Arizona State University

Growing Arizona

Technology and Research Initiative Fund (TRIF) at work

Creating the conditions for prosperity

Publicly supported through voter approval, Arizona's Technology and Research Initiative Fund (TRIF) enables research and innovation that advances and sustains Arizona's economy.

TRIF investment creates an ecosystem that empowers businesses to succeed in our state. Arizona's long-term commitment to research attracts and generates companies that advance emerging technologies and helps them stay ahead of disruptive trends.

Our universities provide the talent, knowledge and infrastructure companies need to be competitive. In turn, they create stable, high-wage jobs and invest in their communities — a "virtuous cycle" of economic growth and human well-being for generations to come.

Over the last 10 years, 347 companies located new facilities in the Greater Phoenix region, in industries ranging from manufacturing and finance to solar and software.

TRIF at Arizona State University

Arizona State University transforms TRIF investment into big gains for Arizona. Programs seeded by TRIF go on to attract significant federal and philanthropic funding, recruit exceptional talent, and create new products and businesses that generate high-quality jobs.

From FY 2002–2019, TRIF investment at ASU has:

- Attracted $1.725 billion in external funding, a threefold return on investment.
- Provided training and hands-on experience to 8,800 graduate students and postdoctoral scholars and over 6,000 undergraduate students.
- Generated over 2,400 invention disclosures, 522 U.S. patents, and 500 licenses and options.
- Supported the launch of 160 startup companies.

In FY 2017, the economic impact of ASU's research expenditures topped $886 million.

Saving lives and improving health

Attacking Alzheimer's

By 2035, there will be more people over the age of 65 than under the age of 18 in the U.S. for the first time. With the fifth-largest aging population in the country, Arizona is projected to have the greatest increase in the proportion of people living with dementia. Scientists in the ASU-Banner Neurodegenerative Disease Research Center are tackling Alzheimer's and other dementias from many angles. Recently, they developed a blood test that can diagnose a genetic risk for Alzheimer's as early as age 20. They are now exploring a promising new treatment, DYR219, which could potentially prevent formation of the disease's hallmark plaques and tangles.

Arizona has the third highest incidence of Alzheimer's disease in the U.S. The number of cases is expected to rise 43% by 2025.

Better breast cancer detection

Mammography is a valuable tool, but it misses about a quarter of breast cancers. Also, it has a high false-positive rate, leading to unnecessary biopsies and undue stress. Scientists at ASU's Biodesign Institute developed a new technology for early breast cancer detection, which has been licensed by Provista Diagnostics to create Videssa® Breast. The first blood test of its kind, Videssa Breast complements mammography and improves the accuracy in early breast cancer detection in women with abnormal or unclear imaging results.

Treating autism from the gut

About 1 in every 59 children has been diagnosed with autism spectrum disorder, but there is no effective standard treatment. Recently, ASU researchers harnessed gut microbes as a promising treatment for autism symptoms. At the start of the study, 83 percent of participants were rated as having "severe" autism. Two years later, only 17 percent were "severe," and 44 percent fell below the cutoff for mild autism spectrum disorder. The next step is a larger, placebo-controlled trial.

Driving Arizona business

HealthTell is a spinout company based on immunosignaturing technology developed at ASU's Biodesign Institute. The technology allows for rapid detection of more than 50 diseases from a single drop of blood — even before symptoms appear.

ASU spinout **OncoMyx Therapeutics** raised $25 million in new venture funding in FY 2019 to develop a viral-based therapy to treat cancer. The Arizona Bioindustry Association named OncoMyx as a Fast Lane Company for 2019.

Creating solutions for air, water and energy

Cost-effective carbon capture

Even if we stopped emitting all carbon dioxide today, the CO_2 already in the atmosphere will continue to warm the Earth for several decades. What if we could efficiently pull CO_2 out of the air? ASU's Center for Negative Carbon Emissions has created mechanical "trees" that passively collect CO_2 from the air for reuse. The technology is expected to cost below $100 per metric ton at scale, making it the most commercially viable option in the industry. It is now being commercialized and deployed by Silicon Kingdom Holdings. Popular Science named the carbon-catching endeavor one of the "most important engineering innovations of 2019."

ASU tech stands to remove 3.8 million metric tons of CO_2 from the air each year, equal to the emissions of 800,000 passenger cars.

Eliminating unsafe chemicals

Research from ASU's Biodesign Institute found that antimicrobial chemicals added to many cleaning and personal care products are not effective, persist in the environment and pose risks to human health. In September 2017, the Food and Drug Administration implemented a ban on the antimicrobials triclosan and triclocarban in consumer goods. The decision was largely informed by ASU's findings.

