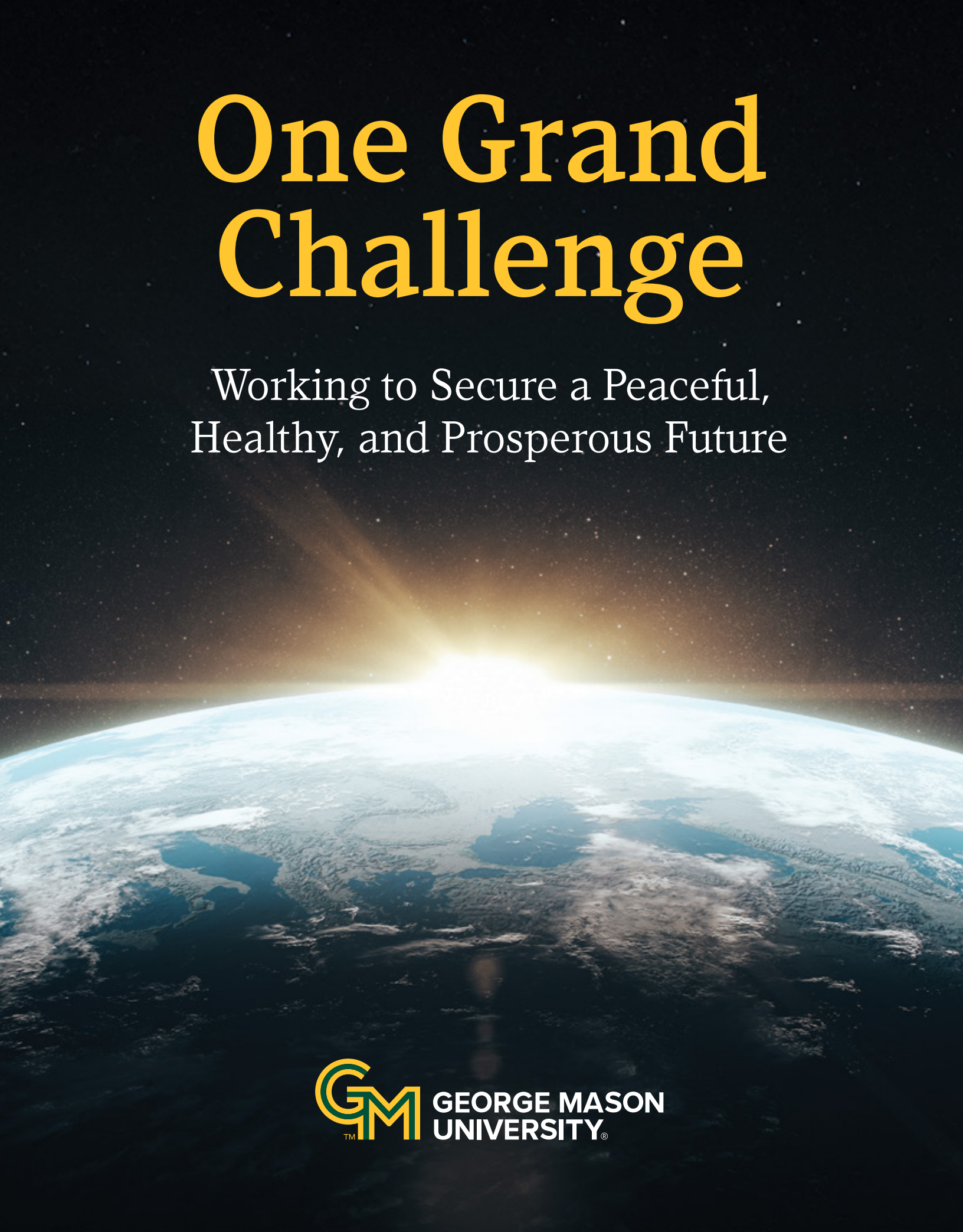
One Grand Challenge

Working to Secure a Peaceful, Healthy, and Prosperous Future



GEORGE MASON UNIVERSITY

PHOTOS BY GETTY IMAGES AND GEORGE MASON UNIVERSITY

George Mason University has launched its Grand Challenge Initiative (GCI), a comprehensive research framework backed by an initial five-year, $15 million investment. The initiative aligns university resources, faculty expertise, and educational programs around six interconnected solution areas addressing what George Mason President Gregory Washington describes as "humanity's ultimate grand challenge"—securing a peaceful, healthy, and prosperous future.

