

**Arizona Board of Regents**

# Strategic Initiatives

May 2017



# Strategic Initiatives

**Establish ASU as a leading global center for interdisciplinary research, discovery and development by 2025.**

ASU has designed a knowledge enterprise around the needs of society today and in the future. Our path toward becoming the most innovative university in the country began in 1994 when ASU earned the designation of Research I university. In 2002, ASU underwent a radical redesign and emerged a New American University. Since then we have accelerated the growth of our research enterprise while also generating increasing economic impact in the region.

Today, ASU is a strong engine of economic growth and a leader among research universities. Our trajectory of success has been built on year-over-year achievement in small and mid-size funding (\$1M-\$25M). As a result of building this robust foundation, ASU is positioned to be exceptionally competitive for the acquisition of larger funded projects (>\$25M), integrating strategic and corporate partnerships and national lab-like initiatives to enter an era of high-impact research translation.

As part of our strategic vision, we have identified targeted areas of research in which we will acquire large-scale projects. These are aligned both with the expertise of our faculty and researchers and the state-of-the-art research infrastructure and facilities. In addition, these targeted areas translate directly to the projected needs of the Arizona employment sectors. Bringing these large-scale projects to ASU will create jobs for Arizonans and create or strengthen regional economic markets in ways that are unavailable to corporations and government working separately.

The following areas are being targeted for large-scale project acquisition at ASU:

- Health and Well-being
- Food | Energy | Water Nexus
- Earth and Space Exploration
- Industrial Transformation
  - Advanced Manufacturing
  - Advanced Materials
  - Future Transportation
- Smart Cities and Urban Resilience
- Internet of Things and Cybersecurity

The world is rapidly changing and as a society we face great challenges, many acutely apparent to Arizona citizens. At ASU we have built a knowledge enterprise encompassing research, entrepreneurship and economic development to directly address these challenges. Advancing our knowledge enterprise into an era of high-impact translational research will help advance Arizona as an outstanding place to work, study and live – while preparing a new generation to continue a tradition of excellence.



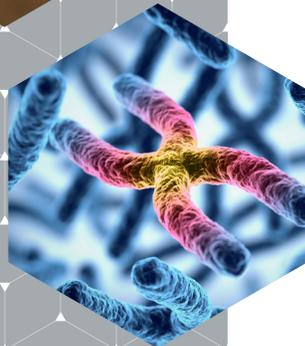
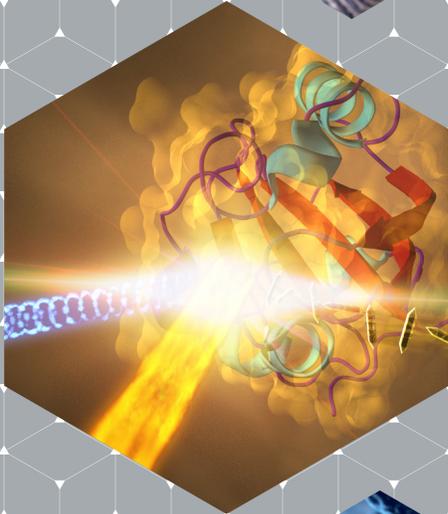
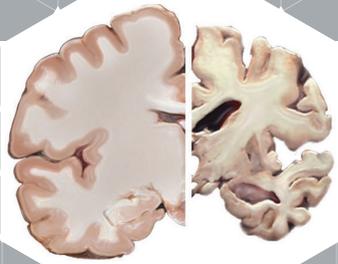
# Health & Well-being

## Situation

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Since 2002, ASU has been the fourth fastest growing biosciences research enterprise among U.S. universities that conducted more than \$40M in biosciences research annually. While the national growth in university biosciences research since 2002 has totaled 77%, ASU's biosciences research funding grew by more than 220% from \$40.5M in 2002 to \$129.9M in 2014. As a result of this progress, ASU is now ranked among some of the nation's top biosciences research enterprises. For example, ASU is now ranked 10th in the nation for research expenditures in bioengineering.