Engines of efficiency

Energize Phoenix was a partnership between ASU, the city of Phoenix and APS to promote energy efficiency along the light rail corridor. Results include:

- 33+ million square feet of commercial space upgraded.
- 2,014 residential units upgraded.
- $12.5 million in annual energy cost savings.
- 95,000+ metric tons of CO_2 equivalent saved.
- $31 million added to the local economy.

ASU leads two national Engineering Research Centers focused on sustainability solutions and is a key partner on a third.

Driving Arizona business

NantEnergy, a company based on technology developed at ASU, has garnered more than $150 million in venture investments for sustainable energy storage through zinc-air batteries. These rugged, long-duration, pollution-free batteries support a wide range of energy storage needs, from remote microgrids to utility-scale virtual power plants.

Zero Mass Water, an ASU spinout company, produces solar panels that generate clean drinking water from air and humidity, even in arid regions. The panels have been deployed in more than 35 countries on six continents.

Protecting human safety and security

Driving Arizona business

ASU spinout **CYR3CON** is the first company to take a preventive approach to cybersecurity. With help from a team of ASU students, the company recently filed a patent for software that helps predict where hackers are likely to strike next.

> "I can apply what I have learned to the real world's issues at CYR3CON through the lab and fill the working experience in my résumé while I am pursuing my degree. I also can extend my professional network through this lab experience since I meet other researchers inside and outside of CYR3CON."
>
> – **Kazuaki Kashihara**
> computer science graduate student

Streamlining and securing

The Department of Homeland Security awarded ASU $20 million to establish the national Center for Accelerating Operational Efficiency. CAOE works with government agencies to improve disaster response planning, identify indicators of potential lone-wolf style attacks and make airport security checkpoints safer and more efficient — particularly relevant to Arizona as a border state with one of the busiest airports in the nation.

More than 1,200 domestic and international flights arrive and depart from Phoenix Sky Harbor daily.

Electricity anywhere

From disaster areas to refugee camps to remote military outposts, many places in the world don't have access to reliable electricity. ASU researchers have developed a solar-powered electrical grid within a shipping container, which can provide energy to places where power doesn't reach. ASU is collaborating with industry partners and further innovating the technology using the Grid Modernization and Microgrid Test Bed on ASU's Polytechnic campus. The researchers also provide training programs for workforce development.

Rapid response to a nuclear event

In a nuclear emergency, the ability to rapidly assess how much radiation a person has been exposed to will be critical, because early medical treatment can reduce the effects of contamination. ASU researchers have partnered with Life Sciences Solutions Group to commercialize a test that looks at the effect of radiation on gene expression in white blood cells. It runs on real-time PCR systems from Thermo Fisher Scientific — instruments that already exist and are regularly maintained in clinical labs.

Pre-crisis preparation

American diplomats are trained in how to deal with crisis situations, but what if we could train them to identify and respond to pre-crisis situations to avoid or reduce damage? ASU's Decision Theater and the McCain Institute collaborated with the American Academy of Diplomacy to develop a game-based training curriculum. It allows users to explore pre-crisis scenarios and the tradeoffs of various decisions. The program is currently being used by the Foreign Service Institute to train newly appointed U.S. ambassadors.

Arizona is ranked third in the nation for its solar energy industry, which has attracted more than $11 billion in investment.

Pioneering a new space age

A giant leap toward a moon base

One of the biggest challenges of space travel is weight. It takes a lot of energy (and thus, cost) to escape Earth's gravity. If we could use the moon as a way-station, we could reduce the amount of fuel and water we have to carry from Earth and take advantage of the moon's lower gravity on takeoff. ASU was awarded $6 million to lead a NASA CubeSat mission to orbit the moon. The LunaH-Map mission will map the abundance of water ice in hidden regions of the moon's south pole.

ASU is 1 of only 7 institutions in the U.S. that can build flight instruments for space.

Student-led ground station

ASU has partnered with NASA's Jet Propulsion Laboratory and commercial satellite provider M2 Antenna Systems to install a satellite tracking ground station on the Tempe campus. All of the work has been done by undergraduate students. This station will have the ability to receive data and send commands to ASU and other small satellites in low Earth orbit and beyond. The goal is to track the next batch of CubeSats bound for the moon, including ASU's LunaH-Map mission. In 2019, the team began building a smaller station to operate ASU's Phoenix CubeSat, which was delivered to NASA in August 2019.

