FY 2025
TECHNOLOGY AND RESEARCH INITIATIVE FUND REPORT

ARIZONA BOARD OF REGENTS
ASU ◆ NAU ◆ UA

ABOUT THIS REPORT

This report details Arizona's public universities Technology and Research Initiative Fund (TRIF) expenditures in accordance with state law and the universities' board approved plans.

The report has four sections, one for each university and one for Arizona Board of Regents' grants, initiatives, and operations. Each section provides an overview of the TRIF activity for the last fiscal year and an update for each TRIF supported project or initiative. Supporting material for each university initiative or project, including the original proposal, budget, and an update for this fiscal year, are available through the Reports section of the Board's website at www.azregents.edu.

ABOUT THE ARIZONA BOARD OF REGENTS

The Arizona Board of Regents is committed to ensuring access for qualified residents of Arizona to undergraduate and graduate institutions; promoting the discovery, application, and dissemination of new knowledge; extending the benefits of university activities to Arizona's citizens outside the university; and maximizing the benefits derived from the state's investment in education.

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September 1, 2025

INTRODUCTION

Proposition 301 established TRIF through an increase in state sales tax dedicated to K-12, community colleges and Arizona's public universities. Collection of the tax began on June 1, 2001, and the proposition was extended for another 20 years in 2018. Twelve percent of collections go to the Arizona Board of Regents to administer for the expansion of research, workforce development and increasing access to public higher education. TRIF monies are continuously appropriated to the board and do not lapse at the end of the fiscal year.

Since its inception in June 2001 the program has received over $1.95 billion in TRIF funds. In FY 2025, the university system received over $138 million in TRIF revenue. The university system carried over an additional $11.8 million from FY 2024 to FY 2025 resulting in $149.8 million in total TRIF revenues available for allocation in FY 2025.

The Board allocated FY2025 TRIF funding as follows:

University Research & Workforce Base Funding

- Board Office Operating – $2 million to the board office for operating expenditures in support of administrative oversight and reporting, specific board initiatives, programs and infrastructure, and activities designed to support and promote the board's TRIF goals and initiatives.
- Base Allocation Funds – $86 million for the universities' board approved three-year TRIF plans. The base allocation awards 40 percent of funding to Arizona State University; 40 percent to the University of Arizona; and 20 percent to Northern Arizona University.

Arizona Board of Regents Grant Programs to Impact and Improve Arizona

- Regents Community Grants Funds – $1 million to a grant funding process designed to engage Arizona's local communities with university resources and talent to solve real world problems at the local level.
- Regents' Research Grants Funds – $10 million to a grant funding process designed to address critical Arizona issues and problems by leveraging Arizona's public universities' research talent and assets.

Arizona Board of Regents Approved Initiatives

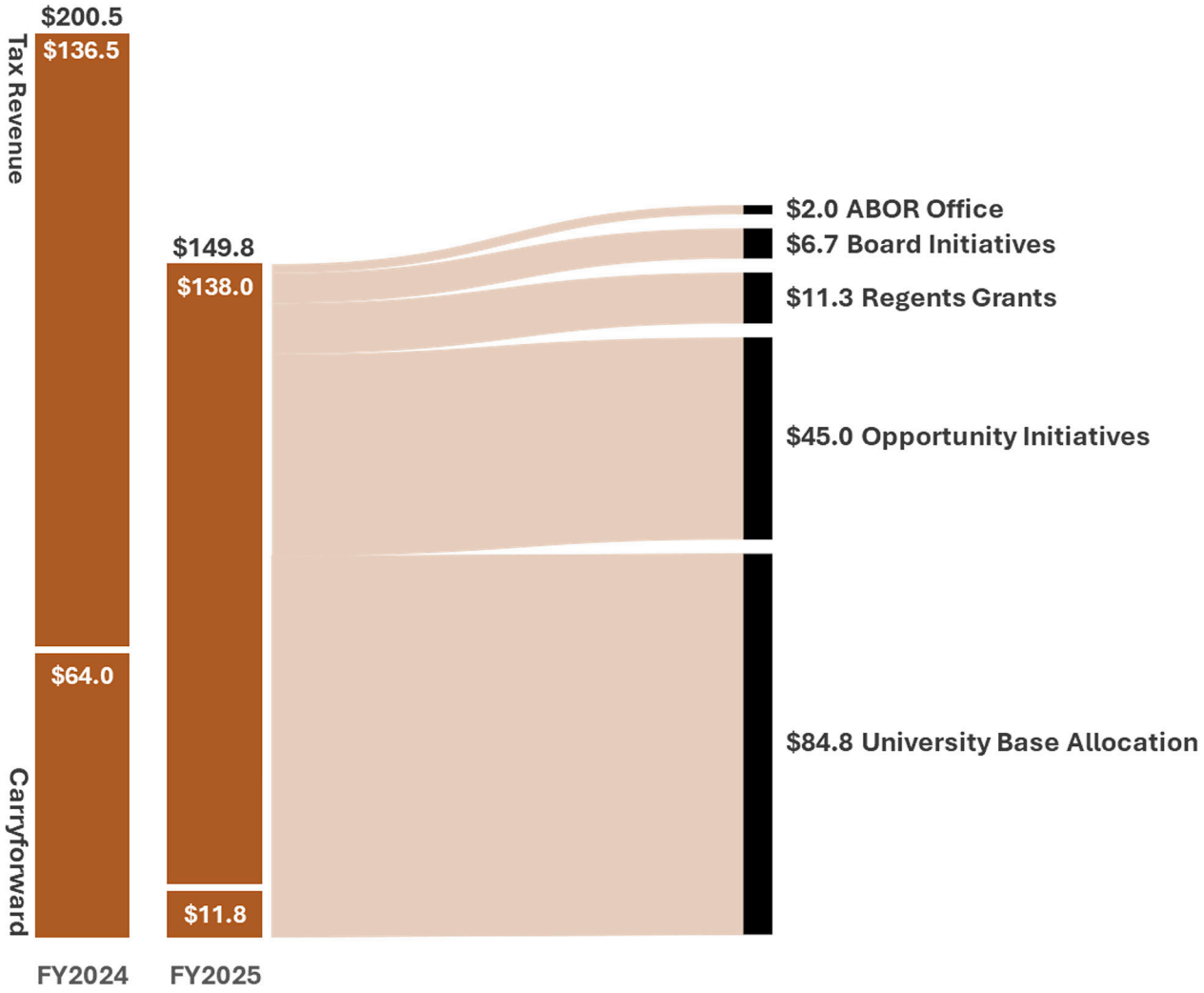
Board approved initiatives, including:

- General Education Assessment – $300 thousand to the board office and the universities to help design and administer the general education assessments to support and improve student and workforce outcomes.
- Phoenix Bioscience Core – $1.4 million for the Phoenix Bioscience Core in support of its research, technology transfer and workforce development efforts.
- Board and university attainment and workforce initiatives - $5 million to expand programs in workforce development including $2 million at Arizona State University, Northern Arizona University, and the University of Arizona, as well as $3 million at the Board office to support the FAFSA completion program and statewide college-going initiatives to enhance college preparation and access for students and families in Arizona.

Regents' Opportunity Grants Awarded to the Universities

- Regents' Future Opportunity Initiative Funds – $45 million allocated on a year-by-year and university-by-university basis to support board priorities in research and improving Arizona workforce and higher education access, comprised of $13 million to Arizona State University, $12 million to Northern Arizona University, and $20 million to the University of Arizona.

In FY 2025, the board and universities allocated TRIF dollars within these areas (See chart below, $ millions).



Universities Three-Year Plans

The largest TRIF investments are in the base allocation funds awarded to each university for research, attainment, and workforce initiatives in accordance with the universities' board approved three-year TRIF plans. The universities develop the three-year plans in compliance with A.R.S. §15-1648(C).

The three-year plans' identified initiatives and projects must be in one or more of the following board-approved research investment areas:

Improving Health

Water, Environmental and Energy Solutions

National Security Systems

Space Exploration and Optical Solutions

Higher Education Access for Workforce Development

For TRIF supported research initiatives, the universities must categorize each project or initiative from a research pipeline and infrastructure perspective as:

- Basic Research (defined as 10 plus years to a potential commercial product development)
- Applied Research (defined as two to five years to a potential commercial product)
- Development (defined as less than two years to a commercial product)
- Infrastructure (defined as support resources and related services used to conduct research and technology transfer)

For FY2025, the board approved the universities adding a fourth year to their current three-year plans. A new three-year plan cycle will be approved for FY2026-2028.

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Exhibit Enterprise.1: FY 2025 Base Expenditure Summary

