ASU Thrive

ARIZONA STATE UNIVERSITY
Volume 28 Number 4

Chipmakers and ASU are boosting Arizona's economy

History: Football fashion 1896–now

FROM 'the call' TO THE cure

Fueled by personal loss, one scientist is changing how we fight cancer — for everyone

Arizona State University

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Research matters

If you're concerned about the challenges we face today, then you understand the critical role that research and innovation at ASU and other American higher education institutions play in our lives and how we advance.

Research is the invisible hand that powers America's progress. It unlocks discoveries, improves quality of life and creates opportunity. It develops new solutions, technologies and approaches – discoveries that change the world and make America the globe's leading economic power.

Furthermore, ASU's enormous success as a top national research institution stengthens Arizona's economic health. Our state has emerged as a national hub for vital semiconductor manufacturing, a transformation fueled by our robust research infrastructure and partnerships with industry leaders that spur innovation and cultivate new talent.

Consider the output generated by Skysong Innovations, the exclusive technology transfer and intellectual property management company for ASU; and other businesses advancing ASU-owned intellectual property.

From 2014 to 2023, that amounted to a cumulative $2.5 billion in economic impact for Arizona, including 13,270 Arizona jobs (equivalent to 1,327 people each employed full time in the state for a decade) and $846.3 million in labor income statewide. An estimated $80.6 million in state and local taxes was collected because of these companies operating in Arizona.

History has consistently demonstrated that scientific research is the cornerstone of economic prosperity, both for Arizona and for the nation. Our collective success hinges on our commitment to this path. Together, we must continue to invest in and prioritize research to ensure a healthy and prosperous future for all.

Michael M. Crow
President, Arizona State University
michaelcrow michaelmcrow
asuprescrow presidentcrow

Learn more about the impact of ASU research at researchmatters.asu.edu.

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Connect with ASU

Arizona State University | ASU | ASU Alumni | magazine.asu.edu | Sun Devil Athletics

JEFF NEWTON; CHARLIE LEIGHT/ASU

Grow your own yummy food

Join the Garden Commons Workshop to find out which plants thrive in fall, and learn about soil, water and sunlight requirements for an organic garden.

Wednesday, Oct. 1, 11 a.m.–noon, Polytechnic campus, Garden Commons

asuevents.asu.edu

Free Family

Kyle Smolen, junior, ice hockey

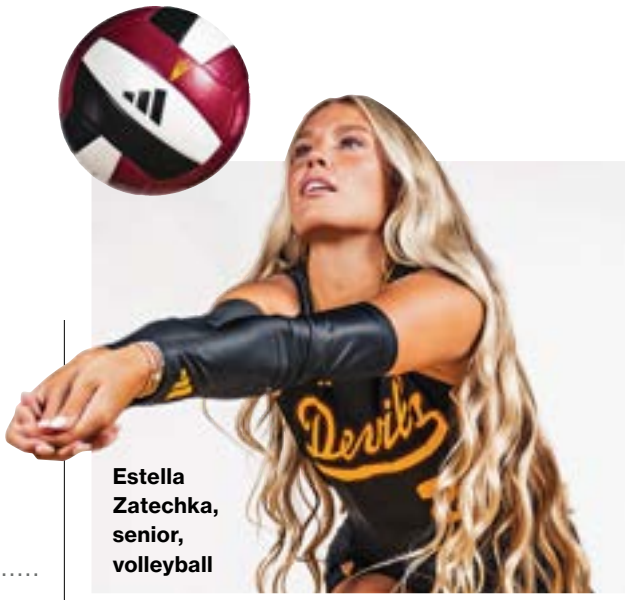
Sun Devils heat it up on the ice

Dropping the puck on the 2025–26 season, featuring 36 total games, including 20 matchups at home inside Mullett Arena, Sun Devil Hockey opens the season against Penn State. Stream all games through the National Collegiate Hockey Conference or watch select games on FOX 10 Phoenix.

Friday, Oct. 3–Thursday, April 9, FOX 10

sundevils.com/sports/mens/ice-hockey

Family Ticketed



Estella Zatechka, senior, volleyball

Ready, set, spike

See why Sun Devil Volleyball draws big crowds and cheer them on at their Big 12 Conference home opener against the Utah Utes. Last season, ASU Volleyball won the Big 12 Championship in its first year in the conference.

Friday, Aug. 29–Saturday, Nov. 29

sundevils.com/sports/womens/volleyball

Family Ticketed

Venture into outer space

Get ready to be on the edge of your seat during "The Edge of Exploration: ASU Explores the Solar System." View the universe through planetarium technology that renders Earth and space science themes in 3D stereographic vision.

Saturday, Oct. 25, 1 p.m., Marston Exploration Theater, 781 Terrace Mall, Tempe

sese.asu.edu

Family Ticketed

Movie under the stars in LA

You won't want to miss this community event featuring "Encanto," the Disney film that tells the story of the Madrigals, a family whose children have magical gifts — all except Mirabel, who saves the family's home from the brink of disaster. This movie is a charmer you can bring the whole family to see.

Saturday, Sept. 6, 5–11 p.m. (5–8 p.m. pre-show, 8–11 p.m. film), Grand Hope Park, 919 S. Grand Ave., Los Angeles

california.asu.edu/news-and-events

Family Ticketed

Visit asuevents.asu.edu for events. Visit sundevils.com for athletics.

SUN DEVIL ATHLETICS/ASU; X-RAY: NASA/CXC/PENN STATE UNIVERSITY/G. GARMIRE; OPTICAL: NASA/STSCI

Events

Wherefore art thou Romeo?

This hilarious new musical flips the script on the greatest love story ever told. “& Juliet” asks: What would happen next if “Romeo and Juliet” ended differently? Get whisked away on a fabulous journey as Juliet ditches her famous ending for a fresh beginning and a second chance at life and love.

Tuesday, Nov. 4–Sunday, Nov. 9, ASU Gammage
asugammage.com
Family Ticketed

Celebrate those who serve

Honor individuals and their families who have served in the military, along with those who serve their communities, at Salute to Service 2025. Events will take place across all Phoenix metro campuses, including the Salute to Service football game on Nov. 15.

Friday, Nov. 7–Sunday, Nov. 16, all ASU campuses
veterans.asu.edu/salute-service
Free Family

Winter Wonderland

Enjoy sparkling holiday lights amid an enchanted snowfall, partake in free holiday crafts, indulge in festive treats and create wonderful winter memories at this community event.

Saturday, Dec. 6, 6–9 p.m., ASU West Valley, Fletcher Lawn
asu.edu/west-valley
Free Family

A loyalty program for Sun Devils and ASU fans!

Earn Pitchforks toward exclusive ASU merchandise and more. New users receive 1,000 ’Forks. Already a user? Enter secret word ASUThrive for 100 ’Forks.
sundevilrewards.asu.edu

MATTHEW MURPHY FOR MURPHY MADE; PETER VANDER STOEP; MANAV PRAJAPATI/ASU

Sun Devil Football 2025 Schedule

Home game

August

30	vs. NAU	

September

6	at Mississippi State	
13	vs. Texas State	
20	at Baylor	Big 12
26	vs. TCU	Big 12

October

11	at Utah	Big 12
18	vs. Texas Tech	Big 12
25	vs. Houston	Big 12

November

1	at Iowa State	Big 12
15	vs. West Virginia	Big 12
22	at Colorado	Big 12
28	vs. Arizona	Big 12

See all details of games and ticket options at sundevils.com.

GAME D

Sparky's Touchdown Tailgates

This free, family-friendly event is your go-to pregame destination before every home Sun Devil Football game. Enjoy live music, games, food trucks, a beer garden, activities for kids and more. Earn Sun Devil Rewards by checking in to tailgates and football games on the app.

Tailgates start two and a half hours prior to each home game kickoff at College Avenue and 6th Street

alumni.asu.edu/gameday

Free Family

Sparky's Touchdown Tailgate hits the road

The ASU Alumni Association is hosting the official away game tailgates at Baylor and Iowa State. Join your fellow alumni on the road.

alumni.asu.edu/2025-away-game-tailgates

Family Ticketed

Family Weekend

Celebrate ASU spirit, pride and tradition with your Sun Devil and your entire family at Big 12 Family Weekend. Enjoy exciting activities across all four Valley campuses, including the Big 12 home game on Saturday, Oct. 25.

Friday, Oct. 24–Sunday, Oct. 26, ASU Valley campuses

familyweekend.asu.edu

Family Ticketed

ASU Alumni Homecoming week: Nov. 9–15

Sparky's Challenge

Begin Homecoming festivities on the right foot with the annual Sparky 5K/10K walk/run for people of all ages and ability levels. Registration required.

Sunday, Nov. 9, 9 a.m., ASU West Valley campus, Sun Devil Fitness Complex; free for ASU faculty, staff and students; $15 for ASU alumni, affiliates and community members

asuevents.asu.edu

Family Ticketed

Sparky's Carnival

Jump into a fun-filled celebration featuring carnival games and rides, bounce houses and food trucks.

Sunday, Nov. 9, 6–9 p.m., ASU West Valley campus, The Quad

asuevents.asu.edu

Free Family

Lantern Walk

This hike up "A" Mountain, a cherished ASU tradition since 1917, is held the night before the Homecoming football game. Join us.

Friday, Nov. 14, meet at the base of "A" Mountain with a DJ, time TBD; climb starts at time TBD.

homecoming.asu.edu

Free Family

Alumni Homecoming parade, block party and game

Celebrate Sun Devil spirit at the annual Homecoming Parade. Afterward, join fellow Sun Devils at the Block Party for food, entertainment and more before the Homecoming game. Wear gold!

Saturday, Nov. 15 Homecoming: alumni.asu.edu/homecoming

Free Family

Football game: sundevils.com

Family Ticketed

“With a little bit of imagination, you can totally rock what the industry standard is.”

— FREDI LAJVARDI, ’88 BAE IN SECONDARY EDUCATION - GENERAL SCIENCES, FORMER HIGH SCHOOL ROBOTICS COACH AND COMPETITION JUDGE

Then-senior biomedical engineer Matthew Singh, ’25 BS in biomedical engineering (biomedical devices), makes some last-minute fixes on his team’s chair in the HCI Design Challenge Internship.

News

RAPID PROTOTYPE

A training wheelchair for under $500

A pair of ASU students won first place for successfully building a motorized training wheelchair for children that costs less to build than a new gaming console.

The wheelchair, designed by business majors Daniel Chaves, '25 Master of Global Management, then-senior, and then first-year Gianna Franz, will allow children ages 4–7 to practice maneuvering and driving in preparation for their wheelchair driving exam.

Wheelchair users need to pass this test before insurance companies approve a regular motorized chair, which can cost more than $5,000.

Find the plans to build it.

CHARLIE LEIGHT/ASU

New tomato variety will grow better in Arizona

ASU researchers created a new tomato type that can thrive in short seasons and harsh climates. Desert Dew, developed by ASU's School of Life Sciences Associate Professor Changbin Chen, is optimized for rapid growth, nutrient density and adaptability to extreme environments.

It completes its life cycle three to four weeks earlier than conventional tomato varieties — making it ideal for container gardening, high-density planting and indoor or urban agriculture.

Chen envisions using Desert Dew to benefit the local community — possibly even starting with ASU's campuses.

Learn more at sols.asu.edu.

The whale shark, the world's largest fish, remains poorly understood due to its migratory habits.

CHANGBIN CHEN/ASU

Why sharks and other wide-ranging ocean species need more than protected areas

Designated areas meant to protect marine life fall short, according to new research at ASU.

In a study, researchers gathered a massive set of data tracking the movements of sharks, seabirds, turtles, whales and other highly migratory marine animals. It showed that less than 8% of the area used by tracked individuals overlaps with designated marine protected areas.

The findings make clear that area-based conservation is not sufficient to protect the ocean's most mobile species, according to ASU's Leah Gerber, who co-authored a commentary on the research in the journal Science.