ASU's Improving Health Initiative focuses on the Biodesign Institute. Created on the premise that scientists can overcome complex societal challenges by re-imagining the "design rules" found in nature, the Biodesign Institute embodies ASU's New American University design aspirations to conduct use-inspired research, fuse intellectual disciplines and value entrepreneurship – principles that are increasingly important to federal agency, business and nonprofit sponsors. The Biodesign Institute will anchor the health and well-being focus area with the support of other health outcome-focused units and facilities.



## Arizona State University-Banner Neurodegenerative Disease Research Center

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The partnership between Arizona State University (ASU), one of the nation's largest public research universities, and Phoenix-based Banner Health, one of the nation's largest nonprofit health systems, includes the launch of a new Arizona State University-Banner Neurodegenerative Disease Research Center.

This effort capitalizes on Banner's internationally recognized programs in Alzheimer's disease research and patient care and ASU's rapid ascension as a world-class research university.

The agreement between Banner and ASU is an extension of their work with the Arizona Alzheimer's Consortium, a leading model of statewide collaboration in biomedical research, and it is intended to help make Arizona a destination for the best and brightest minds in this field. The two institutions will continue to work closely with other organizational partners to advance scientific research.

## Biodesign Center for Mechanisms of Evolution

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The center will integrate molecular and cell biology, biophysics and chemistry, experiment and theory, toward understanding mechanisms of evolution.

Research is focused at the gene, genomic, cellular and phenotypic levels, with special attention being given to the roles of mutation, random genetic drift and recombination. Comparative analyses of completely sequenced genomes are performed to shed light on issues concerning the origins of genomic, gene-structural and cellular diversity. Researchers use mathematical theory to understand constraints of the evolutionary process. Evolution is a population-level process, and the underlying philosophy of research at the center is that "nothing in evolution makes sense except in the light of population genetics."

## Center for Adaptive Computing

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Malicious behavior arises spontaneously in many complex systems.

Whenever agents can adapt their behavior to achieve competitive advantage, especially by subverting the operating rules of the system itself, cheating and other destructive behaviors often emerge. For example, viruses and cancer exploit the reproductive mechanisms of host cells to replicate and spread; bullies use intimidation to exert power, violating social norms; investors are duped by numerous schemes to manipulate financial markets; and cybercriminals exploit software vulnerabilities, eroding trust in networked systems.

The center will focus on defenses against malicious behavior across a wide variety of systems, focusing primarily on living systems and computation. Activities will include computational and mathematical modeling of immunological processes, cancer and evolutionary diseases such as influenza. It will also focus on cybersecurity issues, evolution of software, and potentially robotics and other embedded devices. Research in the center will emphasize projects that require tight integration of biological principles and computational abstractions.



## Impact

ASU has engaged both practitioners and patients at our partner institutions: Mayo Clinic, Banner and BNI, to push use-inspired research further, faster. This connection between discoverers and end users to co-create solutions will accelerate translation to market. A recent study by the Seidman Research Institute showed that the Biodesign Institute made an economic impact of \$1.5 billion over its first decade of operation. Annually, Biodesign Institute operations have contributed an average of \$135.5 million in direct impacts on Arizona's economy, created and supported more than 1,600 high-paying jobs, and generated \$10.5 million in state and local tax revenues.

Currently the Biodesign Institutes employs and trains more than 50 postdoctoral researchers and 300 graduate and undergraduate students each year. The Biodesign Institute has also provided hands-on research experiences for undergraduates, high school students and high school teachers to advance Arizona's STEM education. We expect that over the next five years we will engage and train more than 3,000 graduate and undergraduate students and will be able to attract and support more than 600 postdoctoral appointments.

## Anticipated growth

By 2020: \$30M

By 2025: \$45M

## Mayo Clinic and Arizona State University Alliance for Health Care

ASU is committed to innovating health care delivery. ASU resources and expertise in biomedical engineering, biomedical informatics, medical physics and health economics assist Mayo Clinic in its acclaimed Proton Beam Therapy program. The program will significantly impact both cancer patient care and scientific research. Proton beam facilities now provide "pencil beam" radiation therapy to Mayo Clinic patients in Rochester, MN and Phoenix. This therapy targets diseased tissues with greater accuracy, resulting in significantly less damage to surrounding healthy tissues.