"Our world is at a crossroads," he says. "It is time to either brace for global decline and a future that none of us wants, or seize control of our destiny and work to reverse course. It will take all of us working together on all these solutions at once to alter the trajectory of our future."

A FUTURE WE WANT

ONE GRAND CHALLENGE SIX GRAND SOLUTIONS

Andre Marshall, vice president for research, innovation, and economic impact, leads the initiative, which was developed through a faculty-driven task force and focuses on six grand solutions:

- Advancing 21st-century education for all
- Building a climate-resilient society
- Driving responsible digital innovation and sustainable infrastructure
- Improving human health, well-being, and preparedness
- Pioneering space exploration, research, and collaboration
- Strengthening peace, trust, and engagement in democracy

"George Mason is driven by discovery," says Marshall. "This means unleashing our bold ideas from their theoretical and laboratory boundaries, thoughtfully cultivating them as they take shape, and fearlessly deploying them as innovations that will transform our lives."

GCI will enhance educational opportunities, increase faculty talent and expertise, align current research projects, seed new proposals, and build essential infrastructure across George Mason's campuses. Working in conjunction with the university's $1 billion Mason Now: Power the Possible campaign, the initiative seeks partnerships with government, industry, and nongovernmental organizations.

LEARN MORE ABOUT GCI.

ADVANCING 21ST-CENTURY EDUCATION FOR ALL

At George Mason, we believe talent is equally distributed among people, but opportunity is not. Education helps creates more productive ways to participate in civil society, allows more choice in how to contribute to the economy, and prepares people to make more informed choices for a healthy and prosperous life. As Virginia's largest and most diverse university, George Mason is transforming excellence and access through flexible and scalable learning experiences, accessibility research, focused PreK-12 skill development, and robust STEM and systems-thinking education alongside critical thinking and cooperation skills.

THE GEORGE MASON ADVANTAGE

The **ADVANCE Program**, George Mason's highly successful transfer partnership with Northern Virginia Community College, has been recognized as a national model by the U.S. Department of Education. Under an initiative called the **Mason Virginia Promise**, the university has taken that collaboration a step further and begun partnerships with community colleges throughout Virginia and created pathways that help students save time and money when pursuing a four-year degree.

Research in Action

AI + MATHEMATICAL MODELING = NEW TEACHING TOOL

With support from the National Science Foundation, George Mason researchers Ziyu Yao of the College of Engineering and Computing and Jennifer Suh of the College of Education and Human Development are creating a virtual classroom called MathVC where middle school students can work through mathematical modeling problems with artificial intelligence-powered chatbot "students."

Mathematical modeling creates a mathematical representation of a real-world scenario to help teach students math concepts in context. These can be small-scale scenarios—calculating costs for a party—or global challenges—supplying clean water to a city after a major flooding event.

Within the virtual classroom, the human student can work with generative AI student personas on problems that combine computational skills and soft skills like critical thinking, collaboration, and communication. Once the program is deployed, access will be as simple as logging into a website.

STUDENT RESOURCES

Since 1987, the **Early Identification Program** (EIP) has been working with Northern Virginia public school systems to bridge the opportunity gaps that motivated and talented first-generation students can face in achieving their goal of higher education. EIP provides year-round academic enrichment, familial support, and leadership training opportunities.

PARTNERSHIPS

The **Shenandoah Valley Rural Regional College Partnership Laboratory School for Data Science, Computing, and Applications** is the result of the combined efforts of Frederick County Public Schools, Mountain Vista Governor's School, and Laurel Ridge Community College, among others, to support 10th through 12th grade students through academic programming that fosters data literacy and showcases the latest innovations in STEM.

The **Accelerated College and Employability Skills (ACCESS) Academy** is an innovative partnership between the College of Education and Human Development, Loudoun County Public Schools, and Northern Virginia Community College for 9th through 12th grade students designed to give students access to the information technology education and skills essential for IT careers.

COMMUNITY ENGAGEMENT

The **Tutors-to-Teachers** program, developed by the College of Education and Human Development and funded by the U.S. Department of Education, is a Virginia statewide project designed to build tutors' skills and increase achievement in elementary and middle school students.

FACULTY SPOTLIGHTS

Christan Coogle of the Special Education Program is the principal investigator of the Early Childhood Training and Technical Assistance Center. She is working to expand and improve resources for Virginia teachers to better support students with learning delays and disabilities.