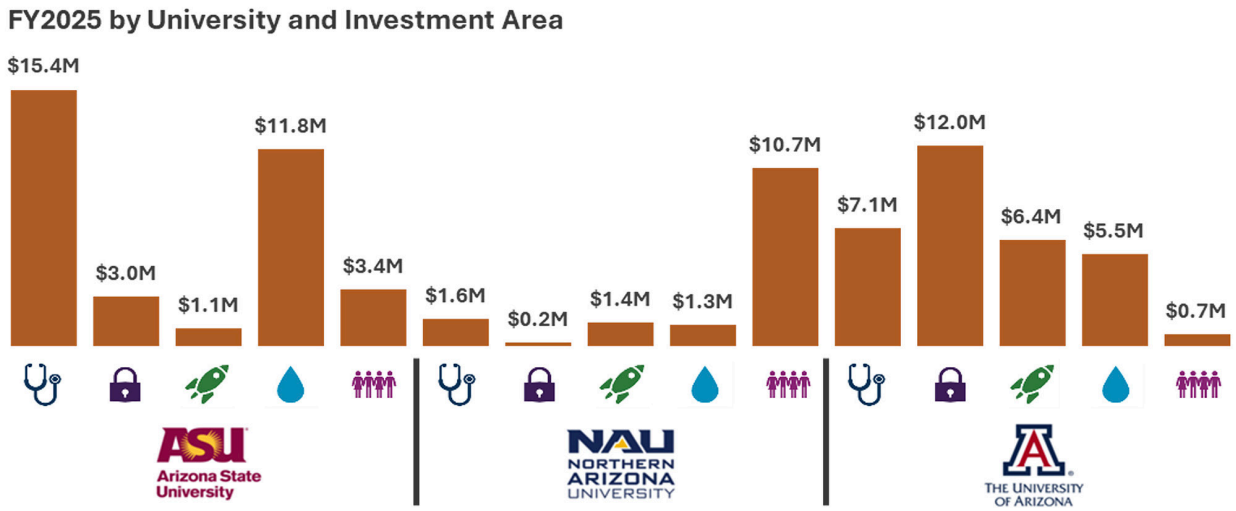
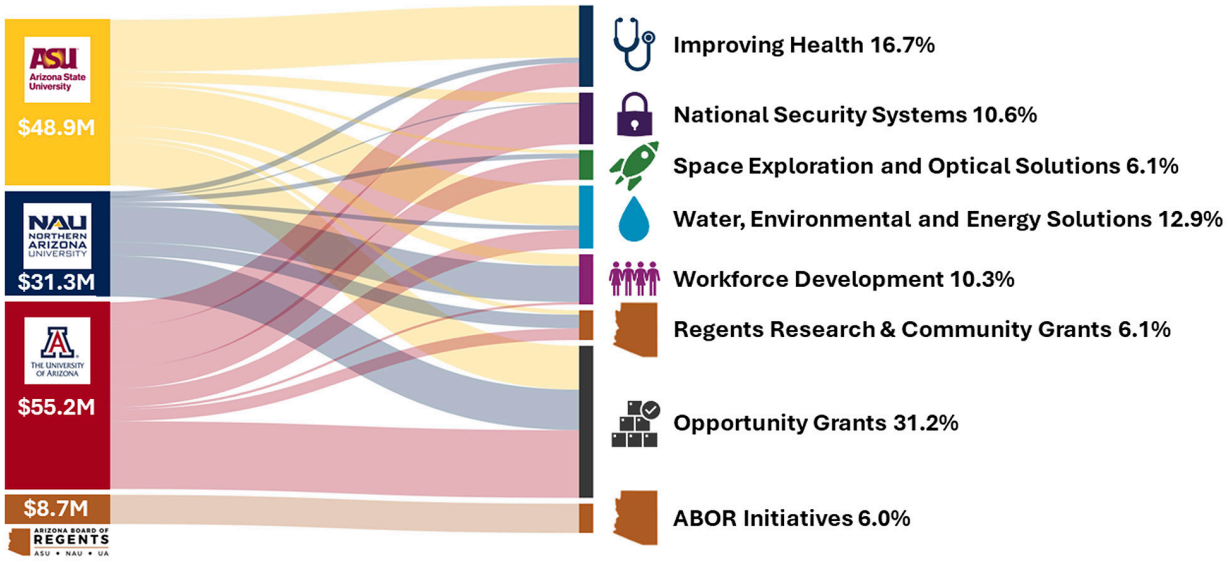


Table Enterprise.1: FY 2025 TRIF University Base Expenditures by Investment Area

Improving Health	$24,109,966
National Security Systems	$15,227,392
Space Exploration and Optical Solutions	$8,840,835
Water, Environment and Energy Solutions	$18,620,425
Workforce Development	$14,839,044
Total	**$81,637,662**

Exhibit Enterprise.2: FY 2025 All TRIF Expenditures by Investment Area



TECHNOLOGY AND RESEARCH INITIATIVE FUND REPORT

Arizona State University, FY 2025

EXECUTIVE SUMMARY

TRIF funding has proved essential to Arizona State University's emergence as a national leader in research and education. TRIF investment powers projects and programs that yield tremendous benefits to Arizona and its residents and address key challenges unique to our state.

Since TRIF's inception, ASU's annual research expenditures have more than quintupled, teetering on the edge of $1 billion, placing us at #5 in the nation for institutions without a medical school. Over the past 25 years, TRIF has helped ASU to attract more than $3 billion in external funding, a threefold return on investment. TRIF support has trained more than 23,000 graduate students and postdoctoral scholars and 12,000 undergraduates, equipping them with the skills, knowledge and experience required to succeed in the changing job market.

