ASU Global Security Initiative

Arizona State University

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

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.

$11 million+ in research expenditures in FY 2017
Funding sources: government, industry and foundations

#8 for DARPA Young Faculty Awards

150+ affiliated faculty

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.

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 and 2018

The fastest-growing research university in the U.S. with more than $100 million in research expenditures

#4 in the U.S. for interdisciplinary science research expenditures
National Science Foundation HERD Survey 2015

#7 top college for veterans
College Factual 2017

#6 producer of faculty Fulbright Scholars
Chronicle of Higher Education

#11 for student Fulbright awards
Chronicle of Higher Education

Exceptional people. Impactful ideas. Powerful relationships.

Letter from the director

The Global Security Initiative (GSI) not only welcomes challenges, but also makes them our everyday business. Our mission is to address the world's wicked problems, the toughest challenges threatening global and national security.

Cyber threats. Resource scarcity. Epidemics. Privacy in the age of big data. These are wicked problems – security challenges that are global in scale, borderless by nature, interdependent and often have conflicting objectives with no clear solutions. These threats are driven by complex, interwoven sets of factors. They require a novel, more holistic approach centered on interdisciplinary research that spans the public, private and academic sectors.

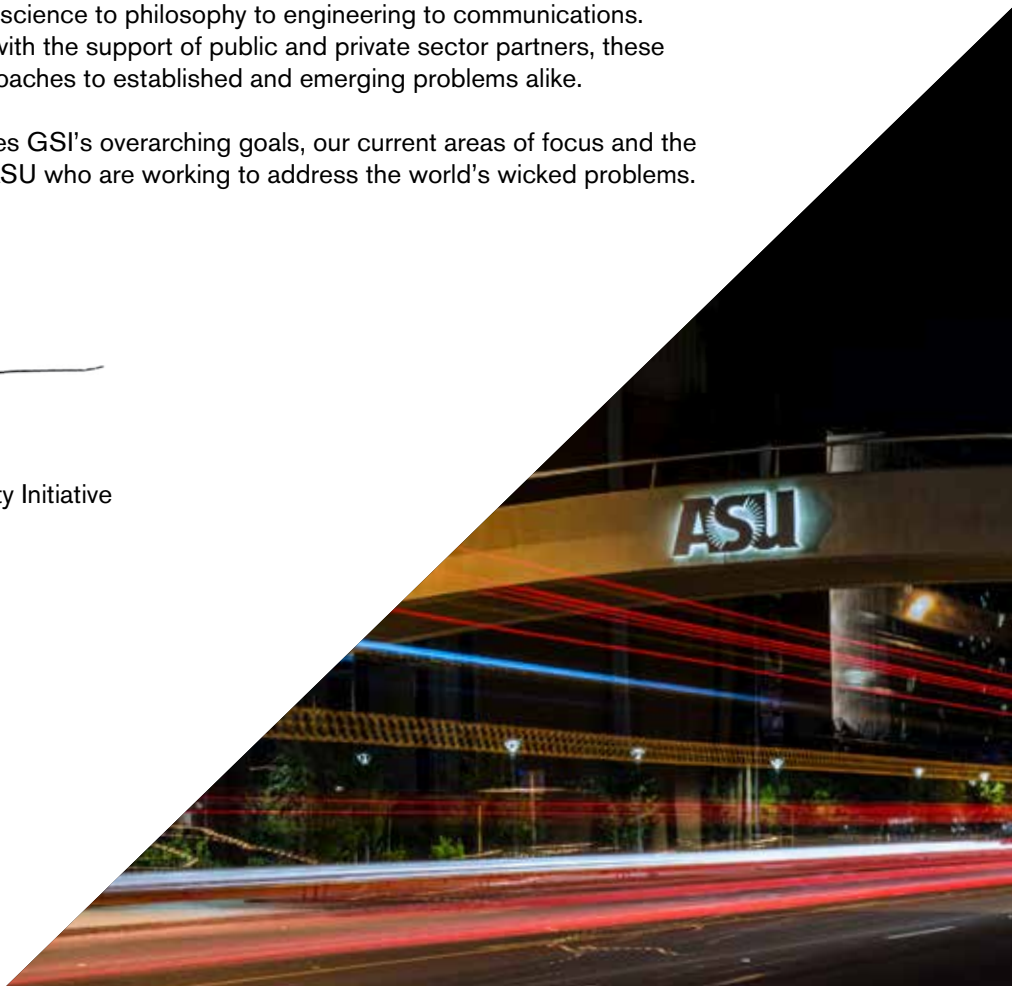
GSI is leading that new approach, leveraging the world-class expertise of Arizona State University faculty and GSI's connections with the global defense, development and diplomacy communities to produce mission-relevant approaches and decision support tools that are timely and useful to policymakers and implementers. The goal is nothing short of enhanced national security and global impact.