Padmanabhan Seshaiyer of the Department of Mathematical Sciences has been recognized for his contributions to STEM education across the commonwealth. In 2025 he received two "Programs That Work" Awards from the Virginia Mathematics and Science Coalition.

Future-ready skills aren't just a buzzword—they are a necessity. Skills such as critical thinking, creativity, digital fluency, and environmental stewardship are the currency of tomorrow's workforce."

Ingrid Guerra-López, Dean, College of Education and Human Development

PHOTOS BY EVAN CANTWELL

ASPIRING SCIENTISTS SUMMER INTERNSHIP PROGRAM (ASSIP)

Founded in 2007, ASSIP provides opportunities for high school and undergraduate students to work one-on-one with faculty researchers across many disciplines. In summer 2025, nearly 400 students participated in the eight-week program.

GEORGE MASON AS A LIVING LAB

From the canopies of the trees in the accredited Level II Arboretum to the stormwater running into Mason Pond, George Mason's nearly 1,000 acres of land, waterways, forests, and buildings are being used as a dynamic **Living Lab** for hands-on environmental research that may one day have a global impact.

PHOTO BY EVAN CANTWELL

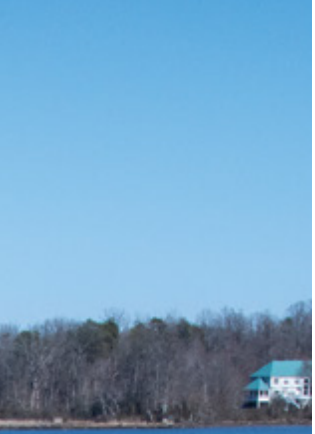
George Mason, being the largest public university in Virginia, owes it to the residents of the commonwealth to create innovative solutions to increase community resilience."

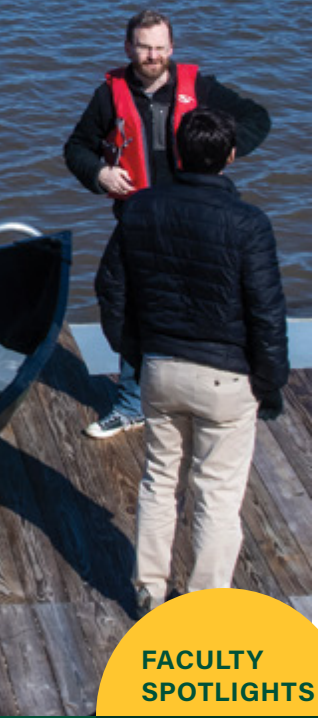
James Kinter, Director,
Center for Ocean-Land-Atmosphere Studies

POTOMAC SCIENCE CENTER

The **Potomac Environmental Research and Education Center** is a key component of George Mason's Potomac Science Center in Belmont Bay. The center focuses on Potomac River restoration and local sustainability practices, so that the local ecosystem will be healthy for years to come. They translate research into award-winning field programs for K-12 students and the larger community.

PHOTOS BY EVAN CANTWELL





BUILDING A CLIMATE-RESILIENT SOCIETY

THE GEORGE MASON ADVANTAGE

In 2023, George Mason was selected to host the **Virginia Climate Center** and lead research on tackling climate-related challenges, such as energy, vector-borne illnesses, and extreme weather and flooding in Northern Virginia and throughout the commonwealth. Funded through the National Oceanic and Atmospheric Administration and sponsored by the late U.S. Representative Gerry Connolly, this congressionally directed community project seeks to increase Virginia's resilience to the impacts of climate changes.

Research in Action

HELPING LOCAL COMMUNITIES IMPROVE FLOOD RESILIENCE

"Flooding is a growing issue across local communities," says Celso Ferreira, who leads George Mason's Flood Hazards Research Lab. "It is one part of engineering that's not well-solved. Communities want to understand and adapt to flood risk, but it's expensive. That's where this idea came in—we thought, why not involve students? Not just teach them engineering but help them create useful products for these communities."

Ferreira recently redesigned the CEIE 445/645 Flood Hazard Engineering and Adaptation course to work with community partners to deliver real projects as part of an Institute for a Sustainable Earth and NSF Accelerating Research Translation Program's Seed Translational Research Project.

In the course, undergraduate and graduate civil engineering students work together on teams to develop flood risk maps and conduct analyses to help real clients in local communities improve their flood resilience. For some communities, especially smaller counties or tribes with fewer resources or no engineers on staff, this can provide critical data to help them address areas at higher risk of flooding.

