ASU Global Security Initiative

Arizona State University

Addressing **global security challenges** in partnership with **defense, security** and **diplomacy communities**

"The Global Security Initiative is on the leading edge of ASU's comprehensive, interdisciplinary approach to designing enduring solutions for security challenges that impact citizens around the world."

Sethuraman Panchanathan, executive vice president of Knowledge Enterprise Development and chief research and innovation officer at ASU

Mission

Catalyze and support Department of Defense, Department of Homeland Security and Intelligence Community activity across the university.

Perform landscape development and provide intellectual leadership for "wicked problems" in global security.

$20.2 million+ in research expenditures in FY 2018 (Funding sources: government, industry and foundations)

#3 in the nation for DARPA Young Faculty Awards

130 + affiliated faculty

About the Global Security Initiative

GSI's vision is a security and intelligence landscape transformed through interdisciplinary research and discovery, in which defense, development and diplomacy operate collaboratively to drive positive outcomes for complex global challenges.

About Arizona State University

ASU Charter

ASU is a comprehensive public research university, measured not by whom it excludes, but by whom it includes and how they succeed; advancing research and discovery of public value; and assuming fundamental responsibility for the economic, social, cultural and overall health of the communities it serves.

#1 in the U.S. for innovation (#1 ASU, #2 Stanford, #3 MIT)
U.S. News & World Report, 2016, 2017, 2018 and 2019

#4 in the U.S. for interdisciplinary science research expenditures
National Science Foundation HERD Survey 2016

#6 producer of faculty Fulbright Scholars
Chronicle of Higher Education

One of the fastest-growing research universities in the U.S., with more than $100 million in research expenditures

#7 top college for veterans
College Factual 2017

#7 for student Fulbright awards
Chronicle of Higher Education

Exceptional people. Impactful ideas. Powerful relationships.

Letter from the director

The Global Security Initiative (GSI) has grown considerably in its three years of existence. Research expenditures have increased by 274 percent in that time, and GSI is now home to three centers that are producing novel, practical solutions for government and industry partners in the areas of cybersecurity, data analysis and artificial intelligence.

With this growth comes the opportunity for greater impact. GSI's new Department of Homeland Security (DHS) Center of Excellence, for example, is working directly with DHS components — agencies like the Transportation Security Administration (TSA) and the Federal Emergency Management Agency (FEMA) — to improve their inner workings. This research will directly affect our government's efficiency, ability to plan for and respond to emergencies, and capacity to deter malicious attacks. It may save lives, and we take the execution of such a consequential program seriously.

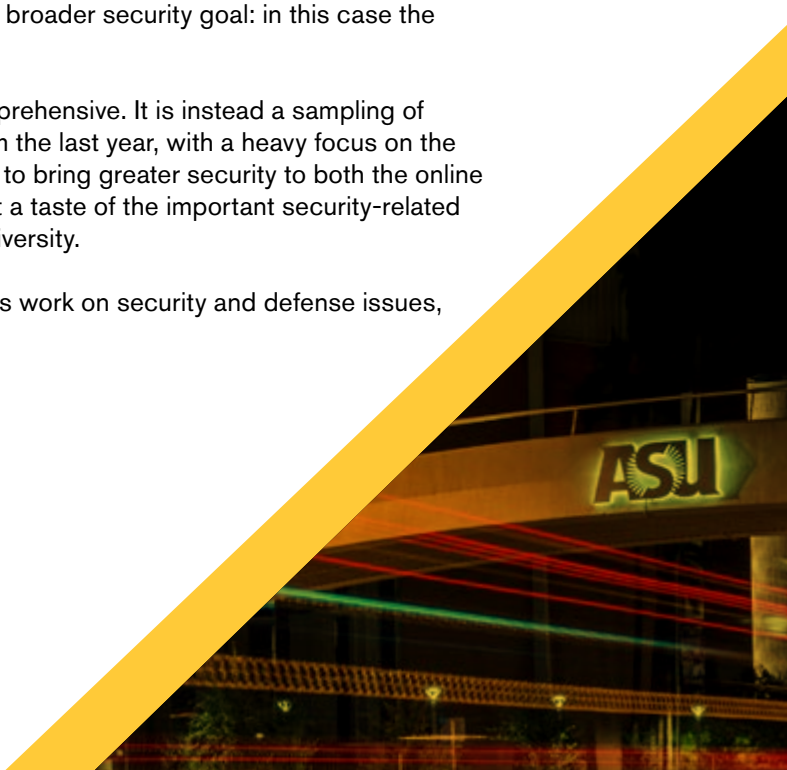
While smaller in scale, GSI's work with philanthropic partners is also producing real-world change. This past year, GSI partnered with the Leonardo DiCaprio Foundation to develop a data analysis and visualization tool that will help the foundation better plan for and prioritize its land conservation efforts. This is exactly the kind of outcome GSI strives for — the production of user-friendly tools and technology that can be used by partners to help achieve a broader security goal: in this case the preservation of threatened resources.