Building on ASU's culture of innovation, GSI affiliates are leading experts in fields ranging from computer science to philosophy to engineering to communications. Working in teams and with the support of public and private sector partners, these experts take fresh approaches to established and emerging problems alike.

This annual report shares GSI's overarching goals, our current areas of focus and the exceptional people at ASU who are working to address the world's wicked problems.

Sincerely,

Nadya Bliss, PhD
Director, Global Security Initiative



Tackling the world's wicked problems

Wicked Problems: Emerging global challenges characterized by complex interdependencies and conflicting objectives where solutions may not exist

GSI leverages the world-class expertise of more than 150 ASU faculty members to produce its solutions, technologies and decision-making tools. The faculty, together with GSI research scientists, work in teams to produce groundbreaking studies and solutions in the following global security areas:

Cybersecurity

Defining the new frontiers of cyber defense technology and designing solutions for industry and government partners. Areas of focus include dark web market behaviors, personal privacy issues, digital forensics and next-generation authentication.

Health Security

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

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.

Human, AI and Robotic Teaming

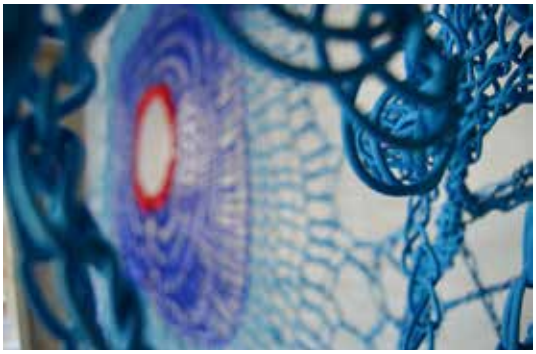
Cultivating effective, ethical teams of humans, artificial intelligence and robots that work together in support of national security.

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.



"The legal world has yet to catch up with what our digital tools are doing in our everyday lives in regards to digital civil rights. Everyday technology puts you at risk because the information is shared and sold, and has a much bigger impact than most people realize."

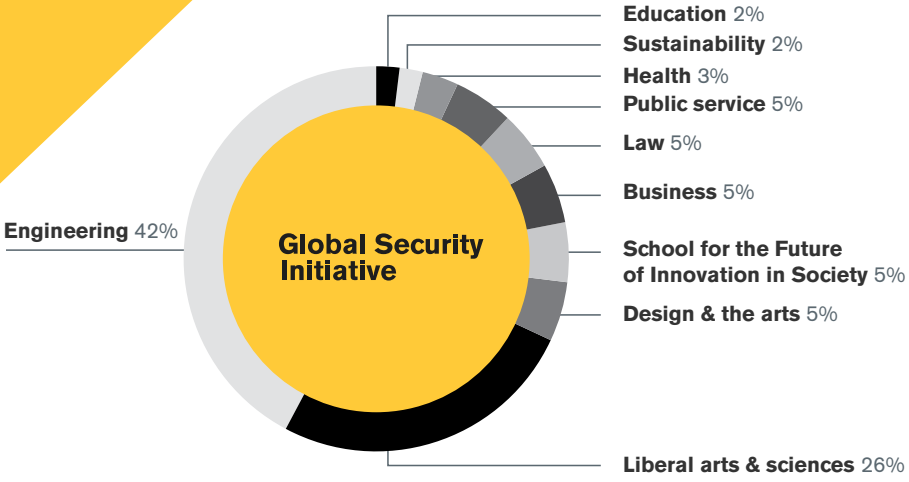
Jacqueline Wernimont, GSI fellow, co-director of GSI's Human Security Collaboratory and assistant professor of English.