The student teams used recently developed Virginia Department of Conservation and Recreation models, which provided ground elevation surface data (topography), hydraulic friction values, and surface water infiltration values. This served as a common framework for building each project.

STUDENT RESOURCES

George Mason Facilities sets aside $100,000 a year for the **Patriot Green Fund**, which supports infrastructure improvements and student research projects to make George Mason's campuses more sustainable. Projects have included smart hives, rain gardens, and the Foragers Forest on the Fairfax Campus.

PARTNERSHIPS

In a unique partnership, George Mason and the **Smithsonian Conservation Biology Institute** established the Smithsonian-Mason School of Conservation, which offers hands-on, interdisciplinary programs in conservation where students can work alongside Smithsonian scientists and conservation experts from around the world.

FACULTY SPOTLIGHTS

Jennifer Salerno, a professor in the Department of Environmental Science and Policy, is helping redefine how we monitor and protect coral reef ecosystems. Salerno is working on a technique to assess coral reef health by analyzing microorganisms in reef water.

Daniel Tong of George Mason's Center for Spatial Information Science and Systems is part of the NASA Health and Air Quality Applied Sciences Team working on improvements to the National Air Quality Forecast Capability.

DRIVING RESPONSIBLE DIGITAL INNOVATION AND SUSTAINABLE INFRASTRUCTURE

From artificial intelligence and robotics to digital twins and quantum computing, new technologies are reshaping every aspect of life and culture at a rate faster than most institutions can keep up with. George Mason is researching and applying technologies that improve human life and a peaceful coexistence in increasingly digital societies by enhancing connectivity, economic opportunity, and reducing disparities through public services while also protecting the planet. Through cross-disciplinary collaboration, workforce education, and public–private partnerships, George Mason is helping shape a digital future that is both ethical and advanced.

PHOTOS BY RON AIRA

We can no longer separate technology from the public good. Innovation must serve society, and at George Mason, we're doing just that."

Amarda Shehu, Chief AI Officer

STUDENT RESOURCES

Fuse at Mason Square labs provide students with research and educational opportunities that cross disciplines to address local and global needs in autonomy, embedded AI, and robotics.

THE GEORGE MASON ADVANTAGE

As Virginia's most innovative university, George Mason is a national leader in responsible digital innovation—combining technical excellence, societal commitment, and unmatched regional partnerships. The first public university in the nation with a comprehensive artificial intelligence vision, George Mason collaborates with industry leaders like Google, AWS, and Dominion Energy to build sustainable, secure, and inclusive technologies for the public good.

Research in Action

MOVING TARGET DEFENSE KEEPS HACKERS IN THE DARK

Cyberattackers are constantly finding new ways to get around defense systems and complex code. But how successful can they be when their target isn't where they think it is?

College of Engineering and Computing Professor Kun Sun, associate director of the Center for Secure Information Systems, studies what's known as Moving Target Defense (MTD) to thwart attempted cyberattacks, among his many projects for the U.S. Office of Naval Research.

"The great thing about MTD is it's proactive. I'm shifting the target, such as the IP address, from time to time, so it's hard to know where I'm holding my valuable asset," he says.

Sun added that attackers can scan quickly to locate targets, so those trying to hide their systems—in this case, the U.S. Navy—can add another layer of protection in the form of a decoy.

"We will build something resembling a real system, such as a server or a website," he says. "One thing this does is waste their time as the attacker scans and then tries to determine if this is a real or fake system."

PARTNERSHIPS

George Mason leads the Northern Virginia Node of the statewide **Commonwealth Cyber Initiative (CCI)**, which encompasses 10 Virginia universities, colleges, and community colleges. CCI is Virginia's access point for cybersecurity research, innovation, and workforce development.

The **Tech Talent Investment Program (TTIP)** is a statewide program to invest in expanding state computer science, computer engineering, and software engineering degrees over a 20-year period. This program, which started in 2019 and will run until 2039, will see roughly 380 additional degree recipients each year.

FACULTY SPOTLIGHTS

Elizabeth Phillips, director of the Applied Psychology and Autonomous Systems Lab and codirector of the Human-Robot Interaction Lab, studies how robots and other technologies are changing the way humans interact with the world and one another.

Massimiliano Albanese, executive director of the Institute for Digital Innovation, is a recognized expert in cyberattack modeling and detection, optimal defense strategies, and adaptive security technologies.