Understanding where migratory species are located will help us "prioritize where we should establish conservation areas or take other protective measures," Gerber says.

Learn more about ASU's conservation efforts at globalfutures.asu.edu.

Powerful new system to reduce wildfire deaths, destruction, and adapt power grid operations

ASU researchers developed a new system to help prevent the devastation caused by wildfires. Wildfire Awareness and Risk Management, or WARM, is a wildfire detection and risk mitigation system that improves sensor accuracy for detecting fires earlier and adapts power grid operations based on wildfire risk. If the sensors in the base layer, such as humidity and wind speed sensors, detect risky conditions, they trigger the next group of sensors that check for smoke or gases from fire. If those go off, the thermal camera turns on. This method saves batteries yet still catches fires early without the cameras running all the time.

If a fire risk is detected, utilities can reduce power on just affected lines instead of shutting all of them off entirely. This approach prevents electrical grids from causing additional fires but keeps the power on for as many residents as possible.

This is the balance the WARM team is trying to strike: preventing unnecessary power loss while avoiding wildfire disasters.

The WARM system is currently operational and ready to be commercialized and put to use in communities.

Learn more at ecee.engineering.asu.edu.

Downed power lines are a major trigger for destructive wildfires.

DEANNA DENT/ASU

Teaching method improves high school students' writing skills

The ASU-led Pathway to Academic Success Project is helping high school students write better. In 2023, classes that participated in the project showed improvement of at least half a letter grade better on argument essay scores.

The Pathway Project trains teachers to improve instruction using cognitive strategies, which adopt a "tool kit" approach to writing through planning and goal setting, making predictions or forming interpretations.

Teachers can learn more at ucipathwayproject.com.

Keep up with the headlines at ASU

by subscribing to the ASU News e-newsletter at news.asu.edu/subscribe.

"Tackling obesity is also tackling the roots of many other diseases related to obesity, like Type 2 diabetes, heart diseases, metabolic disorders, pulmonary disorders and sleep apnea."

— ERICA FORZANI, A PROFESSOR IN THE SCHOOL FOR ENGINEERING OF MATTER, TRANSPORT AND ENERGY

Invention helps people reach weight goals

A device that brings scientific data to weight loss now has the chance to address obesity internationally. Breezing Med, invented at ASU by Associate Professor Erica Forzani and the late Professor NJ Tao, recently received Medical Device Regulation certification, which allows it to be used in the European Union.

The device measures resting metabolic rate, which is how many calories the body burns at rest. Since the body can adapt to a low-calorie diet by lowering resting metabolic rate, tracking this rate helps doctors personalize weight loss plans to avoid weight loss plateaus. Hands-free and able to transmit data via Bluetooth, Breezing Med can be used across a variety of clinical departments, including obesity medicine, bariatric surgery, endocrinology, family medicine and nutrition.

Learn more at biodesign.asu.edu.

MINDFUL REST

How you and your kids can get a better night's sleep

Sleep is more than just what happens between bedtime and waking. It affects child development, as well as how we handle stress and respond to illness.

That's why ASU researchers have spent years studying factors that affect stress and sleep to develop evidence-based tips for a better night's rest.

Findings include:

- **Avoid screens in the hour before bedtime.** This allows your children to calm down before falling asleep. Reducing noise and ensuring the bedroom is completely dark can also help with this transition. You can apply these same tips to your own bedtime routine.
- **Establish a consistent bedtime routine** with set sleep and wake times, which helps regulate the internal clock.
- **Teach children how to manage stress** since it can disrupt sleep and lack of sleep impacts a person's ability to perform daily activities.

Learn more at psychology.asu.edu.

"Instead of parents wondering how to help their child better regulate their behavior, they can try to focus on creating more consistent sleep and media-use schedules."

— LEAH DOANE, CHAIR OF THE ASU DEPARTMENT OF PSYCHOLOGY

Arnel Garcesa, ’25 PhD in systems engineering, poses with the power-saving technology.

Making electricity up to 40% cheaper for Valley residents

New technology developed by ASU researchers may help lower electricity costs. Adaptive Control of Energy Systems, or ACES, is a software that coordinates energy use and storage across existing systems using smart controls.

“Think of it as a brain that tells different energy systems how to work together,” says James Nelson, ’15 BS in mechanical engineering, ’16 PSM in solar energy engineering and commercialization, ’19 PhD in systems engineering, and director of technology and innovation for ASU’s Laboratory for Energy and Power Solutions.

ASU tested ACES at the Arizona Department of Emergency and Military Affairs because of its existing building automation system and microgrid. Using predictive analytics to automate operations, ACES shrunk utility bills at the site by 26% to 40%, saving about $1,000 a month. Results also showed a 22% improvement in electrical system performance during mock grid outages.

Partnering with ASU on the project, SRP will apply these findings to other research at the utility’s new microgrid lab so the learnings can help the utility reduce costs.

Watch the technology in action.

Bringing an offline digital library to students in Kenya

A school and orphanage in Kenya now has access to educational materials and more than 300 books and videos thanks to a team of ASU students. In partnership with the Jirani Project, which provides schooling and vocational training for orphans and children in difficult circumstances, 11 students in ASU’s Engineering Projects in Community Service program spent three years compiling resources in both English and Kiswahili, a language common to several regions in Africa.

The digital library not only replaces outdated physical study materials, but provides video instruction in Kenyan Sign Language to 42 hearing-impaired students.

Learn more at epics.engineering.asu.edu.

“It feels like something that is revolutionary. It’s very exciting.”

— BRANDON MIRANDA, EIGHTH GRADE STUDENT AT HARVEST PREPARATORY ACADEMY

Yuma 8th graders build robot to clean the oceans

A classroom in the middle of the Sonoran Desert might be the last place you would expect to find ocean research — but that’s exactly what’s happening at Harvest Preparatory Academy in Yuma, Arizona. Adriel Magana and Brandon Miranda built a robot capable of removing microplastics from waterways where it can harm marine life and anyone who eats seafood.

Magana and Miranda designed a robot called MP Guard with the help of Vernon Morris, an affiliate professor in ASU’s School of Mathematical and Natural Sciences. The pair used a 3D printer, duct tape, pool noodles and LEGO pieces to build it. The robot works as a skimmer — using a sharp-toothed ratchet to collect particles, which are then trapped by a filter made from sustainable coconut husk fibers. The bot is designed to remove microplastics that are even invisible to the human eye.

See the invention at work.

“We are transforming our landscapes to better reflect our desert environment.”

— ALEX DAVIS, ’12 BS IN INDUSTRIAL ENGINEERING, ASSISTANT DIRECTOR, UNIVERSITY SUSTAINABILITY PRACTICES OFFICE

Desert plants and decomposed granite ground cover line the banks and median along River Parkway at the ASU Research Park.

CHARLIE LEIGHT/ASU

DESERT ADAPTED

Saving millions of gallons of water through smarter landscaping

A pair of ASU landscaping projects is helping conserve one of the desert’s most precious resources — water.

The ASU team redesigned 4.8 acres in the ASU Research Park in Tempe along River Parkway with desert-friendly plants and beds lined with decomposed granite instead of turf. At Papago Golf Club, which is home to Sun Devil Golf, 15 acres of turf were removed. Together, every year, these projects will save an estimated 29.1 million gallons of water — or nearly the amount used annually by 267 Valley homes.

“The Papago Golf Club is irrigated with Colorado River Water, and being able to conserve that water for another need around the Phoenix area is one way of supporting the community,” says Alex Davis, assistant director in ASU’s University Sustainability Practices office.

Learn more at cfo.asu.edu/optimized-water.

Science-based insights on drinking water keep construction teams safe

ASU researchers are using sports science to educate construction workers about the dangers of extreme heat. According to a new Maricopa County report, there were more than 600 heat-related deaths identified in 2024. And all of those, they say, could have been prevented.

To address this, PhD student Kinta Schott, who is a part of a team of scholars under the direction of Floris Wardenaar, an assistant professor in the College of Health Solutions, developed a fact sheet on hydration — offering science-based tips for improving heat tolerance, staying hydrated and learning the signs of heat-related illnesses. The team visited construction companies in the Valley to provide resource sharing on jobsites and distribute the fact sheet to companies like Holder Construction, which employs nearly 1,500 employees and thousands of subcontractors across the country.

"To have someone come on site and share this knowledge is invaluable. We saw a decrease in heat-related illnesses," says Robert Chapman, an assistant safety director with Holder Construction.

Find out more at chs.asu.edu.

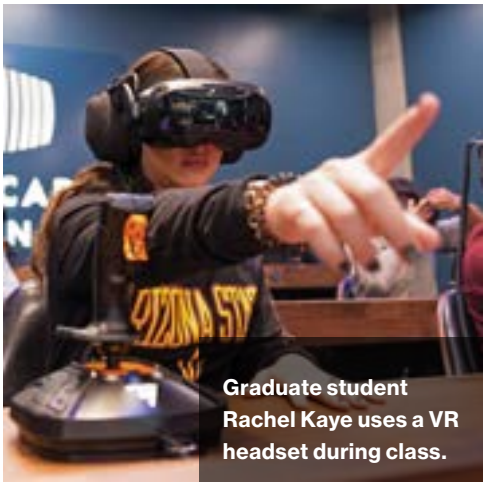
ASU-backed business saves pets from house fires

For many people, pets are family members. That's why firefighter brothers Ryan and Rusty Tussing created Rescue Retriever. The paw-shaped smoke detector guides firefighters to a pet's location during a fire.

The Tussing brothers, who have spent the past few years bringing their entrepreneurial endeavor to market, are turning to the SMB Lab, which helps small- and medium-sized businesses to raise capital, scale their product and bring more awareness to the public.

"We expanded our network to include bankers, digital marketers, supply chain managers and data analysts who listened to our pitch and allowed us to tell our story," Rusty Tussing says.

Learn how SMB Lab helps local businesses at csmb.wpcarey.asu.edu/smb-lab.



Graduate student Rachel Kaye uses a VR headset during class.

Virtual biology courses raise grades and keep students in STEM

More than 42,000 ASU students have participated in a course with a Dreamscape Learn virtual reality experience. In these fully immersive virtual worlds where emotional storytelling is combined with scientific principles, students tackle novel problems, gather data and develop solutions. A new study comparing student outcomes before and after the program's introduction reveals improved student success.

In addition to consistently rating their overall VR experience at 5 out of 5, students who took Biology 181 with Dreamscape Learn experienced a quarter-letter grade improvement in their final course grade for their next biology class, Biology 182, and showed marked improvement in their subsequent 300-level courses. Lastly, research over two years highlights that students who experienced Dreamscape Learn were more likely to remain science majors.

Dreamscape Learn is expanding beyond biology. Experiences have been developed for programs such as global futures, chemistry, astronomy and art history.

Learn more at dsl.asu.edu.

COURTESY OF KINTA SCHOTT; SAMANTHA CHOW/ASU

This is our moment

Changing Futures
From Arizona.
For the world.

As society faces the most complicated issues in recorded history, we cannot be bystanders. Arizona State University is uniquely committed – and uniquely equipped – to make a difference.

Through Changing Futures, we will bring together people, resources, ideas and solutions, focusing on these six impact areas that will change the world for the better:

- Transform global education
- Inspire tomorrow's game changers
- Reshape our relationship with the planet
- Empower community resilience
- Build the future of health
- Advance technology for good

ASU led the launch of the NASA Psyche mission for a better future.

ASU Arizona State University

This mission, this moment, demands partners like you.
Join us: asuchangingfutures.org

Career

CALLED TO CARE

‘Lean on your support system’

As a registered nurse at Phoenix Children’s, Maddie Dircks, ’18 BS in nursing, helps young patients and their families navigate the stressful days of pediatric illness.

“When I started my career, I realized how many people were there to support me. Don’t be afraid to ask for help. It’s always helped me to get a second set of eyes on something.”

Maddie Dircks, ’18 BS in nursing, supports pediatric patients through outpatient surgery.