Wernimont is co-director of Humanities, Arts, Science, and Technology Alliance and Collaboratory (HASTAC), a national educational and research organization with more than 13,000 members.

Breaking through barriers

GSI's innovative approach is built on interdisciplinary research that bridges the gap between academic research and real-world application. By bringing the smartest minds from different fields together, we can take fresh approaches toward solving the world's most complex security challenges.

GSI Affiliates



Defense Advanced Research Projects Agency (DARPA) working group

GSI's DARPA working group helps researchers at ASU build connections with DARPA, stay informed of partnership opportunities, and draft competitive research proposals. Since 2013, ASU has jumped from No. 31 to No. 8 in cumulative ranking of 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.

GSI serves as ASU's primary interface with the defense and intelligence communities.

"There has never been a more exciting time to be a computer scientist — computer science touches just about every aspect of our lives."

Nadya Bliss, director of GSI

Bliss was appointed to a three-year term on the Computing Community Consortium (CCC) Council, a council made up of leading computer scientists that aims to mobilize the computing research community to debate longer-range, more audacious research challenges, and to build consensus around research visions.

Highlights

GSI researchers are helping to create a more sustainable future by investigating **the interplay between food, energy and water systems** and how a breakdown in one could negatively affect the others. The team will not only define and analyze potential problems within the food, energy and water nexus, but also package that data and provide simulations that policymakers and others can use to plan ahead and make decisions.

The Autonomous Collective Systems Laboratory is creating tools and methods for **controlling robotic swarms to collectively complete tasks in unknown, remote and hazardous environments** with limited data and communication. This work will enable robotic swarms to be reliably deployed for applications such as search-and-rescue missions, disaster response, explosive ordnance disposal, chemical/biological/nuclear detection and defense operations. To design swarm control strategies, the researchers draw upon behaviors exhibited by collectives found in nature, such as ant and bee colonies that work together to accomplish a shared goal.

Software developed by GSI is helping government officials in Maricopa County to develop more informed **job creation strategies** and better prioritize targets for job growth. The tool uses big data to identify strengths and weaknesses of local labor forces, and is also being used in the private sector to help companies determine locations that have an existing labor force with the skill set they need.

"You can be like the little Dutch boy and try to plug all the holes, but if you know where the bad guy is going next, why not try to plug those ones first?"

Paulo Shakarian, GSI affiliate and Fulton Entrepreneurial Professor in the School of Computing, Informatics, and Decision Systems Engineering

"Our stake in this initiative is to focus on securing several new technologies that are emerging. We will study energy delivery systems and other infrastructures, including building and home automation infrastructures and the so-called Internet of Things, which may also be vulnerable to cyberattacks aimed at creating imbalance in the grid."

Gail-Joon Ahn, director of GSI's Center for Cybersecurity and Digital Forensics and professor in the School of Computing, Informatics, and Decision Systems Engineering

GSI researchers are developing new cybersecurity tools and procedures to help **protect the nation's electricity infrastructure from attacks,** in partnership with 11 other universities and research labs. The group will work closely with industry to ensure its proposed solutions have real-world application, and is currently piloting its monitoring architecture at a public utility in California.

A deepnet and darknet monitoring system designed at GSI allows users to take a **proactive approach to cyberattacks,** identifying potential attacks before they take place. The system monitors roughly 120 sites at a time for relevant traffic and content. It is almost 92 percent accurate in detecting threats on darknet markets and 80 percent accurate at detecting threats on deepnet forums.

GSI, in partnership with Deepmind, a part of the Alphabet Group, is contributing to the evolution of artificial intelligence (AI), helping **ensure AI learning systems are imbued with knowledge of ethical values.** This is part of GSI's field-leading research on robotics, AI and human teaming.