PATRIOT PERFORMANCE LAB

The Patriot Performance Lab works to advance the treatment, care, and performance of athletes through athletic training, sports nutrition, strength and conditioning, and sports science.

POPULATION HEALTH CENTER

The Population Health Center facilitates partnerships between academia and the community and houses state-of-the-art facilities for telehealth, research, and delivering clinical care. Practitioners and community partners provide referrals for resources to address social determinants of health such as access to housing, food, and prescriptions.

PHOTOS BY EVAN CANTWELL

IMPROVING HUMAN HEALTH, WELL-BEING, AND PREPAREDNESS

Healthy populations are less vulnerable to disease and crises and better equipped to contribute to peaceful and prosperous communities. George Mason is actively approaching improvements in health systems, mental well-being, and emergency preparedness to build resilience for the future. With a people-first integrated approach that advances science, develops talent, and strengthens communities, George Mason is modeling scenarios that prioritize access to preventative care while investing in emergency prevention and preparedness scenario training.

> *We build strength across the health system by building people."*
>
> Melissa Perry, MBA '25, Dean, College of Public Health

THE GEORGE MASON ADVANTAGE

The first of its kind in Virginia, George Mason's College of Public Health is also the first and only in the state to earn accreditation from the Council on Education for Public Health.

Research in Action

$4.65 MILLION NIH GRANT EXPLORES CHRONIC KNEE PAIN

For millions of Americans, chronic musculoskeletal pain is a daily reality that makes even simple activities like walking across a room, playing with grandchildren, or just getting through a workday feel daunting. Researchers at George Mason's Center for Advancing Systems Science and Bioengineering Innovation (CASSBI) are leading a new $4.65 million National Institutes of Health-funded R01 study to better understand what shapes those experiences, and how to improve care.

The multidisciplinary team will work to solve this problem by studying how physical, biological, emotional, and social factors come together to shape the daily experience of living with chronic knee pain. They will look at whether analyzing multiple symptoms over time can help identify important turning points in a person's pain journey, and how each individual's particular mix of stress, biology, and movement plays a role in achieving maximal potential for function.

Over the next four years, the team will recruit participants with chronic knee pain who are receiving treatment at Optimal Motion, a community-based physical therapy clinic. For one year, participants will be followed closely, with data collected every three months on their biomechanics, physical function, biological health, and psychosocial well-being. A smartphone app will also allow participants to share daily reflections, giving researchers an unprecedented look into the lived experience of chronic pain.

"Chronic pain is not just about an abnormal finding in a single body part," says the project's lead investigator Siddhartha Sikdar, director of CASSBI. "It's an individual, day-to-day experience that cuts across physical, emotional, and social dimensions."

STUDENT RESOURCES

The College of Public Health is home to the nation's first **Society for Simulation in Healthcare-accredited Lab for Immersive Technologies and Simulation** at a public health college. This facility redefines how health professionals practice and reinforces George Mason's leadership in cutting-edge technology that revolutionizes public health education and workforce development.

Thanks to the **Center for the Advancement of Well-Being** and a $1.5 million grant from the Clifton Foundation, students in a new peer coaching program are helping others discover their strengths and how to leverage them in everyday situations.

PARTNERSHIPS

George Mason researcher Shane Caswell is executive director of the **Virginia Concussion Initiative**, which is committed to protecting the brain health of all Virginians. This statewide partnership between George Mason and the Virginia Department of Health is supported by funding from the commonwealth and the Centers for Disease Control and Prevention.

FACULTY SPOTLIGHTS

Chemistry and Biochemistry Department chair **Mikell Paige** is designing small molecules to enable drug development in meaningful and practical ways.

Marissa Howard, BS Bioengineering '17, PhD Biosciences '22, leads a team of scientists who have discovered a way to "eavesdrop" on cellular communications that could revolutionize treatments for cancer and other diseases.

PIONEERING SPACE EXPLORATION, RESEARCH, AND COLLABORATION

Space exploration offers essential tools for life on Earth—fueling technological breakthroughs, enhancing environmental forecasting, and expanding our understanding of the universe. From designing an artificial star with NASA to using satellite data for storm prediction, George Mason is driving space-based discovery that meets real-world needs—connecting knowledge to action and impact.