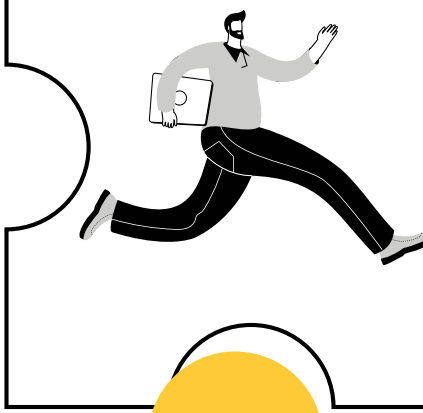
SABIRA MADADY/ASU

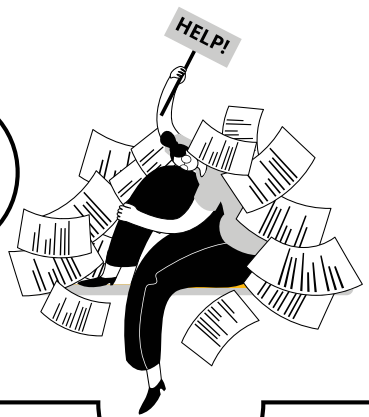
3 work habits holding you back

The key to overcoming silent career killers

Story by MAY BUSCH

Neglecting relationships that could move you forward





Letting limiting beliefs shape your decisions

Have you ever worked hard, done a great job and still been overlooked for the next big opportunity?

Sometimes, it's not the obvious obstacles that stall your career. It's the silent habits we don't even realize are holding us back.

Over my 24 years in corporate life, including 10 promotions, and now as an executive coach, I have seen three habits that quietly derail even the most capable professionals. The good news? Once you spot them, you can shift them.

May Busch is a former COO of Morgan Stanley Europe, who is now an executive coach, speaker, advisor, author and executive-in-residence in ASU's Office of the President. **maybusch.com/asuthrive**

1 Flying under the radar

Doing great work is important, but assuming it will speak for itself is a mistake. I learned this the hard way when a promotion I expected didn't come to fruition. My boss backed me, but when he took my case to the committee of other company leaders at the senior director level, no one else knew who I was. That was enough to sink it.

Whether you're early in your career or leading teams, visibility and timing matter just as much as ability.

Make your work known to others in the company. Speak up in meetings. Say "yes" before you feel completely ready. Keep key stakeholders in the loop. Try a weekly update email with three bullet points: what you achieved, what's in motion and what's next.

"As your career advances, it's no longer just about what you can do alone."

2 Neglecting relationships that could move you forward

It's easy to focus on tasks and leave relationship building for later. However, when you wait until you need something, it's often too late.

From building trust with your boss to staying in touch with mentors, sponsors and peers, you rise faster when people know you, trust you and want to advocate for you.

As your career advances, it's no longer just about what you can do alone. Success increasingly depends on collaboration, support and being part of the right circles – both inside and outside your organization.

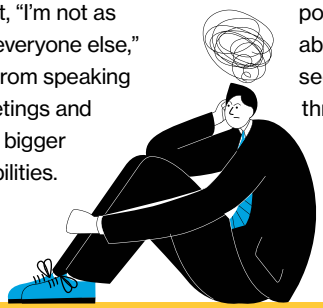
Incorporate relationship building into your schedule. This doesn't have to become a large investment or the need to take on big new projects at work. It could simply be getting to a meeting early to chat as people arrive or showing up to an event you might have skipped. Send a link to an article or be more present when speaking with colleagues.

3 Letting limiting beliefs shape your decisions

Limiting beliefs are the internal stories that hold us back. They might sound like:

- "I'm not ready yet."
- "They probably already have someone in mind."
- "Someone like me wouldn't get that opportunity."
- "I don't have anything interesting to say."

Negative beliefs about yourself can hinder you not just in your life, but in your career too. In the early days of my career, my belief that, "I'm not as good as everyone else," kept me from speaking up in meetings and taking on bigger responsibilities.



It's only by identifying those limiting beliefs that you can replace them with something more empowering – and accurate.

Name it to change it. Notice where you feel stuck or hesitant. That's often where a limiting belief is hiding. Identify it, challenge it and make a new choice.

Habits can be changed

I still remember how it felt to be passed over for that promotion – I had done everything right, or so I thought. But doing great work quietly wasn't enough.

That experience taught me a powerful lesson: Success isn't just about effort. It's also about being seen, connecting with people throughout your organization and believing you belong.

You can shift your habits – and move your career forward. Now that you know how to spot these three common habits that silently stall careers, you can start replacing them with strategic, career-advancing ones.

Which habit will you work on first? ■

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HITENDRA CHATURVEDI; ANDREAS SPANIAS; RENCE ROSARIO/ASU

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The new School of Manufacturing Systems and Networks at ASU's Polytechnic campus.

SABIRA MADADY/ASU

RESEARCH HUB

New learning space at Polytechnic campus

A new state-of-the-art facility is coming to ASU's Polytechnic campus in time for the fall semester.

Interdisciplinary Science and Technology Building 12 will serve as the home for the Ira A. Fulton Schools of Engineering's School of Manufacturing Systems and Networks. As the latest addition to the campus's Innovation Research District, the facility is designed to bring students, expert faculty and industry together in one place.

Equipped with advanced labs for 3D printing, robotics, industrial automation and semiconductor fabrication, the space will provide students with hands-on experience working alongside industry partners and faculty.

Learn more at msn.engineering.asu.edu.

Chip

How the growing semiconductor boom and ASU are transforming Arizona's economy

Story by
DANIEL OBERHAUS, '15 BA

SABIRA MADADY/ASU

Taylor Gowdy, '24 BSE in engineering (mechanical engineering systems) and TSMC Arizona equipment engineer, walks through the fab's air shower.

COURTESY OF TSMC

The scale of the semiconductor industry's economic impact in Phoenix is unprecedented — but it isn't happening by accident. It's the result of years of effort led by ASU, which has created the largest engineering school in the U.S. and developed the state-of-the-art facilities that are fueling the semiconductor boom and countless technological breakthroughs in the industry.

"What is happening in Arizona is the culmination of the work of many people over many years, and it will benefit the state for many years to come. It is a reason to celebrate where we have come from, where we are and what we are becoming – and the nation is depending on us to succeed," explains Sally C. Morton, who leads research at ASU.

This coordinated effort has attracted tens of billions of dollars in new investment to Arizona from companies, including Applied Materials, TSMC and dozens of other semiconductor companies, creating thousands of additional high-tech jobs.

As a result, the semiconductor industry's growth in Arizona is paving the way for hundreds of new small businesses, ranging from parts suppliers to restaurants. Dozens of new ASU workforce development programs and major public works projects will also improve roads, water facilities and other infrastructure across the Valley.

Success through collaboration

The key to attracting the world's top semiconductor companies to the Valley was creating pathways for them to collaborate with world-class researchers at ASU, says Zak Holman, the vice dean for research and innovation at ASU's Ira A. Fulton Schools of Engineering. For more than a decade, Holman has helped shape ASU's semiconductor strategy by forging partnerships with industry.

"Partnering with Applied Materials, which is the world's leading semiconductor equipment manufacturer, was a very purposeful choice," says Holman. "We needed to bring in unique equipment to ASU, and Applied Materials needed innovative people developing unique things on their equipment so they could sell it to their customers like Intel or TSMC."

ASU's industry partnerships are working. In July 2023, Applied Materials announced a $270 million investment to create a Materials-to-Fab Center at ASU's Research Park in Tempe, which ASU and the Arizona Commerce Authority contributed to as well. This investment includes installing machines at ASU's MacroTechnology Works that make materials for the next generation of AI and microelectronics chips.

The multimillion dollar investment that ACA made in 2013 to MacroTechnology Works will enhance Arizona's wafer-level packaging R&D and workforce training capabilities for Arizona.

"There are so many engineering opportunities here. So if someone is looking to work in manufacturing, there will be a role that fulfills their interests regardless of what their engineering background is."

— TAYLOR GOWDY, EQUIPMENT ENGINEER, TSMC

All told, more than a dozen companies, ranging from local startups to multinational tech giants, have taken up residence at the park in Tempe and invested an additional $500 million in the facility and sponsored research agreements with ASU. This center of gravity has attracted still more microelectronics companies, as well as additional funding including government research programs.

In January, the U.S. Commerce Department announced that the new NSTC Prototyping and NAPMP Advanced Packaging Piloting Facility would be located in Arizona adjacent to the MacroTechnology Works building. This facility will be home to bleeding-edge semiconductor prototyping, manufacturing and packaging equipment that isn't available anywhere else in the world,

A molded wafer manufactured by Deca Technologies, an ASU partner at MacroTechnology Works in Tempe.

EMMA FITZGERALD/ASU

creating a domestic R&D capability that is vital for America's national security and maintaining its position as a global leader in semiconductor innovation.

ASU President Michael M. Crow put the state's win in context, saying, "This is the largest of three CHIPS R&D flagship facilities being launched that together represent the greatest national laboratory investments since those that came out of the Manhattan Project."

ASU's efforts have paid off

Ten years ago and even before, ASU and other entities such as the Greater Phoenix Economic Council and ACA were already looking to semiconductors as Arizona's future. Crow, other leaders at ASU and GPEC understood that chips are required for everything.

Today, virtually all computer chips are made abroad and depend on a global supply chain that is increasingly dominated by China. Although the U.S. does produce some computer chips domestically, the vast majority of the chips in our phones, computers and other electronics are made by TSMC in Taiwan. About a decade ago, ASU, the ACA and other organizations, including GPEC, launched a campaign to bring TSMC's first fab in the U.S. to Phoenix. From GPEC's perspective, what really sealed the deal was the workforce and research depth at ASU.

"ASU has thousands of graduates per year in mechanical and electrical engineering, which meant we could illustrate to TSMC that this was the market they should launch and scale from in

the United States," says Chris Camacho, outgoing president and CEO of GPEC.

In 2020, TSMC committed $12 billion to build a fab in Arizona, then expanded that to $165 billion for six fabs and two advanced packaging facilities. It's the largest foreign direct investment in U.S. history.

As of this year, its first fab has started producing advanced 4nm chips for U.S. customers — the first time these types of chips have ever been produced on U.S. soil. The company's second and third fabrication plants are currently under construction and when complete will produce 2nm chips, which are the most advanced commercially available chips in the world.

According to GPEC's analysis, TSMC's first three fabs alone will create 6,000 jobs and more than $33 billion in direct and indirect economic output for the people of Arizona. GPEC also estimates that for every job created in the semiconductor industry, it will also create five new jobs in other industries that support this new workforce, such as construction, restaurants and child care.

The downstream impact

The semiconductor industry depends on a vast network of interconnected suppliers. Arizona is unique in the U.S. because it has all elements of the semiconductor supply chain, which benefit both large companies, as well as semiconductor companies like Saras Micro Devices.

When Ron Huemoeller was tapped to lead Saras Micro Devices as its new CEO in 2023, one of his first major initiatives was finding a new home for the company because it was hard to find enough talent in Atlanta. So last year Huemoeller relocated the company to Chandler to benefit both from the proximity to other semiconductor companies and ASU.

"The primary driver to establish the headquarters in Arizona was because of the broad semiconductor ecosystem that is growing here."

— RON HUEMOELLER, CEO
SARAS MICRO DEVICES

"The primary driver to establish the headquarters in Arizona was because of the broad semiconductor ecosystem that is growing here," says Huemoeller.

The company now employs 52 people, and more than 30 of them work in Chandler. Huemoeller says he expects the company's head count to double by the end of 2026, with many new hires coming from ASU.

"We feel comfortable that we will be able to access the right people for our company here," he says.

The semiconductor ripple effect

The semiconductor boom's economic benefits extend far beyond tech manufacturing. This trend is already visible across the Valley, from construction companies working on fab builds to restaurants opening.