Three GSI mixed-media installations addressed **the personal component of data security** by making mobile device "data-shed" or data exhaust tangible. The installations raised questions and encouraged individual reflection on the extraordinary amount of information we create and share every day. The events encouraged audience feedback and participation at festivals in Arizona, New Mexico and British Columbia, using touch, sound and visuals to inform and inspire contemplation.

GSI and its affiliate, ASU's Center for Strategic Communication, are partnering with Lockheed Martin to investigate **how actors hostile to U.S. interests frame a story in the public media** to justify and generate support for future actions. For example, an adversary may claim a local population is oppressed to justify a coming invasion. By identifying storytelling trends that indicate an imminent act, this research will help policymakers to identify potential threats and improve the odds of deterrence.

GSI is using a solar-powered digital library to **bring health education and other resources to remote villages** in the Pacific Islands. The library gives Peace Corps volunteers and residents living in areas with no internet connectivity access to vital health-related information, often conveyed through videos and pictures. More than 200 of these open-source libraries have been delivered.

Allstate Insurance Company is partnering with GSI to develop new tools for **identity management, malware attribution, privacy issues and secure mobile devices,** among other topics.

Looking ahead

GSI is building on its reputation as a leading innovator on global security issues, enhancing its international reach, and increasing its impact within ASU and its local community.

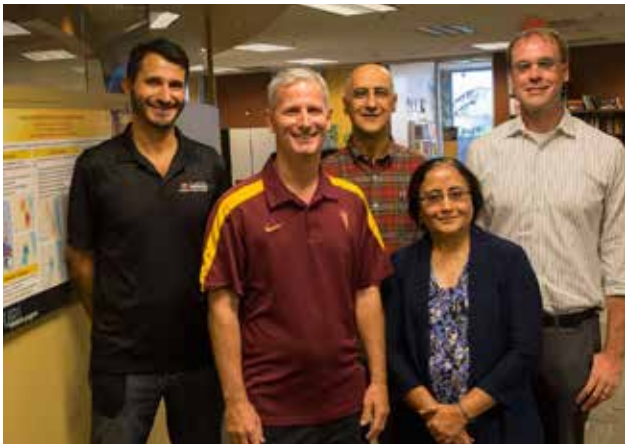
Upcoming focus areas:

Spearheading a U.S. Department of Homeland Security Center of Excellence

In summer 2017, ASU was selected as the lead institution for the new center, which will accelerate DHS's operational efficiency. GSI will work with other consortium partners to develop new tools and technologies to support data analytics, operations research and systems analysis, economics, and homeland security risk analysis.