Mayo Clinic and ASU are embarking on a signature data science initiative that will help transform the way the health system, clinicians and patients interact with health data. Projects will span predictive analytics to data visualization across a number of health-related spectrums.

The Mayo Clinic and Arizona State University Alliance for Health Care is developing comprehensive improvements in the science of health care delivery and practice, all toward one goal: continually advancing patient care. Together, the recognized world leader in patient care, education and research, and the nation's No. 1-ranked university for innovation are combining expertise from every corner of health care – doctors to bioengineers to business experts – for an adaptive approach to preparing the next generation of health care pioneers and practitioners in our communities.

## ASU digital health experience

Digital health data is being innovated by sensors that collect more information from new sources that allow for better data characterization and analysis. ASU's Center for Health Information Research (CHIR) is focused on digital health data with:

- Identifiable health information from multiple statewide sources (voluntary contributors)
- Health claims from health care providers, community health centers, physician groups
- AHCCCS
- Hospital discharge data and vital records from ADHS
- Laboratory data, birth and death data, workforce data
- HIPAA-compliant databases in UTO
- Data from approximately 7 million Arizona residents collected over 15 years
- Arizona Board of Regents-designated research center

CHIR



# Food | Energy | Water Nexus

## Situation

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Historically, policies for agriculture, energy and water have been made in isolation from one another. In reality, these systems are all interconnected. This interplay is called the food-energy-water nexus.

For example, Phoenix is the fourth-fastest-growing metropolitan area in the country, and every resident needs water for drinking and other daily uses. Additionally, water is used to irrigate crops, generate energy and cool power plants. When water levels decrease, issues arise not only for consumers, but also in agricultural and energy sectors. Around the world, as demands on each sector of the nexus continue to grow, the siloed approach to policies involving limited natural resources impedes a sustainable future. Successful policy in all sectors takes into account the links, synergies and conflicts between them through anticipatory governance, or using data and models to predict how variations will affect our world and how we can proactively plan for the consequences through policy.

The Food, Energy, Water Initiative (FEWI) is a key interdisciplinary ASU initiative that has been instrumental to ASU's emergence as one of the nation's leading research universities in this multidisciplinary field. Our goal is to position ASU capabilities in sustainability issues individually with agencies and companies, with a focus on impacts on jobs, reduced costs and greatly increased corporate value.



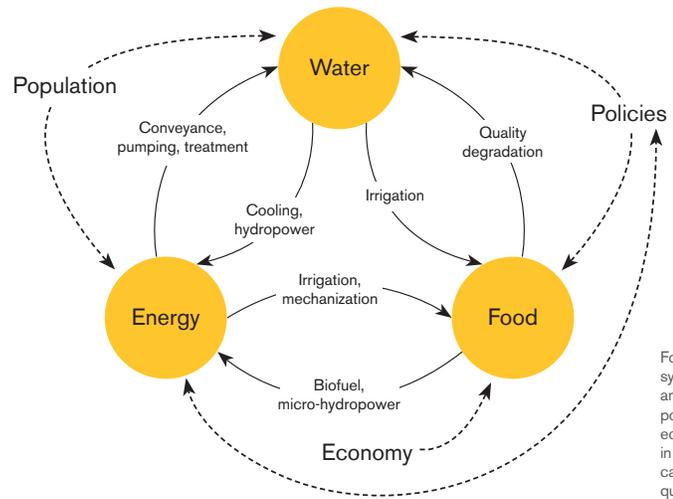
## Impact

ASU brings both innovation and large-scale delivery of new ideas across the entire spectrum of U.S. infrastructure needs. ASU works with multiple corporate partners to develop solutions for their challenges today and to predict operating scenarios for the future. We will grow our capabilities to position ASU to win large awards, highlighting grid resilience, cybersecurity, air traffic control, water, construction technologies, transportation and monitoring, wireless and sensor technology, crisis preparation and management, and community resilience.



## Anticipated growth

By 2020: \$30M  
By 2025: \$40M



Food, energy and water systems are interconnected and are affected by climate, population, policies and the economy. Policy enacted in one area of this nexus can have unforeseen consequences in another.