One of the dozens of examples is Lee Chi Investment Group, a large food distributor and a local real estate investor. In 2024, Lee Chi acquired a shopping center in north Phoenix about 20 minutes from TSMC. At the time, the shopping center was only about 75% occupied but, with TSMC so close, is now growing.

"At this location, people are coming to us because they see the opportunity; usually we have the opposite problem," says Julia Li, director of operations for the group.

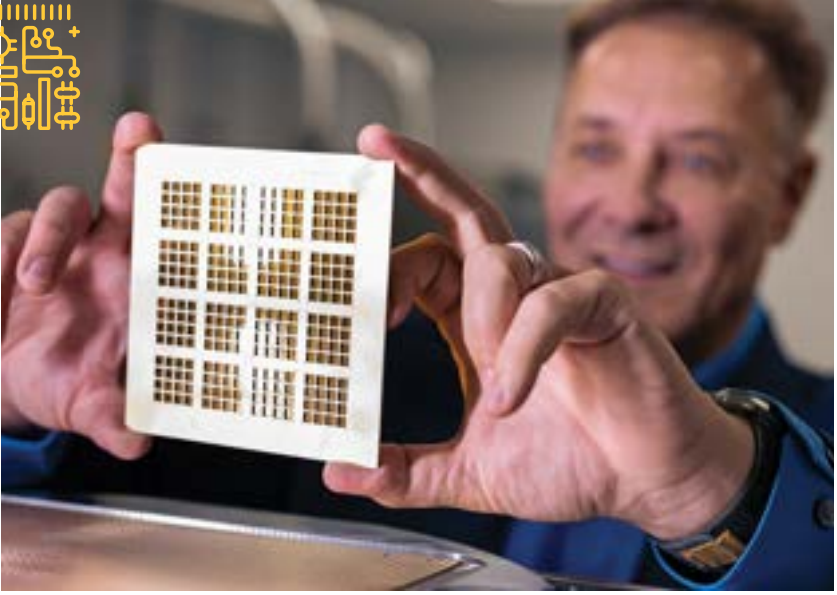
Preparing tomorrow's workforce

ASU's engineering program graduates more than 7,400 students a year. These graduates are essential to the semiconductor companies' success.

"Companies like Intel and TSMC need an excellent, well-trained workforce and a lot of people," says Holman. "ASU has both the volume and quality of graduates to meet that need."

One of those graduates is Taylor Gowdy, '24 BSE in engineering (mechanical engineering systems), who was hired by TSMC Arizona in 2024 as an equipment engineer. She attended classes on ASU's Polytechnic campus, which provided a hands-on, project-based emphasis.

"There are so many engineering opportunities here," Gowdy says. "So if someone is looking to work in manufacturing, there will be a role



Ron Huemoeller, CEO of Saras Micro Devices; MacroTechnology Works is home to cutting-edge semiconductor R&D.

that fulfills their interests."

ASU has been working closely with Applied Materials, TSMC, Intel and dozens of other companies to understand their needs and tailor programs so that students develop the skills to land a job in the industry when they graduate.

"We work really hard to collaborate with our corporate partners to understand the workforce and build the curriculum to fill those gaps," says Katie Smith, '13 BS in biochemistry, '17 MBA, a business development manager at ASU Knowledge Enterprise who leads microelectronics engagements.

A new economic foundation

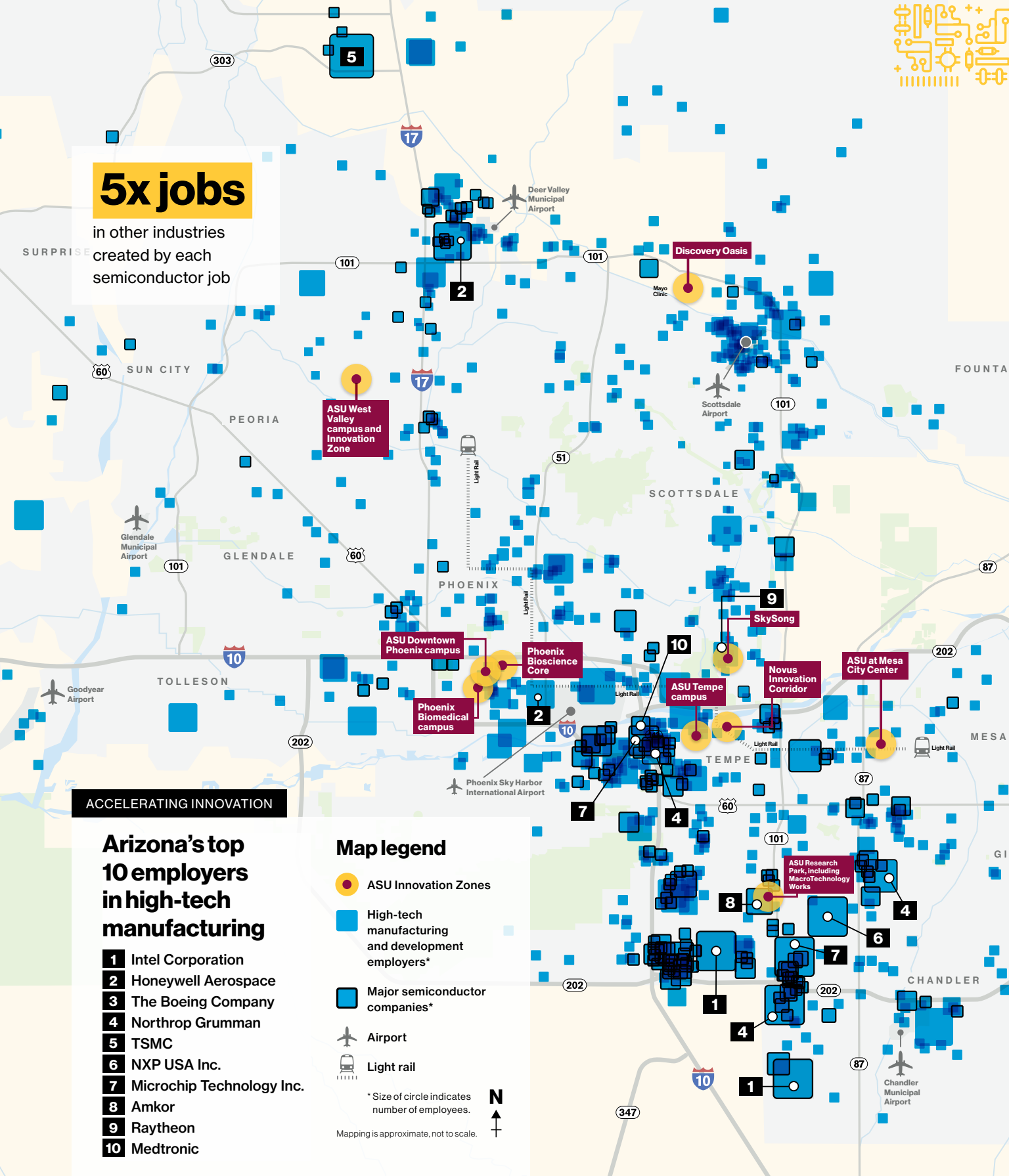
For Phoenix, and Arizona more broadly, semiconductors represent more than just another industry. The semiconductor industry offers a sixth C – "chips" – that will be less cyclical and more future-proof.

"We're entering a new era where chips are going to be the center of everything," says Camacho. "Our economy is now going to be anchored to products that are integrated in the most sophisticated way into virtually every channel of technology."

The numbers support this optimism. According to the Arizona Commerce Authority, in the last five years, there has been more than $200 billion in private investment in Arizona related to semiconductors.

"My children and my children's children will look back at all the semiconductor growth that's happening now and see that it was a pivotal point for Arizona's economy," says Camacho. ■

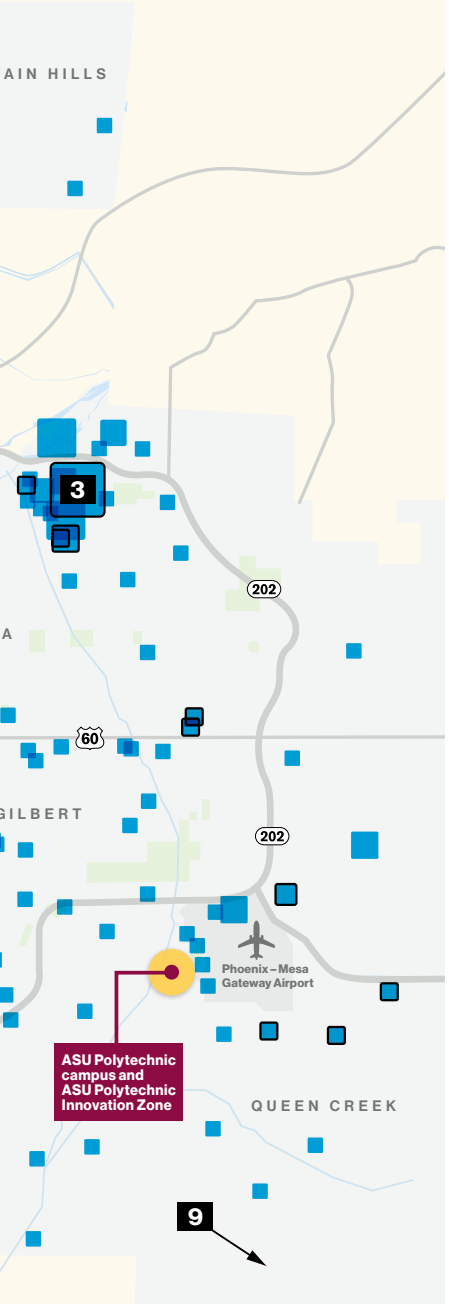
SABIRA MADADY; CHARLIE LEIGHT/ASU



SOURCES: MARICOPA ASSOCIATION OF GOVERNMENTS EMPLOYER DATABASE 2023; GPEC; NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY; ASU

Silicon GIANT

ASU has built the largest engineering school in the U.S., along with developing the facilities and expertise for cutting-edge research, which has helped Arizona attract and build high-tech companies. Today, the Phoenix metro area has more than 1,100 high-tech manufacturing and development employers, including more than 100 from the semiconductor manufacturing industry.



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32,700+

engineering students as of fall 2024

7,400+

engineering graduates for the 2023–24 academic year

#1 **best online master's in electrical engineering programs**

ASU ahead of USC, Michigan and Texas A&M

– U.S. NEWS & WORLD REPORT, 2025

$200+ billion

in private investment in Arizona related to semiconductors in the past five years

$200+ million

in new and improved public infrastructure by Phoenix metro cities as a result of semiconductor companies moving here

$30+ million

invested in workforce development programs at high schools and community colleges in Phoenix in the last five years

SEMICON West comes to Phoenix

In this major industry conference, partners from across the region come together and ASU students and veterans will have opportunities to engage.

Learn more at semiconwest.org.

Universities are the ‘invisible hand’

— MICHAEL M. CROW, ASU PRESIDENT

Marcia McNutt, president of the National Academy of Sciences, and **Michael M. Crow**, president of ASU, emphasize how science drives America’s economic success

Do you see this moment of shrinking budgets for scientific research as a major reset?

McNutt: I would say that if we want America to be great, we need great science.

In the past, budgets have only modestly been adjusted from the year before. And if some new exciting field emerges, then our government enterprise looks for new money to help bolster this breakthrough area.

Very rarely do we reallocate money from a place where there’s not much happening and move it over to another field where the science is rapidly advancing. I think at a time when there’s so much concern about inflation and other matters, it does make sense to pull together scientists and select priorities.

But that’s not what we’re doing. Cutting certain areas of inquiry based on ideology is not going to make America great.

Crow: Yes. Following on Marcia’s points, the United States has been outperforming all other economies. This is an essential point in arguing against taking a meat cleaver to the American scientific enterprise.

Since 1945, 75% of all global economic growth is derivative of technological advance. And since 1990, 90% of that technical advance is derivative of fundamental scientific understanding, which was never the case before.

