sooner and in higher quality than many had dared hope. A half-dozen CASC member organizations are official contributors to the JWST and many are using the telescope's data as fodder for thrilling new explorations into cosmic phenomena and the early universe.

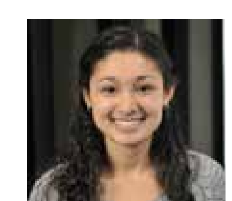
This image shows a region of space known as Pandora's Cluster, in one of the deepest exposures of the distant universe that JWST has made so far. With exquisite detail, the image shows three clusters of galaxies colliding, creating a concentration of matter so dense that it can bend and concentrate light like a lens. Thanks to this spacetime-warping megacluster, imaging Pandora's Cluster can produce even deeper images of space behind it by using this region as a giant magnifying glass in space.

Taking a close look at the multitudes contained in this image, researcher Joel Leja of The Pennsylvania State University and colleagues have peered back in time to observe galaxies and an incredibly large black hole from when the universe was less than 500 million years old. Deciphering the massive starbursts, cosmic dances, and swirling trails of gas and dust will captivate astronomers and the public alike for years to come.

A Surprising Source of Long Gamma-Ray Bursts

For decades, astrophysicists thought that long gamma-ray bursts (GRB) could only come from the collapse of massive stars. However, new research led by Northwestern University graduate student Jillian Rastinejad along with faculty researcher Wen-fai Fong suggests that at least some of these extremely energetic explosions are produced when certain types of stars collide.

After detecting a 50-second-long GRB in December 2021, the team began searching for its afterglow, a burst of bright light that fades quickly and often precedes a supernova. Using computational models to analyze near-infrared spectroscopy data, they uncovered evidence that the burst actually came from a kilonova, a rare event that only occurs after the merger of a neutron star with another compact object such as another neutron star or a black hole. This unexpected finding represents a major shift in the understanding of gamma-ray bursts and creates a new window for discovery. This illustration, created by Aaron M. Geller of Northwestern, shows the kilonova and gamma-ray burst on the right and its parent galaxy on the left. The blue color represents material squeezed along the poles, while red indicates material ejected by the two spiraling neutron stars that is now swirling around the merged object as a fast jet of material (shown in yellow) punches through the kilonova cloud.




Jillian Rastinejad, Wen-fai Fong, and Aaron Geller, Northwestern University. Courtesy of Northwestern University

Workforce Development

Supporting Scholarship

2023 saw the launch of two exciting initiatives that support education and professional development and honor CASC luminaries.

- Charlie Bender Scholarship: CASC established the Charlie Bender Scholarship in memory of Charles “Charlie” Bender, founding chairperson of CASC. The award supports research computing and data professionals in their pursuit of training or professional development. CASC awarded the inaugural scholarship to Manhattan College systems administrator Wyatt Madej, providing funds to support Madej’s participation in the Linux Clusters Institute introductory-level workshop for Linux system administrators who are new to high performance computing.
- Susan Fratkin Scholarship: CASC joined the Texas Advanced Computing Center (TACC) as a sustaining partner for the Susan Fratkin Scholarship, launched in 2023 to address educational inequities and support undergraduate student persistence in higher education. The scholarship honors Sue Fratkin, who played a central role in the founding of CASC and served as CASC Washington Liaison for 25 years. The first scholarships were awarded in May 2023 to 23 alumni of TACC’s Code@TACC program, with a focus on supporting women and underrepresented populations in STEM.

Where Opportunities Abound, Students Dream Big

For Leslie Miller, the sky is no limit when it comes to engineering dreams. As an undergraduate student at Arizona State University (ASU), she had the opportunity to conduct research in the sensor, signal and information processing (SenSIP) industry-university research center through the National Science Foundation-funded Research Experience for Undergraduates program. Collaborating with Andreas Spanias on quantum machine learning approaches for signal analysis research and imaging applications, her work contributed to a conference presentation, scientific publication, and a patent pre-disclosure – honors that many scientists and engineers do not accomplish until much further along in their careers.

Miller took advantage of opportunities to gain real-world engineering experience between semesters, too, serving as an intern with the U.S. Space Force and working with the SpaceX Falcon 9 launch team and the L3Harris vision technology project to develop a hosted payload interface unit, a device that protects information transferred between a payload and the spacecraft that hosts it. In recognition of her outstanding work and leadership, Miller was invited to serve as ASU’s convocation speaker for her graduating class in May 2023. Once she finishes the next step in her educational journey – an accelerated master’s degree in electrical engineering at ASU – she should be well positioned to achieve her goal of working as an engineer for the U.S. Space Force.

Sue Fratkin at the inaugural scholarship celebration in May 2023

Arizona State University student Leslie Miller

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Remote Work at a Whole New Level

Traditional university labs contain a limited number of scientific instruments that are typically used only during normal work hours, often leaving expensive equipment idle. Researchers must devote a significant amount of time to not only running experiments but also training new students and technicians on using and maintaining lab instruments.

Carnegie Mellon University (CMU) and Emerald Cloud Lab have come together to streamline science by building the world’s first automated remote-controlled lab in an academic setting. The new CMU Cloud Lab (shown above) provides remote access to scientific instruments that operate 24 hours a day and are rigorously maintained by trained operators. Researchers can code an experiment through the internet and robotic instruments and staff technicians will perform their experiments exactly as specified.

The lab’s 200 instruments (including 130 unique instruments) improve research productivity by giving scientists the ability to carry out complex workflows, run multiple experiments at once, and replicate procedures with the push of a button. This new approach to science means researchers are no longer limited by the cost, location, or availability of equipment, freeing them to focus less on lab maintenance and more on making exciting new discoveries. In addition, the CMU Cloud Lab will also be used to train tomorrow’s scientists in a new way of working.