## Novel sources of renewable energy

ASU LightWorks is designed to address anticipated shortages of conventional energy. The world's energy system is patently unsustainable, and research and development from LightWorks-funded scientists is creating a more sustainable energy future. As economies expand and personal income rises, the world's energy demand will grow. Filling that growing demand with clean, renewable electricity and fuel, implementing energy efficiency measures, and transitioning Arizona and the nation from fossil fuels is an economic and social imperative.

LightWorks creates a resilient and equitable energy future by stimulating innovations in technology, policy, law and markets. These innovations have at their core an "enterprise mentality." This means that LightWorks invests in scientists who can develop and scale new energy systems that have viable, commercial applications. This investment policy not only addresses the energy challenge but it also creates jobs and revenue for Arizona in the process.

## Food systems

The Food Systems Transformation Initiative (FSTI) tackles projects aimed at making food systems more equitable, diverse and resilient. Adapting local and global food systems to evolving uncertainties in an unstable world will make cities and states more resilient. In addition, food and agribusiness are enormous markets and demand will remain high as world population grows largely unabated. Thus, transforming food systems and enabling food production methods to meet the needs of a 21st-century Earth has the potential to create jobs, generate revenue and position Arizona – a state with a rich economic heritage in food and fiber production – as a world leader.

## Water technologies

ASU faculty have expertise in traditional water engineering and in ancillary technologies, such as sensors and data informatics, which are of direct relevance to the use of water in manufacturing. For example, the Water Innovation for Solution Development in Manufacturing Institute (WISDM) brings together interdisciplinary teams of experts to tackle complex water challenges.



# Earth and Space Exploration

## Situation

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The Aerospace & Defense (A&D) industry has long been one of Arizona's largest and most important employers.

Arizona is a top 10 state for A&D government contracts with \$9.9 billion in federal contracts in 2014. Arizona is one of the highest U.S. states in terms of A&D employment, with employees receiving salaries 52% higher than the average Arizonan wage (ANGLE Technology Group, 2008).

ASU's success in space endeavors is the proof that ASU is scientifically strong and leads in scientific innovation. The interdisciplinary work of ASU's School of Earth and Space Exploration brings together the brightest minds in astronomy and astrophysics, cosmology, geosciences, planetary sciences, exploration systems engineering and science education. Our approach to research tears down the conventional divides, encouraging scientists to cross subject boundaries to pursue new understandings of our universe.



## NASA Discovery Mission, Psyche

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Psyche is both the name of an asteroid orbiting the sun between Mars and Jupiter and the name of an ASU mission to visit that asteroid. The mission was chosen by NASA on January 4, 2017 as one of two missions for the agency's Discovery Program, a series of low-cost missions to solar system targets. The Psyche spacecraft is targeted to launch in October 2023 and travel to the asteroid using solar-electric (low-thrust) propulsion, arriving in 2030, following an Earth gravity assist spacecraft maneuver in 2024 and a Mars flyby in 2025. After a six-year cruise, the mission plan calls for 20 months spent in orbit around the asteroid, mapping it and studying its properties.

## NASA Discovery Mission, Lucy

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The Lucy mission will carry an ASU-designed and -developed thermal emission spectrometer, which will measure surface temperatures on each asteroid the spacecraft visits. This is the third to be built here at SESE. The device continues a growing tradition of hands-on engineering for exploration that has become hallmark of the school.

## New Space

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The space race has evolved. Private sector space exploration and technology efforts are now joining and leading the way.

The ASU Space Technology and Science Initiative (NewSpace) will lead the integration of academic and commercial space enterprises using ASU's core strengths in space science, engineering and education.

To advance space access and exploration further, academic and commercial space enterprises must leverage value-added expertise, facilities and focus to drive the future of this industry. ASU NewSpace is creating academic-commercial partnerships that bring together the most brilliant minds in the space industry sector for an unprecedented collaborative effort.

The NewSpace Initiative will establish and foster partnerships between ASU and next-generation non-governmental space exploration science and technology companies (the NewSpace sector). It will enable the discovery of new research avenues, new partnerships and new opportunities for student engagement. The ASU NewSpace Initiative will be a precursor to a NewSpace Institute that brings together established programs in space science, planetary science and engineering at ASU to transform and define the future of academic-private space partnerships.