This annual report is not meant to be comprehensive. It is instead a sampling of GSI's activities and accomplishments from the last year, with a heavy focus on the three centers and the work they are doing to bring greater security to both the online and offline worlds. In other words, it is just a taste of the important security-related research taking place at Arizona State University.

If you would like to learn more about ASU's work on security and defense issues, please contact us at gsi@asu.edu.

Sincerely,

Nadya Bliss, PhD, Director
Global Security Initiative



GSI leverages the world-class expertise of more than 130 ASU faculty members to produce its solutions, technologies and decision-making tools. The faculty, together with GSI research scientists, work in teams to produce outcomes in the following global security areas:

Tackling complex problems

Cybersecurity

Defining the new frontiers of cyber defense technology and designing solutions for industry and government partners. Areas of focus include threat intelligence, dark web market behaviors, identity and privacy management, and network, systems and data assurance.

Resource security

Developing local, national and global response capabilities to anticipate and mitigate the negative effects of climate and resource instability.

Economic security

Building models and tools for anticipating economic threats and potential cascading effects to proactively implement interventions.

Visualization and analytics

Creating tools that clarify and effectively communicate key information, enabling decision-makers to better plan for and respond to changing events while making judgments that are credible, salient and legitimate.

Human and social conditions

Raising questions about technology's societal impacts, and building responsive technologies and capacities to improve individual and community life.

Human, AI and robot teaming
Cultivating effective, ethical teams of humans, artificial intelligence and robots that work together in support of national security, based on lessons from teaming science and swarm robotics.

Health security
Promoting and securing the health and resilience of individuals, communities and populations globally.

Narrative and strategic influence
Combating the use of misinformation and disinformation by malicious actors, and creating systems and tools to help organizations and decision-makers better understand how information is being used by allies and adversaries alike in pursuit of strategic goals and geopolitical influence.

Arizona State University has an applied research organization that is capable of conducting classified and midrange-technology-readiness-level (TRL) services for the defense and security industry. Learn more at asure.asu.edu.

Center for Accelerating Operational Efficiency

The Department of Homeland Security's Centers of Excellence network is an extended consortium of universities conducting groundbreaking research to address homeland security challenges. The Center for Accelerating Operational Efficiency (CAOE) is one of these centers.

Led by ASU, CAOE is working with agencies like the Transportation Security Administration (TSA) and the Federal Emergency Management Agency (FEMA) to bring cutting-edge technology and academic rigor to bear on operational challenges.

"TSA greatly values its partnership with the DHS Office of University Programs' CAOE. This new partnership provides TSA with continued access to world-class academic resources to better manage risk, improve the security of the Transportation Sector and to proactively address operational challenges."

Jerry C. Booker, Director
Enterprise Performance and Risk
Transportation Security Administration

Featured projects

- CAOE researchers are designing a real-time decision system for emergency command-and-control and repair and recovery of vital transportation, electrical power and diesel-fuel supply chains.
- To enhance aviation security, CAOE is developing new technology to increase efficiency of security screening at airports and explore the possible expansion of the TSA precheck program.
- CAOE researchers are working with DHS to evaluate recent procurement reforms and provide suggestions for continued improvements in the procurement process.
- To optimize risk-informed decision-making, researchers are investigating current gaps — both technological and operational — for risk detection and assessment.