In FY 2025 alone, TRIF investment fueled $834 million in outside related sponsored project funding. Notable TRIF-enabled achievements at ASU in FY 2025 include:

- The National Institute of Standards and Technology chose ASU and Deca Technologies to receive as much as $100 million for the SHIELD USA initiative, driving innovation in the domestic microchip packaging ecosystem, expanding capacity for domestic advanced packaging and helping regain U.S. leadership in microelectronics while strengthening national security.
- Awarded a $24 million contract from the Department of Defense to lead a national consortium supporting the DOD's Irregular Warfare Center and provide research support on topics such as economic statecraft, impact of emerging technologies and international lawfare.
- Biodesign Institute researchers — in conjunction with Mayo Clinic — are developing a rapid test for Valley Fever, a fungal infection that affects 3% of people in the Southwest annually.
- As part of a multi-year Department of Defense national challenge, ASU faculty and students developed a new AI-enabled cybersecurity system that automatically identifies and patches real-world vulnerabilities in software. The system was one of seven finalists out of 42 teams in the Defense Advanced Research Project Agency's (DARPA) AI Cyber Challenge.
- Through Skysong Innovations, obtained 330 invention disclosures, secured 65 licensing deals and 198 new patents and launched 21 new startup companies based on ASU innovations.
- The ASU Research Park will house the third of three CHIPS for America research and development facilities, the National Semiconductor Technology Center (NSTC) Prototyping and National Advanced Packaging Manufacturing Program (NAPMP) Advanced Packaging Piloting Facility. The new facility will combine semiconductor research and prototyping for front-end manufacturing and packaging capabilities, meeting a unique need for advanced packaging R&D within the U.S. semiconductor ecosystem.

- ASU and a team of collaborators received $11.2 million from the U.S. Department of Energy to develop a regional Direct Air Capture Hub for removing carbon dioxide from the atmosphere.
- Biodesign Institute researchers made inroads into understanding exposures that may contribute to Alzheimer's disease. Their study demonstrated, for the first time, that a commonly used weedkiller can infiltrate the brain and increase neuroinflammation, a condition that has been linked to risk of Alzheimer's disease.

TRIF investment is the bedrock on which Arizona's businesses can flourish. The state's long-term investment in research draws and creates companies that advance new technologies and remain adaptive in a rapidly changing landscape. Along with uniting public and private partners, ASU delivers the skilled workforce, expertise, and infrastructure that enable companies to compete. These businesses, in turn, create high-quality and well-paying employment opportunities for our communities — a virtuous cycle of economic growth and well-being for generations to come.

ASU invested 79% of its FY 2025 TRIF funds toward research on improving health and finding solutions in water, environment, and energy. The research dollars were used mainly to support applied research and development.

These investments generated $478 million in outside related sponsored project funding, resulted in 4 startups and supported 3,051 graduate and undergraduate students.

Exhibit ASU.1: FY 2025 Base Expenditure Summary

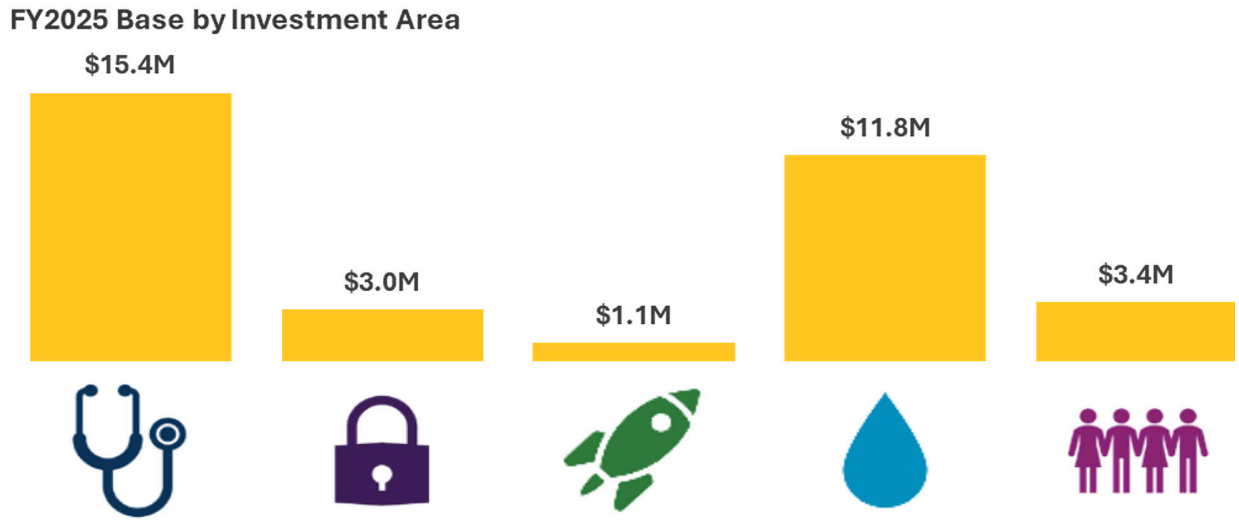


Table ASU.1: FY 2025 TRIF University Base Expenditures by Investment Area

Improving Health	$15,391,655
National Security Systems	$2,973,021
Space Exploration and Optical Solutions	$1,057,323
Water, Environment and Energy Solutions	$11,840,106
Workforce Development	$3,415,345
Total	**$34,677,450**