## Impact

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The A&D industry has a history of being one of Arizona's largest and most important employers. Companies in the industry have found a high-quality and reliable supply of the talented workers that are key to their success. Arizona's workforce is employed in this industry at a rate more than 11 times that of the national average. Arizona manufactures more guided missiles and space vehicles than any other state, and ranks in the top ten in employment for aeronautical and navigation equipment, aircraft, aircraft engines and parts and guided missile parts. *AZ Commerce Authority, AZ Aerospace and Defense Industry 2014.*

## Anticipated growth

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By 2020: \$25M  
By 2025: \$50M

# Industrial Transformation

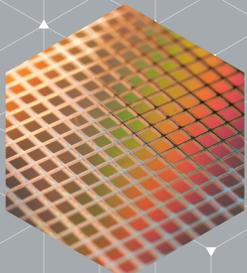
**Advanced manufacturing, advanced materials and future transportation**

## Situation

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ASU is a key innovator in the digital **industrial transformation** that is underway. ASU understands how to deliver technological breakthroughs, fully operational systems and trained workers for this transformation.

Manufacturing is an important component of any healthy economy, and the economy of Arizona is no exception. According to statistics assembled by the Arizona Commerce Authority, Arizona's total manufacturing output (contribution to State Real Gross Domestic Product) in 2014 was \$23.12 billion, or nearly 9% of the state's Real GDP. These are high economic leverage jobs; each of the state's 157,000 manufacturing jobs supported about 202,000 additional jobs.



### Business Development

- Opportunity/Need
- Manufacturing
- Applications Design
- Applications Performance



### Fundamental Materials Research

- Structure
- Processing
- Properties
- Materials Performance



### Integrated Materials Systems Prototypes

- Interface Design
- Functional Systems
- Individual Components
- Systems Performance

## Advanced Materials Initiative

The Advanced Materials Initiative enables the materials research community to accelerate the pace of innovation through strategic teaming, infrastructure development and operational analytics. It identifies and nurtures opportunities of high impact, especially those related to the university's priority application areas:

- Transportation
- Health
- Energy
- Sustainability
- Construction
- Space exploration

ASU takes a transdisciplinary and comprehensive approach to materials, which includes:

- Fundamental materials research (structure, performance, properties, processing)
- Business development (opportunity/need, performance, applications design, manufacturing)
- Integrated materials systems prototypes (functional systems, performance, interface design, individual components)

Our work has allowed industry partners to commercialize technology and led to the establishment of several startup companies.

## Advanced Manufacturing Initiative

In order to build on our foundation and accelerate the university's participation in an important new area of applied research, we have established an Advanced Manufacturing Initiative that will anchor a focus in the field. The initiative coordinates efforts across programs in natural sciences and the Ira A. Fulton Schools of Engineering, and creates center-level research programs involving interdisciplinary clusters of faculty. A central goal of the initiative is to establish strategic partnerships with industry to help shape the research agenda and provide a stream of graduates ready to matriculate to careers as leaders in this field.



## Flexible electronics

The Flexible Electronics and Display Center (FEDC), based in the former Motorola Flat Panel manufacturing facility in the ASU Research Park, serves as the focus of an international consortium of more than 50 companies.

## Materials characterization and synthesis

Capabilities include high-resolution electron microscopy, structural/chemical/optical/surface/thermal analysis, synthesis and defect analysis. These capabilities benefit the local and regional community by providing open access to world-class instruments and techniques for materials characterization to industrial partners for new product development and process engineering.

## Impact

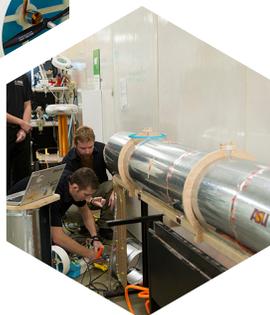
ASU is uniquely positioned to accelerate the pace of technology through materials innovation by integrated focus on discovery, design and development of advanced materials. With our world-class characterization tools in imaging and spectroscopy, and our expertise in materials design, synthesis, processing and large-scale manufacturing capabilities, we are well suited to address structural characteristics of materials at all length scales involving electronic, optical, photonic, electrical, ionic and mechanical properties. With well over 90 faculty members across various colleges and departments, our enterprising research products and innovation has allowed for commercialization of technology by industry partners, and also establishment of several startup companies. Along with attracting large projects in several manufacturing areas, ASU expects to be able to provide highly specialized educational experiences to more than 600 graduate and undergraduate students over the next five years.