Research in Action

WORKING ON THE LANDOLT MISSION

George Mason is the home of the $20 million Landolt NASA Space Mission, which will place a satellite that will serve as an artificial "star" in orbit around the Earth by 2029. Peter Plavchan, associate professor in the Department of Physics and Astronomy and the project's principal investigator, and Peter Pachowicz, associate professor in the Department of Electrical and Computer Engineering, lead the project, and George Mason engineering students are playing an instrumental role in the payload's construction. It's an experience that allows them to work on a project from the inception of the mission to the actual launch and operation of the science payload. It's also an opportunity for the kind of unparalleled experiential learning that George Mason prioritizes.

Graduate student Fatima Bahzad says, "It's the most fun I've ever had in school." Bahzad, a computer science major, is working on the communication of microchips that make up the artificial star.

The team is building the payload in partnership with the National Institute of Standards and Technology. The artificial star will allow scientists to calibrate telescopes and more accurately measure the brightness of stars that range from those nearby to the distant explosions of supernova in far-off galaxies. By establishing absolute flux calibration, the mission will address several open challenges in astrophysics, including the speed and acceleration of the universe's expansion.

PhD student Jay Deorukhkar has been working on testing the individual payload modules. These will later integrate with the satellite bus, which is the core structure and support system that is separate from the specific payload. His dissertation explores the reliability of small satellite buses against radiation effects, making for a particularly relevant bridge between his research and the project.

STUDENT RESOURCES

The **Small Satellite Engineering Graduate Certificate** in the College of Engineering and Computing prepares students for emerging roles in aerospace and defense.

The **Satellite and Earth Systems Studies Program** in the College of Science helps enhance students' understanding of how the natural components of the Earth system—atmosphere, ocean, land, and biosphere—interact with human activities as a coupled system.

FUTURE-READY INFRASTRUCTURE

The **CubeSat/SatCom Engineering Lab**, under director Peter Pachowicz, focuses on hands-on engineering of ultra-small CubeSats and satellite communications systems by combining research and educational objectives.

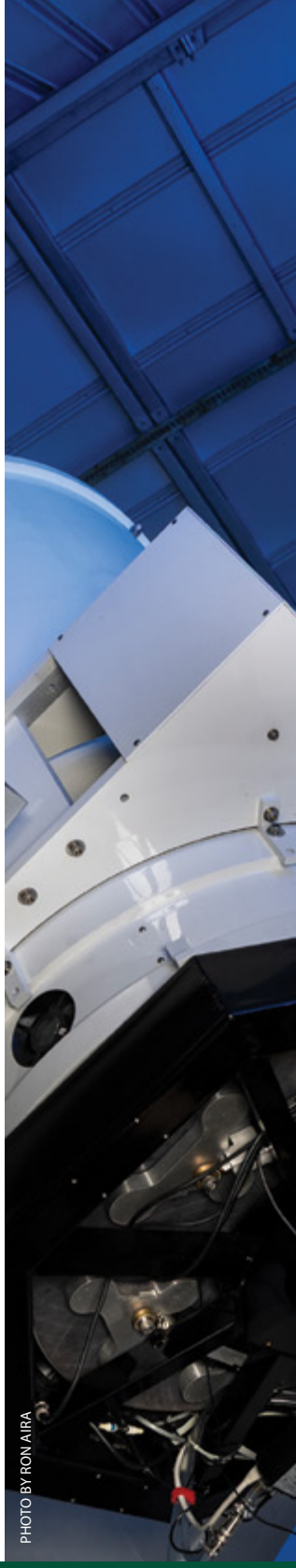


PHOTO BY RON AIRA

FACULTY SPOTLIGHTS

An expert in data and computational science, **Anamaria Berea**, PhD Computational Social Science '12, has worked closely with NASA on several projects, including NASA's Decadal Astrobiology Research and Exploration Strategy (DARES) Task Force 1.

Mike Summers is a planetary scientist who has worked on NASA space missions that study the Earth from a space shuttle and orbiting satellites that probe other planetary atmospheres using deep space robotic missions. He played a leading role in the New Horizons mission to Pluto and the Kuiper Belt.

Space exploration isn't just about discovery—it's about preserving our humanity and values beyond Earth."

Anamaria Berea, Professor, Department of Computational and Data Sciences

THE NANOFABRICATION FACILITY

The Nanofabrication Facility, with its Class 1000 clean room and characterization labs, provides the tools necessary for photolithography, etching, and deposition processes essential for building microfluidics, micro- and nanoelectronics, and other devices.