Exhibit ASU.1: FY 2025 Base Expenditure Summary

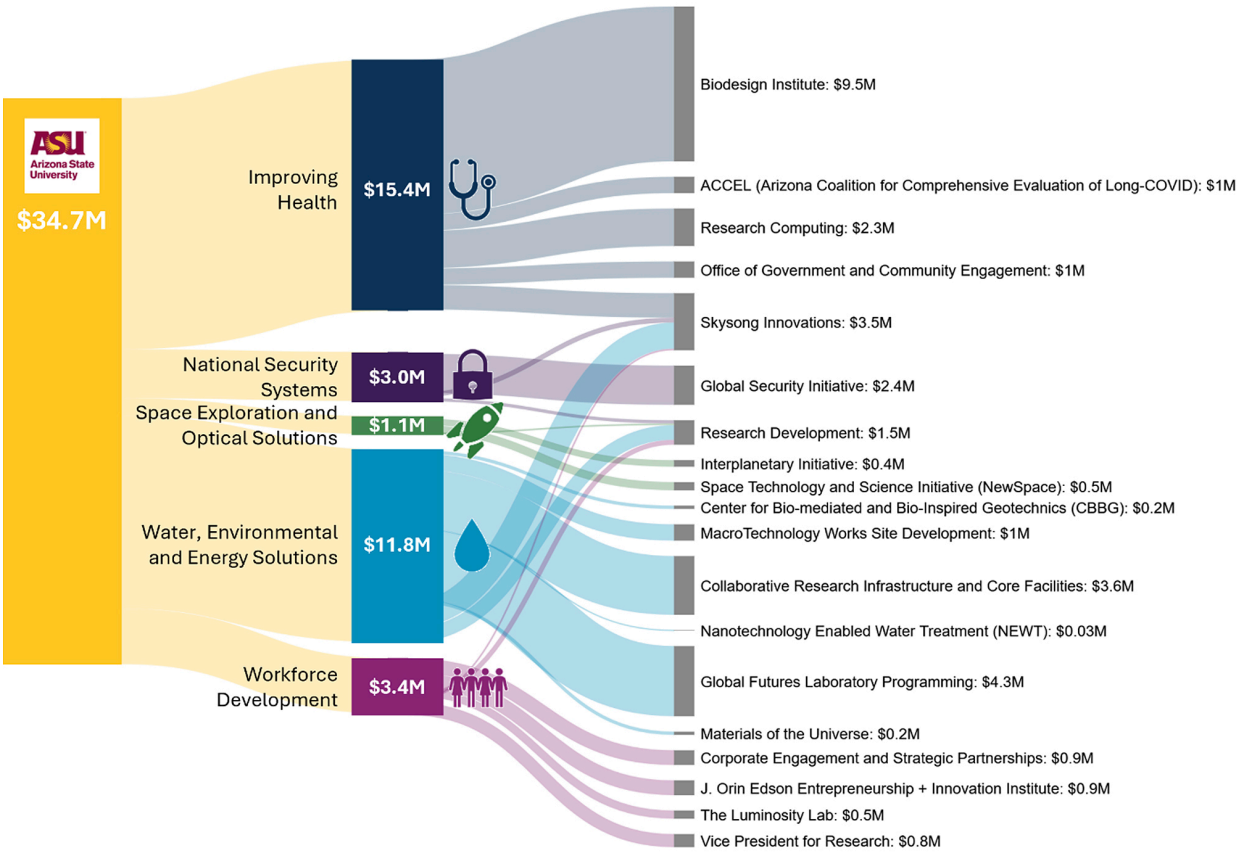
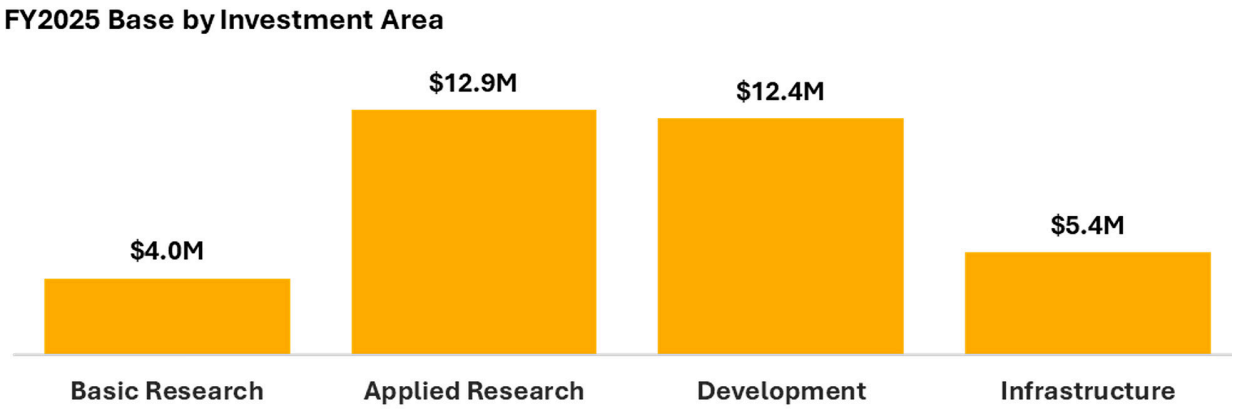


Table ASU.2: FY 2025 Performance Measures

Faculty Startup Package Expenses	$0
Postdocs Supported	374
Graduate Students	2,115
Undergraduate Students	936
Sponsored Project Funding	$477,594,091
Publications in Academic Peer-Reviewed Journals	10
Startups	4