CASC Priority Area: Workforce

Staff members are the lifeblood and most essential piece of any organization, determining success or failure as much as – if not more than – any technology. CASC advocates for key steps that institutions and research sponsors can take to address workforce challenges and recruit, retain, and develop a skilled, diverse workforce in academic research computing and data.

CASC Membership

30+ Years · 100+ Members

- Albert Einstein College of Medicine Department of Information Technology
- Arizona State University Research Computing
- Boston University
- Brown University Center for Computation and Visualization
- Carnegie Mellon University
- Case Western Reserve University Core Facility Advanced Research Computing
- Chan Zuckerberg Biohub CZ BioHub Scientific Computing
- City University of New York High Performance Computing Center
- Clemson University Computing and Information Technology (CCIT)
- Columbia University
- Cornell University Center for Advanced Computing
- Dartmouth College
- Flatiron Institute
- George Mason University
- Georgetown University UIS
- Georgia Institute of Technology PACE
- Harvard University
- Icahn School of Medicine at Mount Sinai
- Indiana University Pervasive Technology Institute
- Johns Hopkins University
- Lawrence Berkeley National Laboratory
- Louisiana State University Center for Computation & Technology (CCT)
- Massachusetts Green High Performance Computing Center
- Michigan State University High Performance Computing Center
- Mississippi State University High Performance Computing Collaboratory (HPC2)
- National Center for Atmospheric Research (NCAR)
- New Jersey Institute of Technology
- New York Genome Center
- New York Structural Biology Center Simons Electron Microscopy Center
- New York University
- North Carolina State University
- North Dakota University System
- Northwestern University
- NYU Langone Hospitals
- Oak Ridge National Laboratory (ORNL) Center for Computational Sciences
- Ohio Supercomputer Center (OSC)
- Old Dominion University Information Technology Services
- Pittsburgh Supercomputing Center
- Princeton University
- Purdue University Research Computing
- Rensselaer Polytechnic Institute
- Rice University Ken Kennedy Institute for Information Technology (K21)
- Roswell Park Comprehensive Cancer Center
- Rutgers University
- Southern Methodist University
- Stanford University
- Stony Brook University Research Technologies
- Swarthmore College
- Texas A&M University High Performance Research Computing
- Texas Tech University High Performance Computing Center
- The George Washington University
- The Pennsylvania State University
- The University of Alabama at Birmingham IT-Research Computing
- The University of Texas at Austin Texas Advanced Computing Center (TACC)
- University at Buffalo, State University of New York Center for Computational Research
- University of Alaska Fairbanks Research Computing Systems
- University of Arizona Research Computing
- University of Arkansas High Performance Computing Center
- University of California, Berkeley Berkeley Research Computing
- University of California, Davis HPC Core Facility
- University of California, Irvine Research Cyberinfrastructure Center
- University of California, Los Angeles Institute for Digital Research and Education
- University of California, Merced Cyberinfrastructure and Research Technologies
- University of California, San Diego San Diego Supercomputer Center (SDSC)
- University of Chicago & Argonne National Laboratory Research Computing Center
- University of Cincinnati Research Technologies
- University of Colorado Boulder
- University of Connecticut
- University of Florida
- University of Georgia Advanced Computing Resource Center (GACRC)
- University of Hawaii Information Technology Services
- University of Illinois at Chicago Advanced Cyberinfrastructure for Education and Research
- University of Illinois at Urbana-Champaign National Center for Supercomputing Applications (NCSA)
- University of Iowa
- University of Kentucky Center for Computational Sciences
- University of Louisville
- University of Maryland Division of Information Technology
- University of Massachusetts
- University of Miami Institute for Data Science and Computing
- University of Michigan Office of Research
- University of Minnesota Minnesota Supercomputing Institute for Advanced Computational Research
- University of Nebraska Holland Computing Center
- University of Nevada, Las Vegas National Supercomputing Institute (NSI)
- University of Nevada, Reno Research Computing
- University of New Hampshire Research Computing Center
- University of New Mexico Center for Advanced Research Computing
- University of North Carolina at Chapel Hill
- University of North Carolina at Chapel Hill Renaissance Computing Institute (RENCI)
- University of Notre Dame Center for Research Computing
- University of Oklahoma Supercomputing Center for Education and Research
- University of Oregon Research Advanced Computing Services (RACS)
- University of Pittsburgh Center for Research Computing
- University of Rhode Island
- University of Southern California Information Sciences Institute
- University of Tennessee at Chattanooga SimCenter
- University of Tennessee National Institute for Computational Sciences (NICS)
- University of Utah Center for High Performance Computing
- University of Virginia Research Computing (RC)
- University of Wyoming Advanced Research Computing Center (ARCC)
- Vanderbilt University Advanced Computing Center for Research and Education
- Virginia Tech Advanced Research Computing
- Washington University in St. Louis
- West Virginia University
- Yale University Yale Center for Research Computing (YCRC)

CASC Coalition for Academic Scientific Computation

The Coalition for Academic Scientific Computation (CASC) is a nonprofit organization dedicated to the use of advanced computing technology to accelerate discovery.

For over 30 years, CASC has represented many of the nation's most forward-thinking research computing and data services organizations—a vibrant community of excellence that today totals more than 100 member organizations. By providing a voice for this broad coalition of members, facilitating the exchange of ideas and resources, and advocating for funding and policies to enable the field to reach its full potential, CASC advances our community's vision for a robust, sustainable research ecosystem to support national competitiveness, global security, economic success, and a diverse and well-prepared 21st century workforce.

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