PHOTO BY EVAN CANTWELL

THE GEORGE MASON OBSERVATORY

The George Mason Observatory, located on the Fairfax Campus, is where research, education, and public service come together under the stars. Operated by the Department of Physics and Astronomy, the observatory allows students and the community to explore astronomy through hands-on experiences with professional-grade equipment.

VICE PRESIDENT MIKE PENCE

A new Distinguished Professor of Practice at George Mason, Pence met with students as a recent guest at University Life's Pizza and Perspectives at Mason Square. The program is designed to engage the Mason Nation in meaningful dialogue on relevant topics.

PHOTO BY RON AIRA

We teach our students to identify the underlying causes of conflict and equip them with the theory and practical skills to put their knowledge into action."

Alpaslan Özerdem, Dean,
Carter School for Peace and Conflict Resolution

PHOTO PROVIDED

STRENGTHENING PEACE, TRUST, AND ENGAGEMENT IN DEMOCRACY

Strengthening peace, trust, and engagement in democracy is vital for creating resilient, inclusive societies where individuals feel empowered to shape their future. George Mason is building civic trust and advancing peace by preparing students to lead, supporting global collaboration, and fostering community resilience. Working with faculty and experts on real-world policy solutions, George Mason equips the next generation to contribute meaningfully to democratic resilience at home and abroad.

THE GEORGE MASON ADVANTAGE

George Mason chairs the **United Nations Sustainable Development Goal (SDG) 16 Hub—Peace, Justice, and Strong Institutions**, a position it will hold for the next three years. As hub chair, the Jimmy and Rosalynn Carter School for Peace and Conflict Resolution is responsible for education and training, research, community engagement, developing partnerships, and working with other SDG hubs to strengthen and further the United Nations' mission of peace and justice.

Research in Action

BALTIMORE PEACE EDUCATION AND VIOLENCE PREVENTION

Arthur Romano is working to prevent gun violence in Baltimore, Maryland, through proactive peacebuilding initiatives. The Baltimore Peace Education and Violence Prevention project, part of a collaboration between the Carter School and Rotary International, is addressing the problem with a multipronged approach: Peace summits that bring together peace building organizations, offering services to municipal governments to strengthen their strategic plans in that area, and an international exchange of violence prevention practitioners to share emerging practices.

"Since community-based violence is a result of multiple compounding stressors and structural issues, then the interventions need to be multi-level," says Romano, an associate professor and founder of the Carter School's Program on Urban Peacebuilding. "We're trying to be proactive and build infrastructure that accelerates learning and communication across organizations."

The research team held a pilot peace summit in Baltimore in April 2025 that brought together practitioners and community organizations on the front lines of violence prevention to share knowledge, identify gaps, and determine areas for collaboration.

A key partner in the project is Carter School alum **Nawal Rajeh**, MS Conflict Analysis and Resolution '10, PhD '24, who organized the peace summit and has been running a peace camp in Baltimore for the past 17 years through her nonprofit By Peaceful Means.

STUDENT RESOURCES

In partnership with George Mason's Housing and Residence Life, the Schar School's **Democracy Lab** is a learning experience open to all first-year undergraduates living on campus. Through the learning community, students engage with the issues that define the journey of democracy in the United States and around the world.

Founded in 2004, the Clinic for Legal Assistance to Servicemembers and Veterans, called **M-VETS**, enables Scalia Law School students to assist service members, veterans, and dependent family members in a wide variety of litigation and nonlitigation matters. Since its inception, students have assisted hundreds of clients from all five branches of the armed services.

FUTURE-READY INFRASTRUCTURE

Carter School Peace Labs identify, test, and enhance existing practices, tools, and models of peace building and reconciliation, assessing their potential and advancing their applications across different social contexts.

FACULTY SPOTLIGHTS

Over the decades, **Marc Gopin** has pioneered peacebuilding work and trained thousands of students in conflict healing and peacebuilding through intensive practice courses in conflict zones around the world.

Guadalupe Correa-Cabrera is an expert and frequent commentator on issues related to Mexican politics, U.S.-Mexico border relations, immigration, drug trafficking, and other forms of transnational organized crime.

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PUSHING THE BOUNDARIES—The Pixel Cube in the Imaging and Vision Lab at Mason Square comprises 90 LED panels arranged in a cube. The system allows for panoramic simulations and is perfect for applications in virtual production, such as driving simulators. Photo by Ron Aira