Exhibit ASU.3: FY 2024 TRIF Expenditure by Research Category



TECHNOLOGY AND RESEARCH INITIATIVE FUND REPORT

Northern Arizona University, FY 2025

EXECUTIVE SUMMARY

TRIF investment at Northern Arizona University has played a pivotal role driving research growth and empowering student access and workforce development programs. NAU was recognized this year as an R1 research university by the Carnegie Foundation, which is the highest classification for higher education research institutions in the United States; this designation reflects NAU's strong performance in research activity and doctoral degrees awarded, which have been enabled by state of Arizona TRIF funds. NAU uses TRIF funding to invest in innovative high priority research areas that address the needs of our state, and leverages TRIF investments to grow our portfolio of externally sponsored research programs.

In FY25 NAU's TRIF investments directly empowered cutting-edge research that addresses critical issues in Arizona and beyond. Examples of impactful projects supported by TRIF in FY25 are many. NAU researchers in our Pathogen Genomics program are working to develop an effective treatment for Valley Fever, which is a fungal lung infection that has a disproportionate impact on Arizonans. NAU's program in Community Health supports the long-running Partnership for Native American Cancer Prevention, which has now provided cancer-related training to nearly 800 individual students focused on rural and tribal communities and successfully recompeted for funds from the National Cancer Institute. The NAU program in Bioengineering created an open-source exoskeleton platform as a community resource to enable and accelerate the development of new next-generation exoskeleton devices to assist and enhance human mobility. These projects are part of an impactful TRIF investment portfolio that also encompasses critical fields of study including wildfire and environmental science, space exploration and cybersecurity.

Additionally, NAU uses TRIF funding to support programming that addresses workforce needs in the state of Arizona. A priority for NAU's use of TRIF dollars is training our students in science and technology fields that represent rapidly evolving sectors of Arizona's economy and long-standing workforce needs, such as healthcare and education. The programs serve transfer students, including adult learners, through statewide and online delivery modes. The continuation of these program investments is critical to maintain the delivery and support of flexible high-quality programming that meets the needs of the Arizona workforce.

NAU's investment of TRIF dollars consistently generates positive impact through the direct outcomes of the projects it supports, by attracting additional investment from federal, industry, foundation and other sponsors, and through the student training and workforce development opportunities that it creates.

NAU invested 71% of its FY 2024 TRIF funds to workforce development projects. NAU also invested 19% of its TRIF funds in targeted research toward improving health and finding solutions in water, environment, and energy.

These investments generated $47 million in outside related sponsored project funding, and supported 3,300 graduate and undergraduate students.

Exhibit NAU.1: FY 2025 Base Expenditure Summary

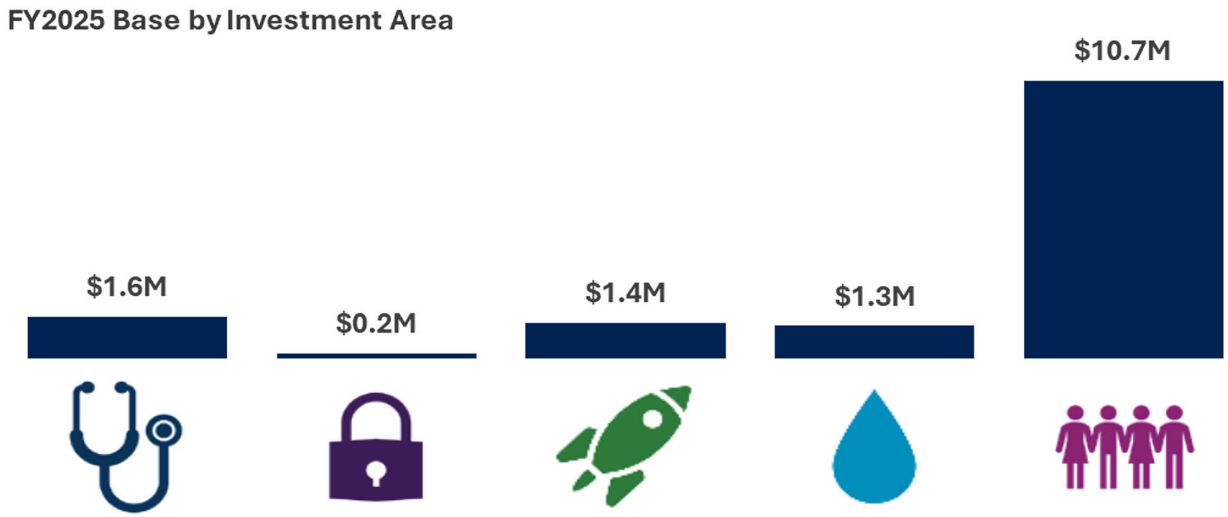


Table NAU.1: FY 2025 TRIF University Base Expenditures by Investment Area

Improving Health	$1,622,061
National Security Systems	$206,950
Space Exploration and Optical Solutions	$1,392,805
Water, Environment and Energy Solutions	$1,254,799
Workforce Development	$10,711,787
Total	**$15,188,402**