The opportunity for making America great lies in the foundation it has created for global economic growth — giving us trading partners and opportunities to generate American wealth and build our nation. **Many people have missed the significance of this transformation into a knowledge-driven, scientifically grounded, technology-advancing economy.**

McNutt: You know, another way to say this is if we look around the world at which countries are prosperous, there are two classes of them.

There are those nations that have invested in science and technology, and they are doing well. They are creating entire new industries, new disciplines, new ways to advance the welfare of humans on this planet.

The other kind of country that is doing well economically is the kind with a lot of natural resources to exploit — but that source of wealth is not sustainable.

Science is still the endless frontier of knowledge and advancement.

What can be done to reshape this conversation in this moment? Where do you see opportunities?

Crow: Look at the People’s Republic of China. Why did China decide 30 years ago to build a hundred new research universities?

Certainly there are military reasons, but also economic-

COURTESY OF NATIONAL ACADEMY OF SCIENCES

ASU's development of the world's first compact X-ray free electron laser, or CXFEL, will allow researchers to explore atomic-scale events important for biochemistry, microelectronics, bioenergy applications, drug discovery and development, quantum computing, and more.

SAMANTHA CHOW/ASU

Scan the QR code to watch ASU President Michael Crow discuss transforming education on CNBC.

A view of slides in the ASU-Banner Neurodegenerative Disease Research Center.

competition reasons. China thinks: If we can beat the Americans in science and technology, we win.

Our nation has become confused by the fact that universities are very complex places. Many people are mad at schools about social, political or freedom of speech issues, and those have to be dealt with.

But now our great universities, which are critical to America's economic competitiveness, are being thwarted in the research space as punishment for perceived misbehavior in those other spaces.

Those two things should be separate. You're going to wound the country, allow others to gain scientific and technological dominance, and lose our economic momentum.

You both seem to have a vision of the STEM enterprise using this time to rethink what STEM careers look like.

Crow: Yes, I was just in meetings about licensing to operate part of our engineering school in the United Kingdom, where we can give three-year degrees.

We're learning to speed up undergraduate degrees and use advanced technologies to speed entry into STEM. We need to change PhD programs — make them shorter, faster and more variable in terms of outcomes.

"Our competitors [in other countries] are not reducing their investments in science and technology or in universities. It's just the opposite."

— MICHAEL M. CROW, ASU PRESIDENT

Our competitors [in other countries] are not reducing their investments in science and technology or in universities. It's just the opposite.

They're building entire clusters of universities built on the American model.

The United States was the first country that gave general rank-and-file citizens the ability to own intellectual property. Beginning with President Jefferson, exploration became a core national activity. Then we built agriculture as a core national activity, then nuclear power, then science itself and now all things digital. In every one of these cases, the only way that we've made any progress is through empowerment of the universities. Universities are the invisible hand.

Taking a narrow view of universities ignores their historical contribution. Pick something as simple as American agriculture. We've had no famines. We have unbelievable food in every grocery store. We have access to everything at relatively low cost. We have 2% of the population feeding the entire country and much of the world through technological advancements.

And it all goes on silently, connected to these land-grant colleges and universities in each and every state, to the county extension officers who are working on scientific transfer and scientific understanding. You don't know where all this bounty came from when you go to the grocery store, because it's invisible.

All of that is in jeopardy. This is a critical strategic error being made right now. ■

DEANNA DENT/ASU

University innovations' economic impact

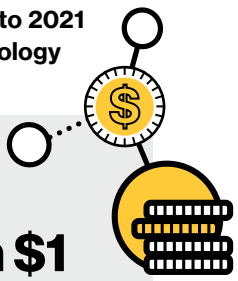
Research that serves America

IMPACT OVER TIME

150%–300% ROI

from government investments in scientific research and development since the post-World War II period

80% **more startups from 2006 to 2021 fueled by university technology**



SCIENCE DRIVING GROWTH

NIH funding in FY24 supported

407K+

jobs across every single state

$94+ billion

in new economic activity nationwide

Each $1

invested in U.S. federal biomedical research in 2024

led to $2.56

in economic activity in the American economy

SOURCES: UNITED FOR MEDICAL RESEARCH, FEDERAL RESERVE BANK OF DALLAS, NATIONAL SCIENCE FOUNDATION

Universities fuel the breakthroughs that shape our future. By advancing scientific research to control disease, generate technological discovery and expand scientific knowledge, higher education institutions invigorate economic growth, positioning the U.S. as a global scientific leader.

"Since World War II, public sector investments in basic scientific research have formed the backbone of American ingenuity and innovation," according to a report by The Science Coalition.

Learn more at researchmatters.asu.edu.

IMPACT OF RESEARCH REDUCTIONS

$10,000

How much poorer the average American will be

due to slower GDP growth if annual public research spending is cut by 50%

3.8%

decline in U.S. gross domestic product

if public research spending is cut by 25%

SOURCE: AMERICAN UNIVERSITY

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Congressman Ed Pastor played a vital role in establishing the ASU Downtown Phoenix campus.

HONORING LEGACIES

Unique place on the downtown campus

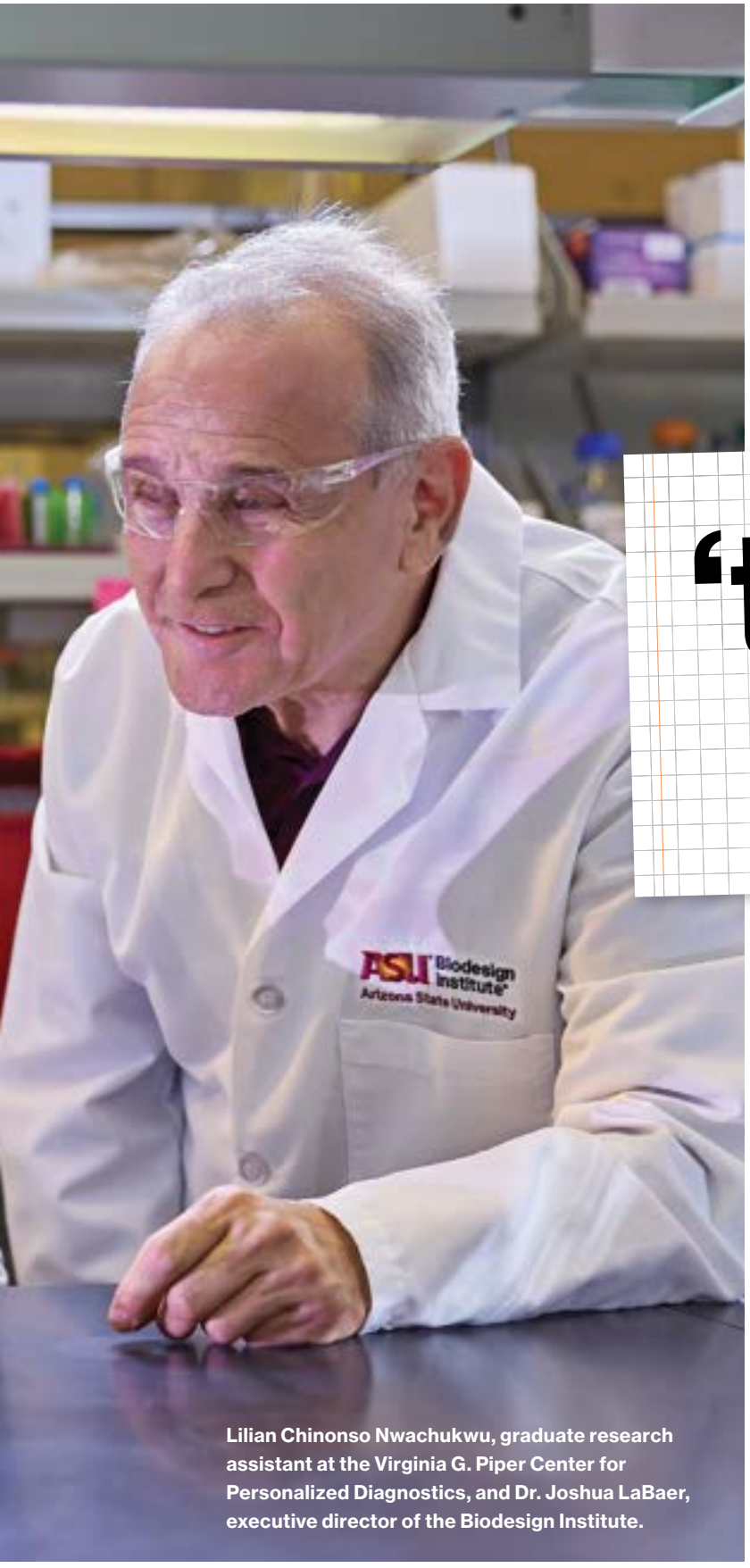
The Ed Pastor Post Office is more than a place to send a letter. In addition to the post office on the first floor, the 1936 Colonial Revival style building houses student organizations, administrative offices and the ASU Police Department.

It was named this past spring to honor the late Congressman Ed Pastor, '66 BA in chemistry and '74 JD.

Check it out at Central Avenue and Fillmore Street in downtown Phoenix.

This ASU building is also a working post office on the Downtown Phoenix campus.

SIDHARTH SIVAPRASAD; CHARLIE LEIGHT/ASU



Lilian Chinonso Nwachukwu, graduate research assistant at the Virginia G. Piper Center for Personalized Diagnostics, and Dr. Joshua LaBaer, executive director of the Biodesign Institute.

Fueled by personal loss, one scientist is changing how we fight cancer — for everyone

Story by SARA CLEMENCE
Photos by JEFF NEWTON

FROM 'the call' TO THE cure

When Joshua LaBaer finished medical school, he was sure of two things: Cardiology didn't appeal to him, and he wasn't going to specialize in oncology. But doing rotations with cancer patients during his internship and residency at Brigham and Women's Hospital in Boston changed Dr. LaBaer's mind.

"It was both intellectually and emotionally very rewarding," says LaBaer, now the executive director of Biodesign Institute at ASU.

"You have to know everything about medicine to be a good cancer doctor, but also the patients are wonderful, and it's a field where you really bond with them."

When LaBaer's mother was diagnosed with breast cancer, the work took on a new kind of

urgency. By then, he was leading a lab at Harvard focused on early detection of cancer through the analysis of proteins. Suddenly, the science became deeply personal.

"It was a mixed blessing," he says. "I could speak the language. I could help. But I also knew too much."

His mother died of the disease. But her case — and how it might have played out differently — remains a guiding force in his work.

Much of LaBaer's research is devoted to breast cancer. One of his team's most promising technologies is a blood test that detects immune responses to early-stage disease. If such a test had existed then, LaBaer wonders, would it have made a difference?

He'll never know the answer. But it's a question that still drives him.

Lydia Sakala, '18 BS in biochemistry, graduate service assistant at the Virginia G. Piper Center for Personalized Diagnostics.

Lab as launchpad

The Biodesign Institute is a multidisciplinary powerhouse with 16 research centers that focus on everything from mitochondrial medicine to how cells evolve. It's also the heart of ASU's cancer research efforts.

LaBaer's lab is a launchpad for promising technologies and budding researchers. Among them is Lydia Sakala, '18 BS in biochemistry, who is originally from Zambia. She came to ASU with an interest in HIV — a pressing issue in her home community — and pursued undergraduate studies in biochemistry. After a brief stint shadowing doctors in an emergency room, she returned to ASU to pursue doctoral research.

At the start of the pandemic, LaBaer quickly marshaled resources, turning capabilities developed through a research project in which PCR tests were used into one that created and processed saliva tests for COVID-19.

Sakala initially applied to help conduct COVID-19 research in LaBaer's lab. Then she took LaBaer's Biochemistry of Cancer course, and began to understand the magnitude and urgency of the problem.

"The more I learned about cancer, the clearer it became that better treatments were needed. Now, I'm grateful to play a small role in this massive undertaking," Sakala says.