Powerful partnerships

Three ASU student-led payload projects launched into space in May 2019 on **Blue Origin's** New Shepard space vehicle. Selected during a competitive pitching competition, the payloads were the first ASU student-designed and -built payloads to be launched into space and brought back to Earth.

The Earth-imaging company **Planet** selected ASU as its first institutional data partner for higher education. Operating the largest constellation of satellites currently in orbit, Planet acquires high-resolution imagery covering the entire landmass and coral reefs of the Earth on a daily basis. The partnership gives the ASU community unprecedented access to Planet's stream of satellite data for research and educational purposes.

Empowering a thriving workforce

Training for veterans

ASU has engaged over 100 veterans in sustainable energy research and trained them to design and manage resilient energy systems. With support from the Office of Naval Research's Naval Enterprise Partnership Teaming with Universities for National Excellence (NEPTUNE) program, veterans and active-duty military members have participated in projects ranging from developing better microgrids to protecting critical infrastructure from cyberattacks.

Nearly 250,000 ASU grads worked in Arizona in 2018, with aggregate earnings of $15.9 billion. They contributed more than $1.13 billion in state and local taxes.

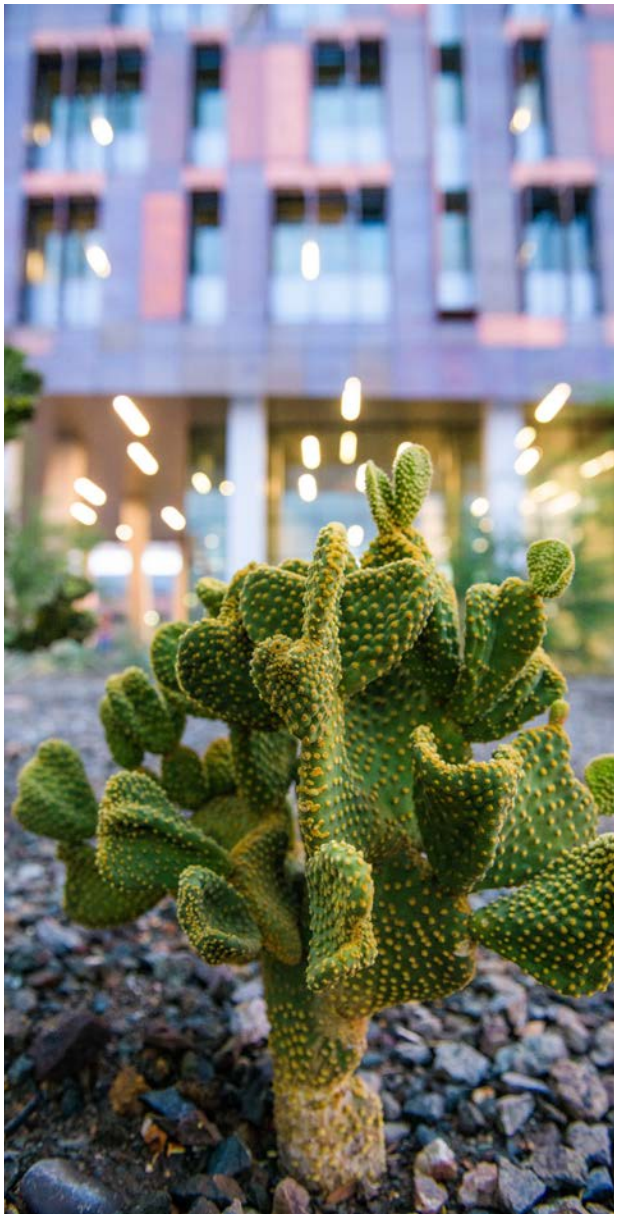
Turning trash into treasure

Americans generate about 268 million tons of trash every year — 4.5 pounds per person per day. The city of Phoenix partnered with ASU to launch a business accelerator focused on waste-to-product innovation, associated with the Resource Innovation and Solutions Network (RISN). During its two-year grant period, the RISN Incubator accomplished the following:

- 16 companies incubated.
- $3.86 million in capital raised.
- $5.17 million in revenue.
- 22 new products.
- 74 jobs.
- 55 internships.
- 7 patents filed.

Space industry certification

To meet the growing demand for operations and support team members in the commercial space industry, ASU's Interplanetary Initiative is partnering with Qwaltec to launch a satellite command and control certificate program. This course will provide students with the foundational knowledge to be successful as they pursue careers in the exciting field of space system operations, regardless of their academic backgrounds.



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