Educating the current and future homeland security workforce

- Providing hands-on educational opportunities for students interested in homeland security careers, including a comprehensive summer research program for undergraduates.
- Increasing data literacy in the classroom by providing workshops for faculty and relevant course materials, with a focus on minority-serving institutions.
- Providing continuing education opportunities for current homeland security professionals, both online and in person.

Capabilities

- Data analytics: real-time rapid response.
- Operations research and systems analysis: improving process and decision time.
- Economic analysis: understanding the true cost.
- Homeland security risk sciences: identifying and prioritizing risk.

Center for Cybersecurity and Digital Forensics

The Center for Cybersecurity and Digital Forensics (CDF) produces high-impact and practical solutions to real-world cybersecurity challenges. Working closely with industry and government, CDF focuses on the development of tools and technologies that can be transitioned into practice.

Faced with evolving threats and adaptive attackers, CDF is keeping the future in mind and training the next generation of cybersecurity professionals. Our hands-on approach to preparing our students involves competitive capture-the-flag events and other cyber challenges to ensure they possess the skills and confidence to succeed.

"The adversaries, the attackers, have a lot of advantages. The attacker only has to find one vulnerability, one way into a system. The defender has to defend all possible areas. So, CDF is trying to answer the question — how can we find vulnerabilities before the bad guys do?"

Adam Doupé, Associate Director
Center for Cybersecurity and Digital Forensics

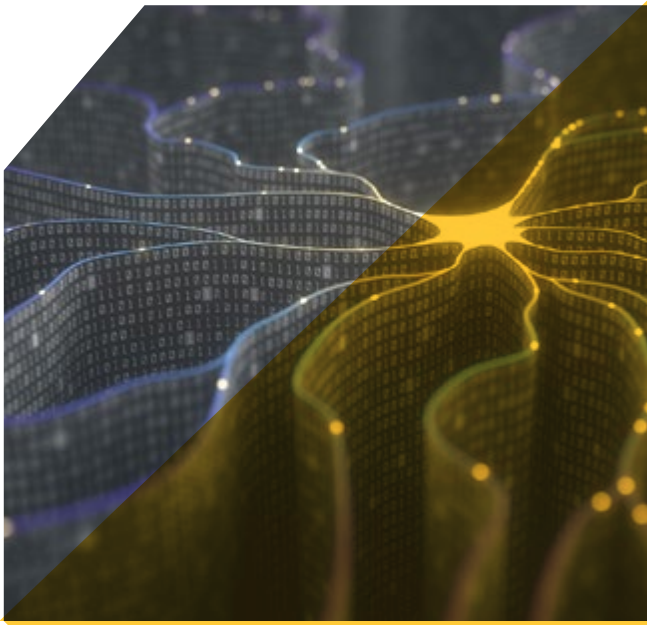
Featured projects

- CDF is developing a helpful worm, a piece of code that uses security vulnerabilities to gain access to, and then repair, remote computer systems. This project is funded by the Defense Advanced Research Projects Agency (DARPA).
- CDF is working with Paypal to develop an automated system that can detect vulnerabilities in payment gateways in mobile applications. This research will help keep users' data safe. As part of the project, the tool will survey more than 2 million Android applications.
- In partnership with five other universities, ASU is developing a personalized approach to cyber defense. The project, funded by the Army Research Office, gathers data on human behavior to profile cyberattackers and use that information to design personalized defenses against them, creating an environment in which the attacker does not know which potential targets are real.

Center for Human, Artificial Intelligence, and Robot Teaming

Advances in artificial intelligence (AI) and robotics are producing machines that can work alongside humans as teammates. In order to recognize AI's full potential, we must understand how to engineer technology that most effectively teams with humans.

Based on lessons from the science of teamwork, the Center for Human, Artificial Intelligence, and Robot Teaming (CHART) is developing and deploying technologies, tools and best practices to ensure these unconventional teammates complement each other and successfully complete missions.



Featured projects

- CHART is comparing the effectiveness of human-only teams vs. teams that include a synthetic teammate powered by artificial intelligence. In a simulated environment, the teams operate an unmanned aerial system to take photos of ground targets. The comparison of the teams' performances allows researchers to identify any shortcomings that stem from the inclusion of synthetic teammates and highlight the attributes that make a good team player.