Sakala now investigates mutations in a key protein known as P53, one that's implicated in the vast majority of triple-negative breast cancer cases, an especially aggressive and hard-to-treat subtype of the disease. Her work is part of a broader effort to understand how specific mutations influence cancer behavior, and ultimately, to help guide the development of more effective treatments.

Josh LaBaer and a photo of his late mother, who died of cancer.

Fellow doctoral student Lilian Chinonso Nwachukwu, who will graduate with her PhD in biochemistry in 2026, was propelled toward breast cancer research at 16, when a close friend's mother died from the disease.

"It was really devastating," she says. "We were pretty young at the time, and she was like an auntie for me."

Her research also focuses on triple-negative breast cancer, named because it lacks the biological markers needed for common hormone therapies. Using

tools including CRISPR and gene expression analysis, Nwachukwu studies how mutations can be exploited for more personalized therapies. It's part of a broader push within the Biodesign Institute to move from one-size-fits-all treatments toward solutions rooted in the biology of individual patients.

"A lot of good things have been done," Nwachukwu says. "But there are still gaps that I and other people could help fill in the future."

Affected by cancer

LaBaer refers to it as "the phone call." Countless people have received it from someone they love who is diagnosed with cancer.

The call came for him when he was around 30. His mother's doctors had found a concerning lesion in a routine mammogram.

By then, the cancer had spread to her lymph nodes. She underwent surgery and high-dose chemotherapy.

LaBaer believes her body was cleared of cancer, but not her brain. The tumor that eventually developed there killed her when she was 64.

"I could speak the language. I could help. But I also knew too much."

— DR. JOSH LABAER, EXECUTIVE DIRECTOR, ASU BIODESIGN INSTITUTE, ABOUT HIS MOTHER'S CANCER DIAGNOSIS

Several years ago, LaBaer gave a TEDx talk in which he showed a slide of progress on diseases since 1950. Deaths from heart disease, stroke, pneumonia and the flu had plummeted, while cancer mortality stayed roughly the same.

Despite that data, he said, he was optimistic. Over the course of his career, cancer science had gone from a cellular understanding of cancer to investigating it on a molecular level.

LaBaer's early fascination was to add to the collective knowledge of science — to explore where no one had yet looked. He grew up in the Phoenix area and went to high school at Washington High

on Glendale Avenue, then started college at UC Berkeley with a plan to become a lawyer or a doctor. He eventually ended up in an organic chemistry class.

Unlike the regular "orgo" class, where students worked on recipe-like experiments, LaBaer's was an honors course. Students took on multistage syntheses whose outcomes were uncertain.

"I thought, 'Whoa, we're going to be the first ones to do something,'" LaBaer recalls. "That bug bit me hard."

He soon realized he didn't have to choose between research and medicine; he could do both.

Earlier detection

LaBaer and his team are now doing pioneering work on a diagnostic approach rooted in the immune system's own record-keeping. A person's blood contains antibodies that form a record of all of the body's past immune responses. Their protein microarrays innovation can analyze thousands of immune responses in a single drop of blood — essentially reading the body's history of disease and potentially detecting traces of cancer before symptoms appear.

"The immune system logs everything. Infections, cancers, autoimmune diseases. If we can read that log, we can detect disease early. Maybe even prevent it."

— JOSH LABAER, PROFESSOR AND EXECUTIVE DIRECTOR, ASU BIODESIGN INSTITUTE

"The immune system logs everything," he explains. "Infections, cancers, autoimmune diseases. If we can read that log, we can detect disease early. Maybe even prevent it."

His lab recently conducted a 12,000-sample study analyzing immune markers in infectious disease and cancer, potentially enabling earlier, more precise detection.

The team has also identified a series of antibodies that could be useful in detecting breast cancer. A blood panel based on those antibodies came achingly close to commercial release before the startup behind it ran out of funding. Now, it's back in ASU's hands, and LaBaer's team is working to get it into the right ones.

In the meantime, he still thinks about his mother's cancer regularly.

"I still do wonder," LaBaer says. "When she had that first mammogram, if they had done a blood test, would they have been more suspicious? Would they have looked a little harder? And if they found it back then before it spread to her lymph nodes and all the rest of that stuff, could she have had a different outcome?"

While there's no way to know, some day, because of the work at ASU, the outcome might be different for someone else's mother, friend or child.

For those driven by loss and hope alike, the work is more than discovery. It's a promise to keep looking, and to keep going.

"I love this work," LaBaer says. "There's nothing more fun than shedding light where there isn't any right now." ■

Learn more about cancer research at ASU at biodesign.asu.edu/research-areas/cancer.

Pairing up to treat cancer

Recently ASU's Biodesign Institute partnered with Dublin City University's Biodesign Europe to develop new therapies for aggressive breast cancer.

ASU's Mehdi Nikkhah and Jin Park will use their 3D "tumor-on-chip" models to study how specific mutations in the TP53 gene drive treatment resistance in triple-negative breast cancer. The Dublin team will investigate how these mutations interfere with calcium-based cell death.

The research aims to develop more effective therapies for not only breast cancer but also many other cancers driven by TP53 mutations.

Grad student Bailey Kane, '25 BS in biological sciences (genetics, cell and developmental biology), seeds bacterial cultures, a process used in drug testing.

SMART MEDICINE

More individualized cancer treatment

Every year, about 2 million Americans are diagnosed with cancer and more than 600,000 of them face cancer that spreads or resists treatment.

That's why the Advanced Research Projects Agency for Health, part of the U.S. Department of Health and Human Services, selected ASU — alongside other top research institutions — to make cancer care more personalized.

Care solutions will be achieved through powerful computer models, new medical tests and patient enrollment in flexible clinical trials within 12 months. Data and tools developed under the program will be made public, promoting innovation across the cancer research community.

Learn more at research.asu.edu.

QUINTON KENDALL/ASU

Water resilience from below

Story by MARSHALL TERRILL
Photos by CHARLIE LEIGHT

MyLand's Dave Booher explains how the outdoor algae production system improves soil so farmers can achieve greater water efficiency.

ASU and soil health company MyLand help rural Arizona farmers save water with new algae-based technology

Ed Curry is passionate about the green, red and yellow chile peppers he grows on his 3,000-acre farm in Pearce, Arizona, a rural community about 90 minutes southeast of Tucson.

He's also passionate about saving water.

"On the farm we have a saying: Make more crop per drop," says Curry, who founded Curry Seed & Chile Co. in 1976. "Our goal here is to cut our water usage whenever we can."

Curry says he cut about 50% of his water usage in the 1990s by going to a drip system. More recently, he estimates he's cut another 10% through a new soil service.

Testing new technology

ASU and MyLand, a Phoenix-based soil health company, use live, native microalgae to improve soil so that farmers like Curry can achieve greater water efficiency, increased yields and reduced environmental impact by needing to use fewer pesticides because of healthier soil and crops.

ASU's Center for Hydrologic Innovations is studying the science behind the innovation by using advanced tools to monitor water-use efficiency on the plots using the algae innovations compared to control plots.

"Our goal is between 7% to 15% water savings to demonstrate the water efficiency gains from better soil health," says Enrique Vivoni, director of the center and Fulton professor of hydrosystems engineering in the School of Sustainable Engineering and the Built Environment.

With more than 900,000 acres of irrigated farmland in Arizona, the potential for large-scale impact is significant.

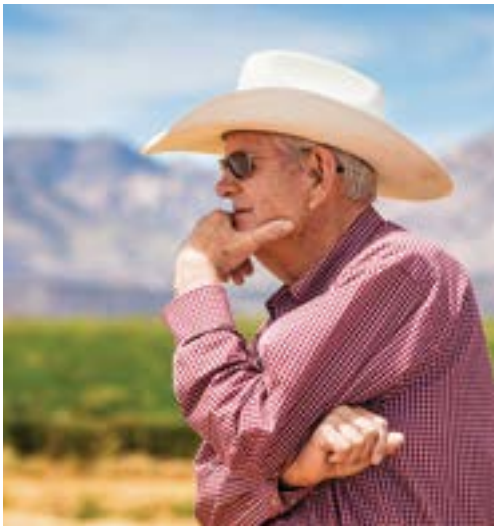
A solution in focus

Thanks to a grant administered through the Water Infrastructure Finance Authority of Arizona, the project will provide free access to a nature-based soil health technology across thousands of acres of Arizona's commercial farmland.

"I'm really excited to see these kinds of efforts," says Paul E. Brierley, director of the Arizona Department of Agriculture.

"What we're really talking about is, 'How can we keep agriculture productive, even in the face of less water?' Which is what we're facing here in this county. So, there's a lot of different ideas, a lot of different solutions."

Chile peppers pop up after seeding and irrigation with the MyLand soil project at Curry Farms.



Farmer Ed Curry says MyLand's soil system helped him reduce his water consumption by 10%.

How it works

MyLand started working on the idea about 15 years ago, says Dave Booher, MyLand's senior vice president of sales.

"The company was founded in 2011 by three individuals with a passion for agriculture and thinking of a better way to regenerate the soil," says Booher. "We spend a lot of time treating things above ground but haven't really thought about the potential for what's below ground."

MyLand's "Soil as a Service" approach uses live, native microalgae to improve soil health and influence biological, physical and chemical changes in the soil. These changes enhance the soil's ability to hold and utilize water, which in turn supports both productivity and sustainability.

"We have growers who have documented a 15% decrease in water use on alfalfa, an extra half-day between irrigation cycles on peppers and a 24% improvement in water-use efficiency on tree nuts."

The service, which includes installation and operation of the system, grows the live, native microalgae in algae production vessels, on-farm, and injects directly into the irrigation system.

Greg Sweatt can attest that the innovation improves crop yields.

"I harvest Ed's pecans for him, and I noticed that last year was one of the better-quality crops," says Sweatt, owner of Whitewater Irrigation Inc. in Cochise County. "I asked Ed if he had sprayed the crops with pesticides. He says, with MyLand, he never sprayed anything."

That's because when the quality of the crops improves, the insects stay away, according to Chad Koehn, owner of Koehn Farm LLC in Pearce.

"All insects are nature's garbage collectors," he says. "When you change the health of the plant, those insects will leave it alone."

Bringing it to other rural farmers

The lessons learned in Pearce will be shared with other farmers in Arizona and beyond through outreach and education, says Lindsay Gaesser, a research specialist with the Swette Center for Sustainable Food Systems.

"Our goal will be to engage with farmers about the benefits of this microalgae solution and how they could use it on their farms," says Gaesser. "We also have students engaged in this research to support wider adoption of this technology and pursue its approval as a conservation practice with the USDA."

This will help get the technology into the hands of more rural farmers, starting in Arizona. ■

Soil innovation with measurable results

900,000

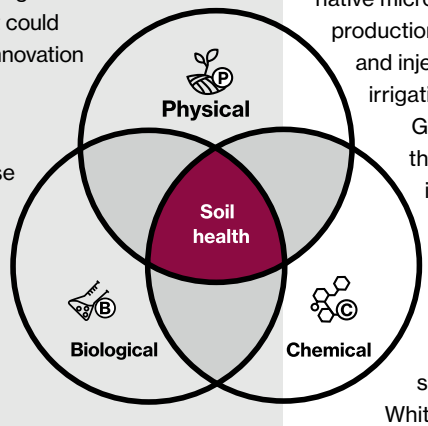
The number of acres of irrigated farmland in the state that could benefit from soil health innovation

24%

Improvement in water-use efficiency on tree nuts

15%

Decrease in water use on alfalfa



Source: MyLand

In Cochise County, as in much of Arizona, groundwater basins are in decline.

COMMUNITY SOLUTIONS

Water savings in Cochise and La Paz counties

Arizona's farm communities are building a more secure water future with help from ASU. In Sulphur Springs Valley and La Paz County, residents worked with Impact Water - Arizona, part of ASU's Arizona Water Innovation Initiative, to develop strategies for their communities.