## Advanced transportation

ASU is uniquely suited to address the complex transportation challenges of moving people and goods around the world. ASU researchers work across disciplines – from materials to systems engineering, renewable fuels to urban planning and policy – and with external partners to create infrastructure and mobility innovation for the future of transportation.

ASU's key areas of future focus are:

- Next-generation transport (including autonomous vehicles, urban planning, aviation and aerospace technology, megacities)
- Smart infrastructure development (advanced pavement materials, durability and extending life of infrastructure, preservation)
- Innovative fuels (alternative fuels and energy production, storage, and conversion technologies; electric, hydrogen and biofuel vehicles and infrastructures)



## Anticipated growth

By 2020: \$25M  
By 2025: \$30M

A nighttime photograph of a city skyline with illuminated skyscrapers and light trails from traffic on a highway. A white grid pattern is overlaid on the left side of the image. The title 'Smart Cities and Urban Resilience' is centered in large white font.

# Smart Cities and Urban Resilience

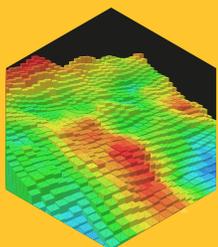
## Situation

Understanding how cities, and in particular, megacities will live, work and succeed in the near future is foundational to the success of our nation. This includes the protection of its people and infrastructure. In this scenario, individuals and infrastructure are highly connected, internet and sensors are plentiful and integrated, and it takes large perturbations to disrupt the system. Using data gathered from satellites, sensors and even smartphones can provide information leading to findings about nominally mundane yet essential aspects of urban living, including daily travel patterns, energy consumption and other facets of a city's metabolism. All of this information helps build our understanding of the functioning (and conversely, the potential for malfunction) of the megacity. Decision Theater at ASU is a unique tool that can take multiple streams of information and provide a user-friendly, pliable interface to explore scenarios within the smart city.



## Impact

The future is increasingly urban. ASU is a key innovator in understanding cities. ASU works with multiple partners to develop solutions for urban challenges today and to predict urban operating scenarios for the future. We are positioning ASU to win large awards, highlighting grid resilience and monitoring, wireless and sensor technology, crisis preparation and management, targeted infrastructure needs and community resilience.



## Anticipated growth

By 2020: \$15M  
By 2025: \$25M

## The Central Arizona-Phoenix Long-Term Ecological Research program

CAP LTER examines the urban ecology of the central Arizona-Phoenix region. This experience was leveraged and expanded to secure the NSF-funded Urban Resilience to Extreme Weather-related Events Sustainability Research Network (UREx SRN). This network focuses on integrating social, ecological and technical systems to devise, analyze and support urban infrastructure decisions in the face of climatic uncertainty.

## Sustainable Cities Network

The goal of this innovative network is to help cities address their sustainability challenges. In the absence of having solutions to challenges such as water supply and quality, waste management, energy and others, an economic and social core of Arizona—its cities—will be at risk of failure. The network is a vehicle for communities to share knowledge and coordinate efforts to understand and solve sustainability problems. It is designed to foster partnerships, identify best practices, provide training and information, and create a bridge between ASU's research and the front-line challenges facing local communities. An example of ASU's research being applied to addressing the real challenges facing Arizona's cities, is our efforts to reducing the Urban Heat Island Index and to improve long-term air quality in metropolitan Phoenix.

## Megacities modeling and analysis

Megacities are defined as urban regions with populations of 10 million people or more, characterized by explosive population growth and potential volatility. Because of demands on housing, infrastructure, transportation, food, energy, water and other basic natural resources, megacities are considered "high risk" areas. Threats such as pollution, disease, poverty, capacity overloads, and natural and manmade risks endanger effective functioning of services. Disadvantaged groups are especially vulnerable to these disruptions. But megacities also have great potential as global junctions of information and resilience. In particular, they can serve as centers of significant economic growth and technological development, and provide opportunities for individuals to flourish in creative and unique ways.