Exhibit NAU.2: FY 2025 All TRIF Expenditures by Investment Area

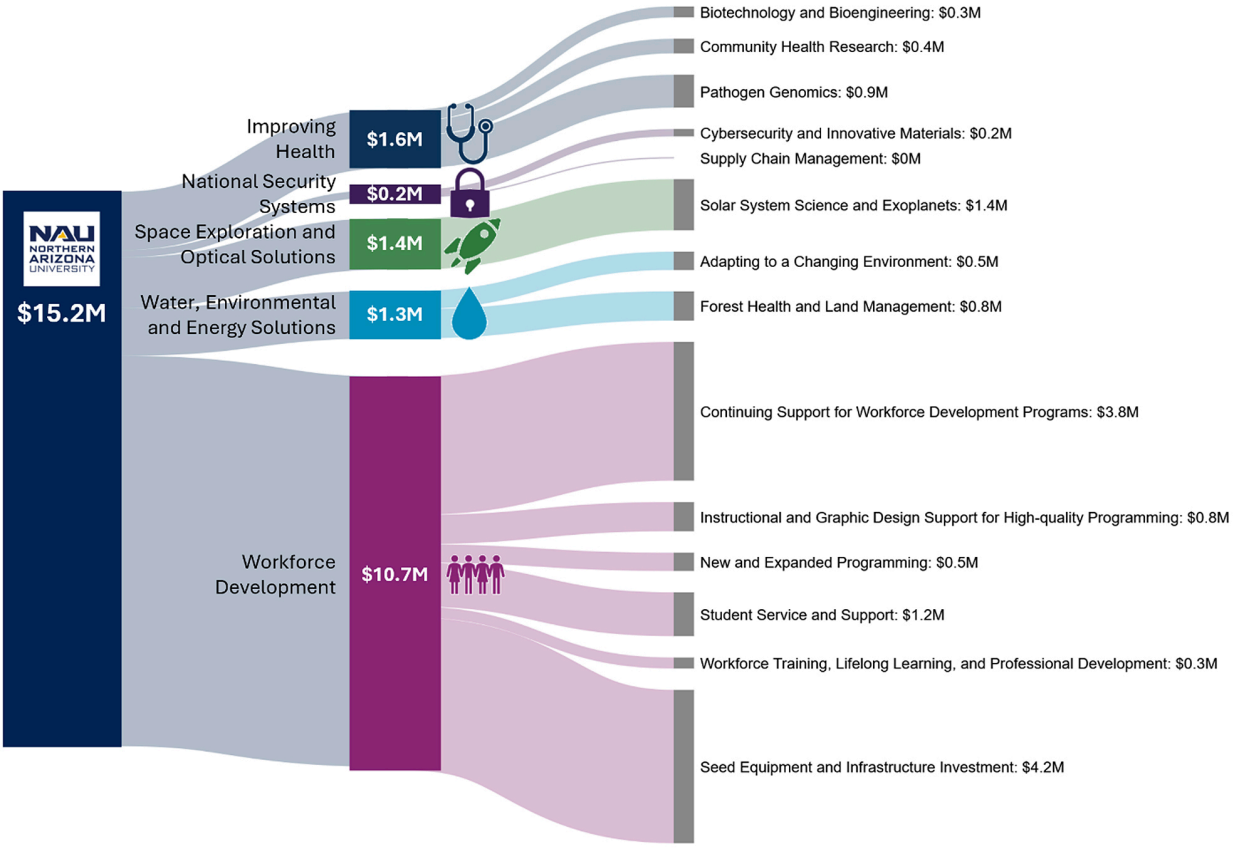
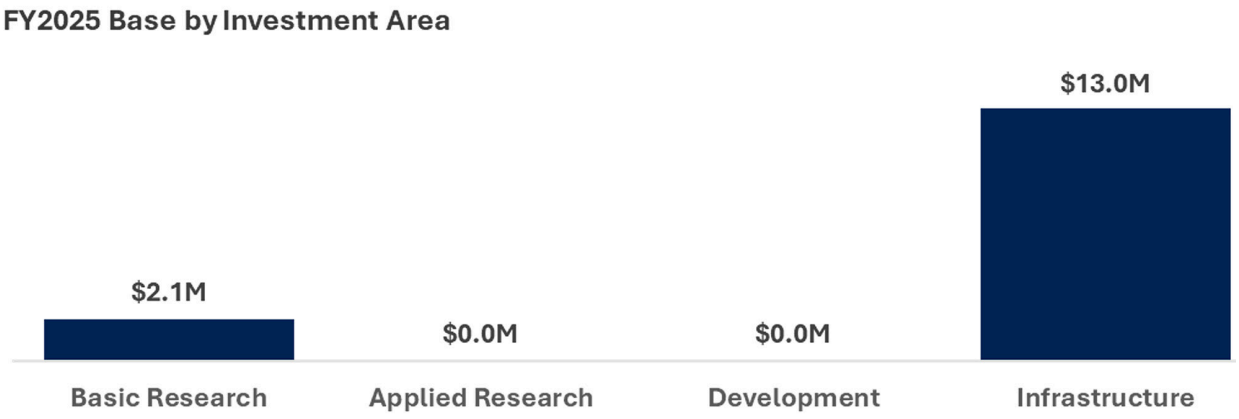