They created the Sulphur Springs Water Alliance, resulting in the groundwater basin's largest user reducing consumption by 14%. In La Paz, residents discussed policy and plans to create an up-to-date water resource website.

These accomplishments matter, says Susan Craig of Impact Water - Arizona, as groundwater — 41% of the state's water supply — is used faster than it is replenished, especially in rural Arizona.

Learn more at azwaterinnovation.asu.edu.


Clean
water
catal

“Major cleanup of the water supplies will directly affect public health.”

– ALI SHAMBAYATI, PRESIDENT AND CEO, METRICS WATER CATALYST

ASU professor’s new technology takes on ‘forever chemicals’ in the water supply

Story by MONIQUE CLEMENT, ’09 BA

Some of the tiniest creatures on Earth have the power to remove harmful chemicals from our water supply. ASU Professor Bruce Rittmann and his research team are teaming up with specific bacteria to remove chemicals from water called “forever chemicals.”

PFAS, or per- and polyfluoroalkyl substances, are a group of thousands of chemicals used to make things nonstick, grease resistant, waterproof and heat resistant. The properties that make them useful for many everyday products also make them so durable they don’t break down on their own.

Because of their extensive use in manufacturing, forever chemicals are now found in the environment, food, water and even in people’s blood. PFAS exposure has been linked to health problems including increased cancer risks, reduced ability to fight infections, reproductive and child developmental effects, obesity and more.

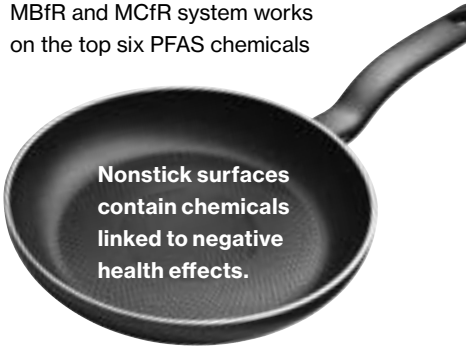
Current methods for PFAS removal involve separating the harmful molecules from water. However, destroying the collected chemicals often requires extreme, expensive measures.

PFAS molecules are hard to break down because they have a long chain of carbon atoms connected by very strong bonds to the element fluorine. Rittmann, who leads the Swette Center for Environmental Biotechnology in ASU’s Biodesign Institute, has shown that even the powerful little bacteria partners can’t break down fluorine bonds on their own. However, he has found a way to help them.

An innovative solution

His team created a technology called membrane biofilm reactor, or MBfR. Now, this technology, combined with his newest invention, the membrane catalyst-film reactor, or MCfR, supports the bacteria in the MBfR. The MCfR uses a metal called palladium, which is deposited on membranes in the reactor, to break the fluorine bonds to the carbon chain. This step allows the microbes to finish the job of turning harmful PFAS into its harmless components.

Rittmann says the combined MBfR and MCfR system works on the top six PFAS chemicals



Nonstick surfaces contain chemicals linked to negative health effects.

Professor Bruce Rittmann is using bacteria to remove contaminants from water and recover valuable metals that would otherwise go to waste.

targeted by the EPA for removal from drinking water. It can also work on others that are of concern to environmental and human health.

Startup employs microbes to clean up PFAS

A crucial step in getting this technology out of the lab is through commercialization. That's where Metrics Water Catalyst comes in. The startup signed an option agreement with ASU toward an exclusive license for the MBfR and MCfR techniques and is working to turn it into a real-world solution for cleaning up contaminated water.

Ali Shambayati, president and CEO of Metrics Water Catalyst, says municipal water distribution and industrial wastewater treatment markets have shown the most interest in the microbe-based solution. These industries currently do not have a cost-effective solution to remove or destroy PFAS on-site.

"Major cleanup of the water supplies will directly affect public health," Shambayati says. "We plan to roll out water treatment stations – both mobile and stationary – to install in heavily populated areas first, and then as a standard part of any water treatment facility globally."

Microbes also isolate valuable metals

Palladium doesn't only help microbes destroy forever chemicals in drinking water. It is also one of many valuable metals that the MBfR can harvest from industrial wastewater so that they then can be turned into a valuable resource.

Palladium is one of six platinum group metals vital to industrial and chemical manufacturing, catalytic converters in cars, medical devices and treatments, and electronics like microchips, but is in limited domestic supply in the U.S.

The research team demonstrated that the technology can currently pay for itself in less than two years by harvesting the critical metals.

Cleaner water

The team has shown that its technology can have a huge impact on human health and the economy. Next, Metrics Water Catalyst will develop more durable MCfR and MBfR modules at a lower price point that remove forever chemicals from water.

Meanwhile, Rittmann and Precient Technologies will conduct field tests to attract private investors to further scale the technology that recovers valuable metals.

"If we get the investment and can go out and demonstrate it, the technology is going to work," Rittmann says. ■

Rittmann honored for water research

The International Water Association presented Bruce Rittmann with the Ardern-Lockett Award at the 2025 Microbial Ecology and Water Engineering Conference in recognition of his pioneering work.

The award is named after chemist Edward Ardern and his wastewater treatment plant co-worker William Lockett, who created a bacteria-based process that is the foundation of today's methods for treating wastewater.

ANDY DELISLE/ASU

“Armed with the scientific knowledge, our team can push forward with coral rescue and recovery, alongside the efforts to reduce overtourism and pollution.”

— JEANA KELEKOLIO, CULTURAL ADVISOR FOR ASU’S ‘ĀKO‘AKO‘A REEF RESTORATION PROGRAM

Sea urchins are dismantling the reef in Hōnaunau Bay through bioerosion by grinding down coral skeletons.

OCEAN HEALTH

Revitalizing Hawai‘i’s coral reefs

A new ASU study recently identified a critical threshold for successful coral reef restoration efforts. Maintaining approximately 26% live coral cover would allow the reefs in Hōnaunau Bay, Hawai‘i, to outpace the destructive effects coming from a variety of sources.

One of them is sea urchins whose overpopulation has been amplified by widespread coral death. While they are a natural part of Hawaiian reefs, too many of them in Hōnaunau Bay are dismantling the reef through bioerosion as they grind away on coral skeletons.

“Armed with the scientific knowledge, our team can push forward with coral rescue and recovery, alongside efforts to reduce overtourism and pollution,” says Jeana Kelekolio, a cultural advisor for ASU’s ‘Ākoʻakoʻa Reef Restoration Program.

Learn more at oceans.asu.edu.

GREG ASNER/ASU

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I certify that the statements by me above are correct and complete: s/Jill Andrews, Publisher, 9/01/2025

Sports

Lu Dort became the sixth Sun Devil to win an NBA Championship.

VICTORY

Lu Dort and the Thunder win the NBA Championship

He did it! Sun Devil guard Lu Dort, in his sixth NBA season with the Oklahoma City Thunder, helped his team clinch the 2025 NBA Championship.

Dort, who was a Pac-12 Freshman of the Year in 2018–19, joined five Sun Devils who have won NBA titles, including Jeff Pendergraph (now Ayres), '08 BS in economics, who took the 2014 title with the Spurs; and Eddie House, '20 BA in liberal studies, in 2008 with the Celtics. Byron Scott, '20 BA in liberal studies, won three with the Lakers, in 1988, 1987 and 1985, while Mark Landsberger won two, in 1982 and 1980. Lionel Hollins, '86 BS in sociology, won one with Portland in 1977.

Learn more at sundevils.com/sports/mens/basketball.

JESSE D. GARRABRANT/NBAE VIA GETTY IMAGES

Football fashion

1896 to now

The uniform from the 1940s.

When Coach "Cap" Irish first took the field with the unnamed team he founded at the Arizona Territorial Normal School in 1896, ASU football was born. The next 13 decades brought new team names — Owls, Bulldogs, Sun Devils — and uniforms that evolved from utilitarian to spectacular.

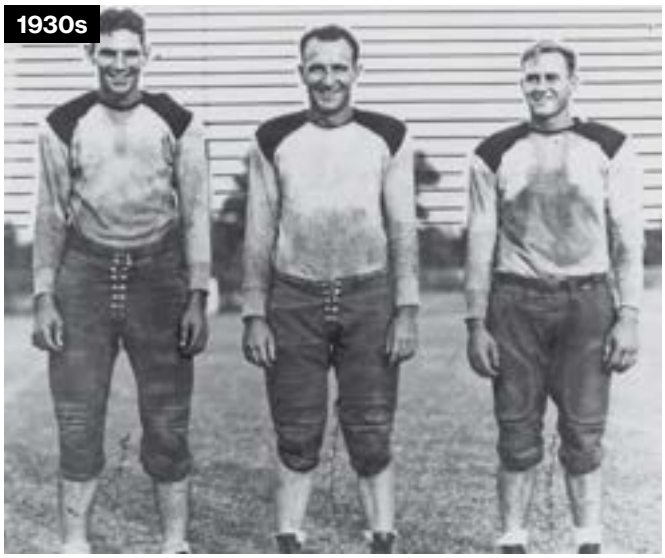
Here's a look back at designs over the years.

ASU ARCHIVES

1902

The 1902 team wore pads inside the uniforms, leather helmets, a knit jersey against the skin and a turtleneck sweater with "N" for Normal School.

1930s



1940s

By the 1940s, the Owls, as the team was known back then, wore more burly padding.

Timeline: major milestones in college football fashion

1890s

Stretchy materials

Early teams wore turtlenecks, then changed to jersey fabric, a tightly woven natural material (silk or wool) that stretched, allowing players more movement. Jerseys also fit the body better, leaving less for opponents to grab.

Late 1890s

Early helmets

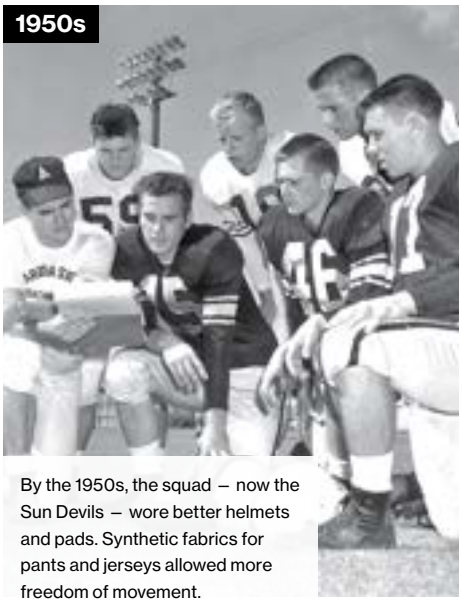
Like rugby teams, the first football players didn't wear pads or helmets. Helmets started to become adopted in the 1890s. "They were leather, but they were strong," says Kevin Jones, curator at the ASU FIDM Museum. He organized the traveling exhibition "Sporting Fashion."

1900s

Small pads over

Pads became essential. "Light padding and padding like a chest plate would be applied on top of the jersey around this time," said Kevin Jones, curator at ASU FIDM, specializing in sports fashion.

1950s



By the 1950s, the squad — now the Sun Devils — wore better helmets and pads. Synthetic fabrics for pants and jerseys allowed more freedom of movement.

1960s

An ASU legend from 1965–68, nose guard Curley Culp (77) wears an away jersey from the era.

1970s

Vs. Washington State in 1970.

1975

Head coach Frank Kush.

1910s

Player numbers

"What became obvious is when you were out watching from the bleachers, everybody looks alike when they're running around," Jones says, "so that's when the numbering system really took off."

1920s

Pads under

When pads got bigger, teams started wearing them underneath jerseys. "It's also because, coming out of World War I is really when the T-shirt as we know it today was developed, which was form-fitting while still stretchy," Jones says.

1940s

Synthetics

Synthetic materials developed during World War II could wick away perspiration and stretch in any direction, fitting perfectly over pads "without any extra fabric that could get caught during tackling," Jones said.