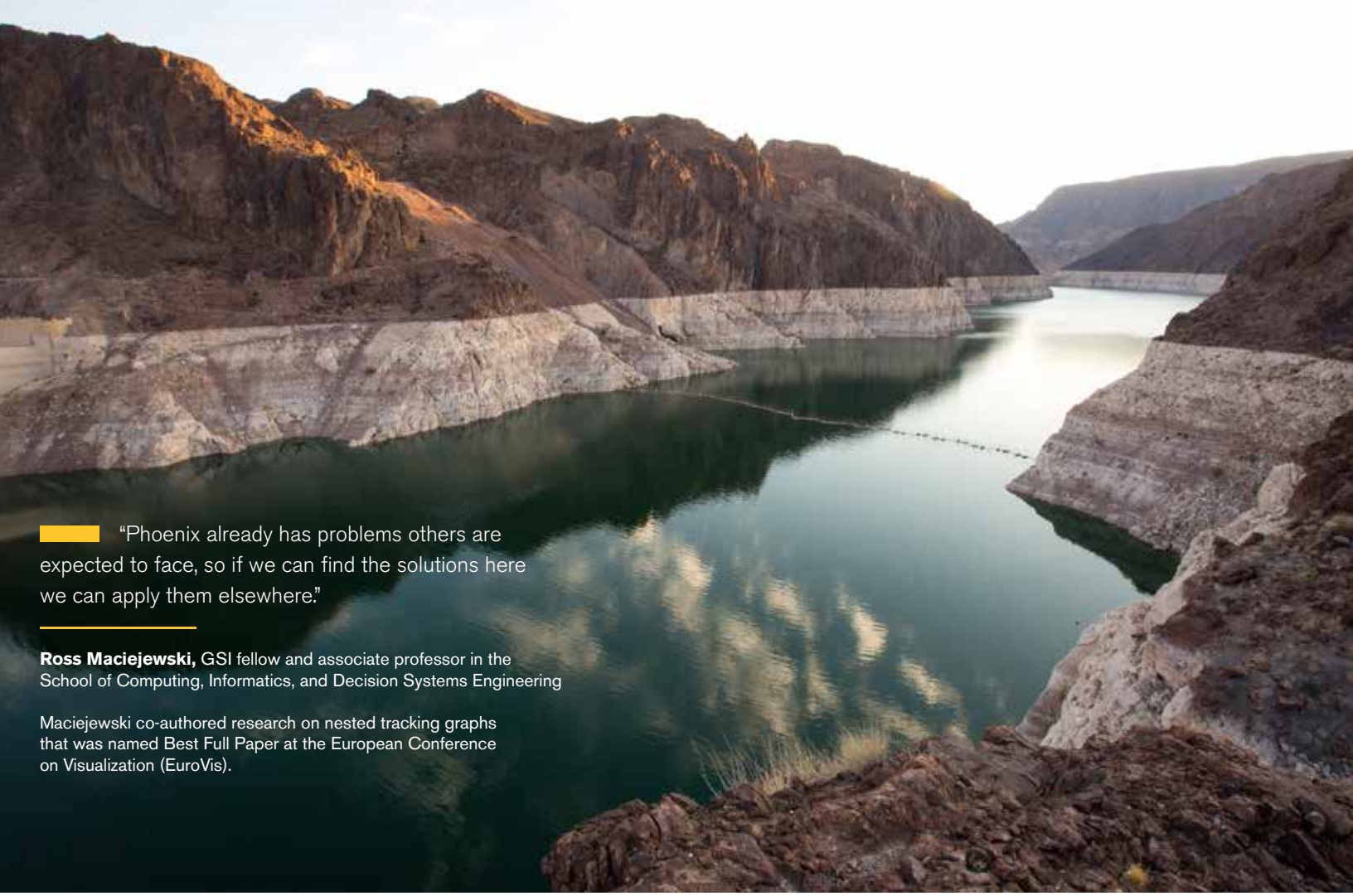
Developing effective, efficient and ethical teams of humans, robots and artificial intelligence

Such teams offer tremendous opportunity in a variety of security spheres, yet also possess inherent challenges and potential pitfalls. GSI will launch a groundbreaking initiative in this area.



"Swarm robotics is a fairly new and highly interdisciplinary field, with many applications ranging from environmental monitoring, exploration and disaster response to biomedical applications at the micro-nano scale, such as medical imaging and targeted drug delivery. Amazing advances are being made in robotic technology that sound like they are science fiction."

Spring Berman, assistant professor in the School for Engineering of Matter, Transport and Energy



"Phoenix already has problems others are expected to face, so if we can find the solutions here we can apply them elsewhere."

Ross Maciejewski, GSI fellow and associate professor in the School of Computing, Informatics, and Decision Systems Engineering

Maciejewski co-authored research on nested tracking graphs that was named Best Full Paper at the European Conference on Visualization (EuroVis).

Creating cross-border educational opportunities for government and security industry officials in the U.S. and abroad

GSI will build upon its partnership with the University of New South Wales Canberra (the educational home for members of the Australian Defense Force Academy) and its affiliation with Global Security PLuS. Such international knowledge-sharing will help improve global security and coordination on transnational challenges.