There are currently more than 20 megacities globally, and by 2025, there will be close to 40. Understanding how the megacity functions, and how to maximize its potential, is critical for moving science and culture forward. ASU's efforts are defined by multidisciplinary research coupled with a focus on quantitative and computational data gathering and analysis. This leverages the fact that megacities are teeming with data resources that can provide insight into their complex nature.



# Internet of Things (IoT) & Cybersecurity

## Situation

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Of the top 20 cybersecurity companies in the world, half have operations in Arizona, including Intel, IBM, Boeing, Northrop Grumman and Raytheon.

ASU's National Security Systems Initiative is spearheaded by its Global Security Initiative (GSI), a university-wide interdisciplinary hub for global security research that focuses on openness, inclusiveness and connections to the global defense, development and diplomacy communities. GSI serves as ASU's primary interface to the Department of Defense (DOD) and intelligence community (IC), positioning Arizona for industry, government and philanthropic investments. Research efforts at GSI also provide insights on new learning approaches to create and sustain the national security workforce needed for Arizona and the U.S. to maintain a competitive edge in the global economy.

ASU is committed to the security of a networked world transformed through our interdisciplinary research and discovery. The goal of GSI is to highlight ASU's ability for complex, adaptive solutions across a breadth of areas as a comparative advantage. This challenge needs diverse, scientific input viewed through a security lens, demonstrating that ASU can uniquely be a convener and bring in other relevant players through alliances.



## Impact

ASU is a key innovator in the digital industrial transformation that is underway. ASU understands how to deliver technological breakthroughs, fully operational systems and trained workers for this transformation. Therefore, we are focused on growth of large-scale cybersecurity research and education projects that are aimed at minimizing the misuses of cyber-technology, bolstering education and training in cybersecurity, establishing the science of security, and transitioning promising cybersecurity research into practice in Arizona. For regional companies, ASU will grow sponsored research focused on identity management, privacy issues, malware attribution, secure mobile devices, predictive analytics/adversarial dynamics and digital forensics.

## Anticipated growth

By 2020: \$25M  
By 2025: \$50M



## Cybersecurity

GSI's Center for Cybersecurity and Digital Forensics (CDF) brings together leading faculty in engineering, social sciences, law and business to conduct sponsored research focused on identity management, privacy issues, malware attribution, secure mobile devices, predictive analytics/adversarial dynamics and digital forensics. CDF's capacity to study and address these challenges is strengthened by its partnerships with Arizona businesses like GoDaddy, Intel and Aetna, as well as national companies and organizations like the U.S. Army Research Office, the U.S. Department of Justice, National Security Agency, National Science Foundation, Microsoft, Google, the U.S. Department of Energy, CISCO and Bank of America.

## Urban security

Cities, including those in Arizona, will need to find new ways to accommodate growth and the numerous challenges that urbanization presents. Among the areas being explored by GSI researchers is the development and use of innovative technologies that will enable policymakers and public officials to anticipate and prevent, rather than react to, potential threats posed by a variety of natural and manmade phenomena, many of which are unique to the state.

## Extreme weather events and infrastructure and resource security

Extreme weather events (droughts, floods, temperature extremes, etc.) can further limit resources and intensify conflicts to control them. Each of these could have significant impact on our national security. GSI addresses these issues by developing research products, tools and processes for decision-making in the context of changing resources and national security dynamics at local, regional and global scales. GSI's capacity to study and address these challenges is strengthened by its research partnerships with local institutions, such as Arizona Public Service and Salt River Project, as well as major research institutions throughout the country, including Pacific Northwest National Laboratory, Oak Ridge National Laboratory and Argonne National Laboratory.

## Human health and human security

Increased connectivity (both virtual and physical), urbanization and environmental change will all have important implications for human health and well-being. Current and future climate variability is expected to significantly impact ecosystems, water, energy and food security, as well as human health. A critical impacted area of human health is that of vector-borne infectious diseases. GSI contributes to the understanding of how these diseases spread, as well as the timely decision-making necessary in a pandemic or epidemic situation.



**ASU** Knowledge Enterprise  
Development  
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