1950s

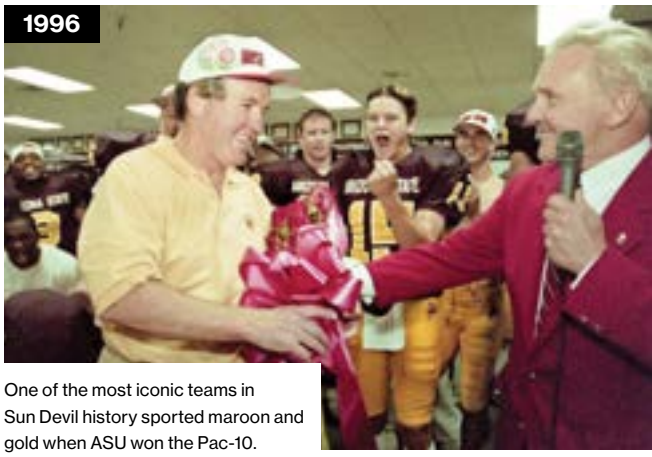
Away jerseys

As college football TV broadcasts became popular, visiting teams wore white to help viewers watching on black-and-white screens.

ASU ARCHIVES

1980s

Striped sleeves on the jerseys have been popular over the years.



1996

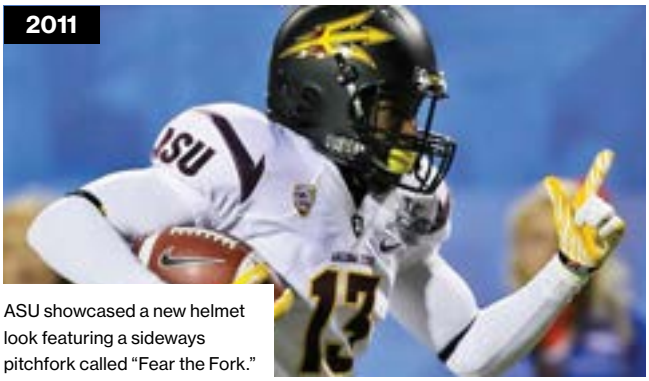
One of the most iconic teams in Sun Devil history sported maroon and gold when ASU won the Pac-10.

1999

Todd Heap, who set an ASU tight ends' record with 115 receptions, wears a maroon jersey and gold pants in 1999.

2005

ASU unveiled a new "Desert Ice" alternate uniform for 2005, along with the home and away uniforms.



2011

ASU showcased a new helmet look featuring a sideways pitchfork called "Fear the Fork."

2000s

2000–10 Multiple uniforms

Teams adopted more than just home and away uniforms, rolling out three or four total themes and even more combinations when paired with various helmet designs.

2010s

New designs each season

Today's college teams get new uniform designs every season, often with the involvement of iconic sporting goods companies. "It's fun," Jones says, "and makes a difference now that players are photographed so often. It also helps to differentiate the season."

2012

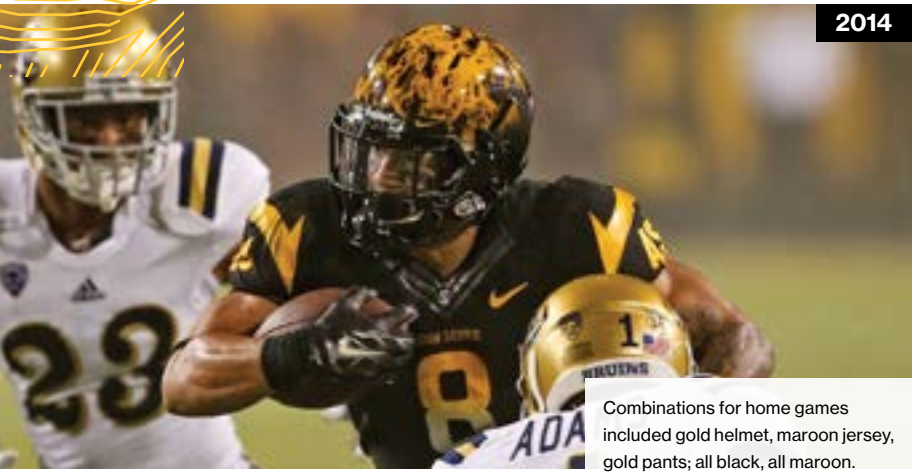
2012 Guardian Caps

The NCAA made it legal to wear Guardian Caps – soft-shell covers designed to reduce helmet impact and head injuries – during practices. Over the next several years, university teams began adopting them for practice.

The future

What's next?

More technology, such as uniform additions that can keep certain parts of the body cooler.



2014

Combinations for home games included gold helmet, maroon jersey, gold pants; all black, all maroon.

"Running out in the Pat Tillman honor uniform was one of the proudest moments of my career. It was a privilege to represent not only Arizona State University, but also the legacy of a true hero who sacrificed everything for something greater than himself."

— DEMARIO RICHARD, SUN DEVIL (#4) IN THE 2017 SALUTE TO SERVICE GAME

2015

The "Desert Fuel" option featured copper and anthracite with all-white gloves and cleats, and several helmet styles.

2017

In 2017, the Sun Devils honored legendary linebacker Pat Tillman with this special alternate uniform. Tillman played for ASU from 1994–97.

2024

ASU unveiled an alternate uniform of all gold, along with home, away uniforms.

2025

All 2025 jerseys feature a Big 12 patch and, on some, a Tillman Leadership Council patch.

Learn more at sundevils.com/sports/mens/football.

ASU ARCHIVES

‘How great do you want to be?’

7 words that define ASU quarterback Sam Leavitt

Story by SCOTT BORDOW, ’98 BA

On a small whiteboard affixed to the outside of Sam Leavitt’s refrigerator are seven words: “How great do you want to be?”

They are more than a question to Leavitt. They are a challenge. And they are why ASU’s quarterback has become one of college football’s best stories.

Leavitt’s physical talent is obvious. The strong, accurate right arm produced 2,663 passing yards and 24 touchdowns last season. The mobility accounted for 543 rushing yards.

Those numbers are a reflection, though. Of whom Leavitt is. Of how hard he works. Of the confidence he has in himself.

How great do you want to be? Those seven words are Leavitt’s commandments.

“That’s the thing he always talks about,” says Leavitt’s cousin, Caleb Hirst, who has known Leavitt since they were toddlers growing up in Oregon. “He always has goals that he wants to accomplish. And he always exceeds those goals.”

Sam Leavitt

PETER VANDER STOEP

Sam Leavitt celebrates the Big 12 Championship.

A standout from the beginning

"My plan from the jump was to go to the College Football Playoff," Leavitt said last season. "It's not like I was openly saying that to everybody … but I had that broad perspective from the jump."

Those who have known Leavitt most of his life are not shocked at all. In their eyes — and in their memories — he's always been an overachiever.

Laura Manning was Leavitt's first- and second-grade teacher at Springville Elementary School in Portland, Oregon. Manning says that after more than 20 years of teaching, it's hard to distinguish one child from another.

But Leavitt stood out. He always was the first one in class to turn in their assignment. And the work wasn't rushed or filled with errors.

Once Leavitt was finished, he asked other students in the class if they needed some help.

"I remember he had a quiet leadership," Manning says.

Sounds like the young man who contacted Arby's last season to get a name, image and likeness deal for eight of his offensive linemen, doesn't it?

"Sometimes, a quarterback makes mistakes and they become more cautious. But that wasn't Sam."

— JON EAGLE, WHO COACHED SAM LEAVITT IN HIGH SCHOOL IN OREGON

A competitive family

Leavitt grew up in an athletic household. His father, Jared, played linebacker for Brigham Young University in the 1990s, and his older brother, Dallin, is a safety for the Green Bay Packers.

Because of their age difference — Dallin is 10 years older — the two brothers didn't have the sort of athletic rivalry that some siblings do. But when they did compete, Dallin refused to let Leavitt win.

Leavitt's competitiveness became a hallmark of his childhood. One year, in Pop Warner youth football, Leavitt's team (coached by his father) reached the championship game and lost. Leavitt threw his medal away in disgust.

"He's still like that," says Tania, Leavitt's mother. "I love Bananagrams and word games, and he'll do whatever it takes to beat me."

Jon Eagle coached Leavitt in his senior season at West Linn High School in Oregon, where Leavitt was named Gatorade Football Player of the Year after throwing for 3,184 yards and 36 touchdowns.

Whether it was a game, a practice or a drill, Eagle says, Leavitt was "super competitive." But what truly set Leavitt apart, Eagle says, was his confidence and football IQ.

How great do you want to be?

Seven words that challenge Sam Leavitt. And define him as he leads the team in defending its Big 12 Championship and chasing a College Football Playoff title. ■

Connect with your Sun Devil Football team
Get the latest updates at sundevils.com/sports/mens/football.

TAYLOR HANSEN/ASU

Top honors for athletics and academics

In its inaugural year in the Big 12, ASU's athletic department won the Commissioner's Cup, awarded to the conference program that best combines athletic and academic excellence, as well as community service efforts.

Four Sun Devil teams – football, men's and women's swimming, and volleyball – won conference championships in 2024–25.

On the academic side, the average cumulative GPA for all of ASU's student-athletes in the spring of 2025 was 3.37, and 48% of ASU's student-athletes made the Dean's List.

"I'm just incredibly proud of our department," says ASU Athletics Director Graham Rossini. "Most importantly, I think it's a good validation that we're on our way."

Learn more at sundevils.com.

Hockey alums win gold with Team USA

Former Sun Devil student-athletes Joey Daccord, '20 BA in business administration (2016–19) and Josh Doan (2021–23) won gold medals as rostered players on the U.S. Men's National Team for the 2025 IIHF Men's World Championships. Team USA beat Switzerland, 1-0, in the championship game, winning the gold medal as the world champs for the first time since 1933.

ASU was tied for the second-most alumni on Team USA's roster, joining Boston College and the University of Michigan with two representatives each.

Sun Devil Hockey competes from October to March, packing Mullett Arena during home games.

See the schedule at sundevils.com/sports/mens/ice-hockey.

Potter gets drafted in NHL round 1

Returning Sun Devil Hockey sophomore center Cullen Potter was selected in the first round of the 2025 NHL Draft as 32nd overall by the Calgary Flames, making him the highest draft pick and first NHL first-rounder in ASU history.

To date, 14 Sun Devils have been selected in the NHL Draft, including Josh Doan (Arizona/Buffalo) and Joey Daccord (Ottawa/Seattle).

With Potter's draft, ASU has achieved first-round draft picks in the MLB, NBA, NFL, WNBA and NHL.

Learn more at sundevils.com/sports/mens/ice-hockey.

> **“Arizona is emerging as a critical national center for innovation. ASU is one of those innovations.”**
>
> — MICHAEL M. CROW, ASU PRESIDENT

TRANSFORMATION

Changing skylines

With cranes dotting the skyline and new buildings rising across campus and beyond, those who haven’t visited Tempe recently may be surprised by the rapid transformation. The population of the Greater Phoenix area has surpassed 5 million and is projected to reach 5.7 million by 2029, according to the Arizona Office of Economic Opportunity. Tempe’s population alone is expected to grow by 42% between 2020 and 2050.

ASU is at the center of the momentum, setting records with over 20,000 graduates in the 2024–25 year.

Learn more at campus.asu.edu/tempe.

From the top of Mountain America Stadium looking southeast.

SABIRA MADADY/ASU

Tag your ride to the rivalry

Score with Sun Devil Athletics and Arizona Ford Dealers

A VIP rivalry game experience versus the University of Arizona on Nov. 28 could be in your future. Get your game face on and show us your custom ASU® license plate in the Ride With Pride sweepstakes for your chance to win exclusive rivalry game access and more.*

Scan to enter:

*No purchase or payment of any kind is necessary to enter or win. A purchase or payment will not increase an entrant's chance of winning. Void where prohibited by law. Must be 21 years of age or older to enter. Ticket offer is subject to availability and while supplies last. Scan the QR code for full rules and regulations.

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