- The Autonomous Collective Systems Laboratory is creating novel approaches for controlling robotic swarms to collectively complete tasks in unknown, remote and hazardous environments with limited data and communication. Potential applications include search and rescue missions, disaster response, explosive ordnance disposal and defense operations.

"We take a lot of measures of what we call team process. How do they interact, how do they communicate, how do they coordinate? All of those things are relevant for trying to understand how to make teams better. We don't want to ask people to interact better with robots. We want robots to interact better with the people."

Nancy Cooke, Director
Center for Human, Artificial Intelligence, and Robot Teaming

Idea to reality

Engaging with the Defense Advanced Research Projects Agency (DARPA)

DARPA is the agency of the Department of Defense (DoD) responsible for the development of emerging technologies. One of GSI's strategic priorities is to ensure that advanced research at ASU is addressing DoD needs and solving not only the challenges of today, but also emerging issues that may affect our national security in the future.

Leveraging its insight into the mission space, its experience conducting advanced interdisciplinary research, and its knowledge of ASU's capabilities, GSI works with researchers from concept development to proposal submission and through project execution to ensure the university is addressing DoD challenges.

Featured project

- ASU researchers are driving the next revolution in electronics circuitry. As part of DARPA's Electronic Resurgence Initiative, researchers are devising a new framework for microsystems that breaks the fundamental trade-off between energy efficiency and ease of implementation. The result will be Systems on Chips (SoC) that are more powerful, smaller in size and provide more processing flexibility.

A leader in DARPA Young Faculty Awards

Since 2013, ASU has jumped from No. 31 to No. 3 in total number of Young Faculty Awards received. These awards are prestigious opportunities for rising research stars, who receive funding, mentoring and defense industry contacts through them. Three ASU researchers were awarded DARPA Young Faculty Awards this year.

One Young Faculty Award winner is examining the impact of environmental, operating and organizational characteristics unique to humanitarian organizations on their strategic choices, in an effort to determine whether or not their incentive to coordinate with other humanitarian organizations varies depending on factors including supply uncertainty and geographical conditions.

Another DARPA Young Faculty Award-winning team is seeking to increase situational awareness in military missions by designing low-cost energy-harvesting devices that never require battery charging or replacement and that support flexible communication protocols.

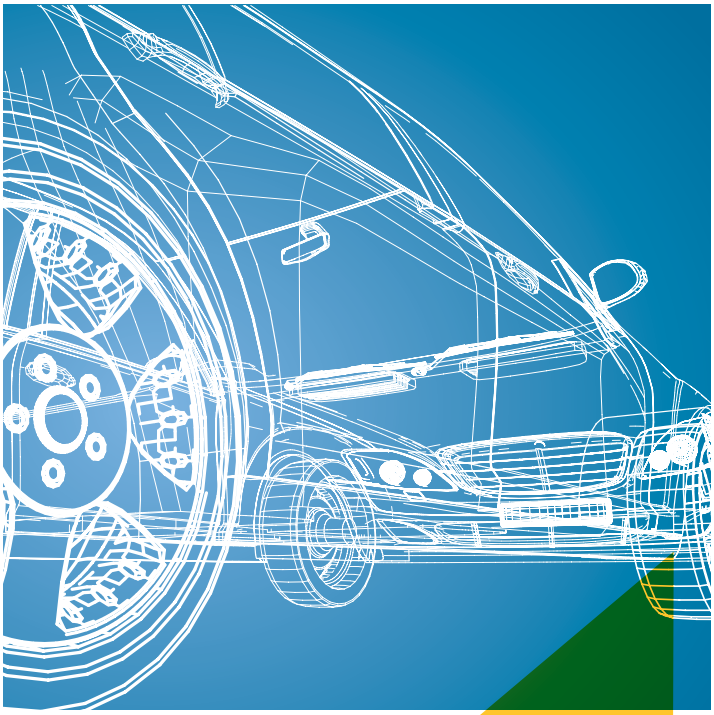
Looking ahead

CDF has organized and supported hacking competitions in the past but took on a national role this year by helping to organize the Capture the Flag competition at DEF CON 26 in Las Vegas. The event is competitive hacking at its best, bringing experts together to compete against each other to solve challenges, identify best practices, and inform and inspire spectators. These types of events are critical for cybersecurity experts to hone their skills and keep up with malicious actors. CDF faculty are slated to help organize the same event at Def Con 27 next year as well.