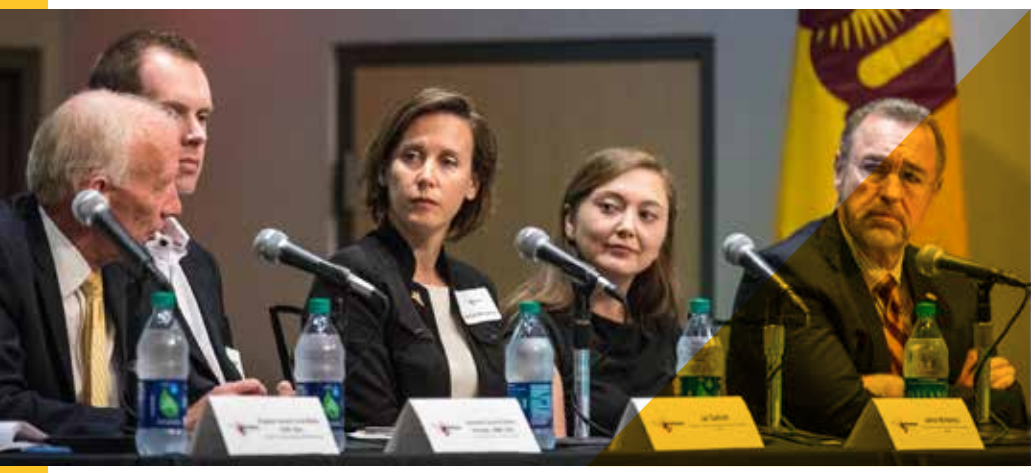
Educating residents of Arizona about protecting their personal data and accounts from malicious actors

GSI will continue its public service efforts to support the core tenet of ASU's mission to "enhance our local impact and social embeddedness."

Leading ASU in strategic planning and organizational innovation

GSI's robust strategic planning process and unique organizational structure are centered around responding to long-term security needs rather than short-term funding opportunities. Over the next year, GSI will lead instructional sessions and advise other units on long-term planning and tips for building interdisciplinary teams that work well together.

Leading the conversation



"We're in the era of sensors right now. But, the incoming flow of data is outpacing the development of theory to make sense of the data. The new problem is how you sift through it all."

Shade Shutters, GSI research scientist, in "How data helps cities withstand shock," The Christian Science Monitor, Jan. 10, 2017

GSI leadership and researchers engage the public in discussions of key security issues through a wide variety of national and local news outlets, including:

ABC 12 News
AZ Central
Christian Science Monitor
Council on Foreign Relations
Cronkite News
Duck of Minerva
Forbes
Foreign Policy
Huffington Post
IEEE Spectrum
KOMO News
KPCC 89.3
Medium
NPR
New America
Public Broadcasting Service (PBS)
Phoenix Business Journal
Phoenix New Times
Politico
PR Web
Quartz
Santa Fe Institute
Slate
Small Wars Journal
The Desk
Urban Resilience Research Network
USA Today
Wired

Industry engagement

Security is not only a government concern. While we work with government departments and agencies, we also collaborate closely with industry partners to develop tools and technologies. Below are a few of our industry partners.

Building on ASU's culture of entrepreneurship, three GSI core fellows have founded companies based on their research. Working with Skysong Innovations, the exclusive intellectual property management and technology transfer organization for Arizona State University, the researchers obtained patents and secured investments to launch their businesses.

Cyr3con

Platform for social threat intelligence on the latest cyber threats, enabling chief security officers to better understand the threat landscape, gain knowledge about malicious hacker behavior and identify emerging attacks against the enterprise

Athena Network Solutions

Providing highly customizable, cloud-based virtual laboratory platforms for users in research, education and enterprise

GFS Technology

Offering a proprietary platform that gives enterprises the power to control mobile devices based on their unique security policies, providing protection on all four layers of vulnerability

Global Security PLuS

Global Security PLuS is a collaborative effort of ASU, Kings College in London and the University of New South Wales Sydney. Drawing upon the expertise of all three universities, it focuses on the prevention, detection and mitigation of threats in violent conflict and war, cybersecurity, terrorism, disasters, and biosecurity.

"We work closely with both government and industry partners to understand real-world problems – particularly in cybersecurity, which is not just a technology problem, but a human-plus-technology problem."

Jamie Winterton, GSI director of strategy

"What we're doing is developing a personalized form of deception. We try to understand the (cyber)attacker. Instead of using a generalized honeypot, we specialize the offense against them, creating an environment in which they don't know what's real and what's not."

Nancy Cooke, GSI affiliate and professor of human systems engineering at the Polytechnic School, discussing a cyber defense project funded by the Army Research Office that ASU is conducting along with five other universities

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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