CHART is developing a testbed for driver interaction with driverless cars using small, modular robots that can function in both autonomous and human-controlled modes. The testbed will simulate the conditions and challenges experienced by full-size autonomous vehicles and will be used to study changes in human behavior when interacting with autonomous vehicles.

GSI will build on the successful development of a data visualization tool, funded by the Leonardo DiCaprio Foundation, that helps philanthropists, governments and NGOs better prioritize conservation efforts around the world.

The spread of falsified media is a threat to democracy and the stability of our nation. GSI is spearheading university activities in this area, from narrative analysis to efforts to identify and flag altered audio and video.



Leading the conversation

GSI leadership and researchers engage the public in discussions of key security issues through a wide variety of venues, from appearances in national media outlets, such as The Washington Post and CNN, to organizing high-level discussions of critical security needs.

ASU Congressional Conference on Cybersecurity

GSI played a leading role in organizing ASU's first Congressional Conference on Cybersecurity. The event featured U.S. Senator John McCain as keynote speaker and six other members of Arizona's congressional delegation. Topics discussed at the conference included how to define critical infrastructure, the responsibilities of different government agencies and how to manage threats that vastly outpace the speed of the legislative process.

"Arizona State University has taken the lead in academia, making a commitment to dramatically increase the output of cyber-qualified graduates. ASU's leadership is critical to solving the number one challenge across the cybersecurity landscape — the need for a trained and capable workforce for both government and industry."

U.S. Senator John McCain speaking at the ASU Congressional Conference on Cybersecurity in August 2017

GSI Director Nadya Bliss serves on the Computing Community Consortium (CCC), a council made up of leading computer scientists that aims to mobilize the computing research community to catalyze longer-range, more audacious research challenges and to build consensus around research visions.

"For many engineers and computer scientists, it may feel unnatural to be the loudest person in the room. We're trained to deliver facts in dispassionate ways. We've been taught to present algorithms, results, system architectures without ringing alarm bells. But we have to make our points heard. We need to make sure that developers, executives and policymakers hear us. We can do this without being alarmist or having people think we all wear tinfoil hats. Let's arm people with useful knowledge that can protect them."

Nadya Bliss, Director
Global Security Initiative

GSI is playing a leading role in an ambitious collaboration with Japanese universities to promote international, cross-institution partnerships and cooperative research. The Japan-U.S. Digital Innovation Hub aims to facilitate and promote research collaboration, especially in fields such as data science, artificial intelligence and cybersecurity.

GSI in the media

- Associated Press
- The Arizona Republic
- Christian Science Monitor
- CityLab
- Council on Foreign Relations
- CNN
- Foreign Policy
- National Public Radio
- New America
- Politico
- Public Broadcasting Service (PBS)
- Slate
- USA Today
- Washington Post
- Wired

"Universities cover more disciplines with greater rigor than any company can. We like the truth, and we like that professors and students are committed to the truth."

Jason Matheny, *former director of the Intelligence Advanced Research Projects Activity (IARPA), during a panel on the importance of mission-focused agencies partnering with universities during the opening activities of ASU's new Washington, D.C., location, the Ambassador Barbara Barrett and Justice Sandra Day O'Connor Washington Center.*

GSI Director of Strategy Jamie Winterton testified on data breaches before the U.S. Senate Subcommittee on Privacy, Technology and the Law. The hearing focused on the data breach at Equifax in the fall of 2017, which resulted in the exposure of more than 150 million Americans' credit records.

"One reason why we can't sufficiently secure online systems is because we fail to understand their complexity — from a computer science perspective, a social science perspective or a legal perspective, much less the overlap of the three."

Jamie Winterton, Director of Strategy
Global Security Initiative

access | excellence | impact

Global Security Initiative

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Find out how you can partner with GSI at **globalsecurity.asu.edu**

To support GSI, please visit **asufoundation.org/globalsecurity** to make a donation.

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