Table NAU.2: FY 2025 Performance Measures

Faculty Startup Package Expenses	$1,681,541
Postdocs Supported	42
Graduate Students	1,674
Undergraduate Students	1,626
Sponsored Project Funding	$46,819,785
Publications in Academic Peer-Reviewed Journals	596
Startups	1

Exhibit NAU.3: FY 2024 TRIF Expenditure by Research Category



TECHNOLOGY AND RESEARCH INITIATIVE FUND REPORT

University of Arizona, FY 2025

EXECUTIVE SUMMARY

The Technology and Research Initiative Fund, or TRIF, fuels the University of Arizona's ability to expand research, strengthen workforce development, drive economic impact and deliver tangible benefits to communities across the state. TRIF investments align with the U of A's strategic imperatives and Arizona Board of Regents priorities.

Across TRIF-funded programs, the University of Arizona advances its three strategic imperatives in powerful, interconnected ways. *Student Success* is strengthened through research and mentoring experiences from K–12 to graduate school, particularly for tribal populations and communities in need. *Community Engagement* thrives through partnerships that co-develop solutions in areas such as water, climate resilience, public health and economic growth. *Research That Shapes the Future* spans artificial intelligence in health diagnostics, sustainable mining, quantum technologies and climate adaptation, preparing the next generation of problem solvers and delivering lasting benefits for Arizona's people, ecosystems and economy.

In 2025, TRIF investments helped:

Accelerate research impact: TRIF support contributed to the U of A's record $1 billion in research activity, enabling investigations that address Arizona's most pressing challenges and create impact felt around the world.

- TRIF investments advanced 49 patents and launched eight startups, leading to a No. 23 ranking on the National Academy of Inventors' list of Top 100 U.S. universities granted U.S. utility patents.
- Solar-powered water desalination technology piloted with TRIF funding is being advanced thanks to a $10 million grant from the Army Corps of Engineers and a collaboration with Tucson Water.
- A collaboration with the Pima County Department of Environmental Quality, Las Aguas and Sunnyside Unified School District led to the deployment of air quality sensors, providing critical data for under-resourced communities.
- TRIF supported the creation of a virtual reality surgical simulator and a tactile computer-assisted training system to enhance medical education.
- Cybersecurity breakthroughs included the development of a digital twin system for detecting cyberattacks on manufacturing systems, a novel taxonomy to classify threats and an AI-driven hardware security platform.
- Pilot research projects to demonstrate proof of concept were started with Fort Huachuca on tactical large language models, Davis Monthan Air Force Base on advanced manufacturing for aircraft structural components, and the Army Yuma Proving Ground on the collateral effects of kinetic, electronic warfare and directed energy defeat mechanisms on unmanned aerial systems.

TRIF investments drive University of Arizona leadership in fields critical to Arizona and the nation. In National Security and Space, projects advance sensing, imaging, quantum

networking and space exploration. Fusion research leverages innovations in materials, energy storage and extreme environment monitoring. AI in Health transforms patient care through advanced imaging, biosensors and precision medicine. In Mining and Critical Minerals, industry collaborations create sustainable water use strategies, improve extraction methods and advance safety technologies, ensuring Arizona remains at the forefront of innovation and its responsible application.

Inspire students: TRIF support helps increase enrollment by motivating students to pursue research-oriented careers and strengthening Arizona's workforce pipeline through programs that create engagement and hands-on learning experiences. In FY25, more than 10,000 students benefited from TRIF-supported programs.

- Studies on STEM education and workforce development fueled by TRIF-supported research assistantships lead to a $2.4 million National Science Foundation grant.
- A student-driven collaboration with Sion Power in Tucson produced an AI model that can predict thermal runaway in electric vehicle batteries.
- Dozens of graduate and undergraduate students secured prestigious internships, fellowships, and jobs at institutions including Microsoft Research, Amazon, Nikola Motor Corporation and the University of Illinois Urbana-Champaign.
- Partnering with SARSEF provided mentored research experiences for more than 100 rural and Title One high school students, many of whom were recruited into STEM programs.
- The TIMESTEP project, which connects undergraduates in astronomy and geophysical sciences with local apprenticeship and internship opportunities, added 16 space and technology industry in Southern Arizona as internship sites.

Recruit and retain talent: TRIF-supported projects are critical to attracting, developing and retaining top researchers and faculty whose expertise advances the university's land-grant mission and strategic imperatives.

- Nearly 250 postdoctoral researchers benefited from TRIF support in FY25, helping foster a strong cross-disciplinary research culture at the university.
- Faculty leverage TRIF dollars to generate support, train students and develop techniques for analysis and technology, including topics as diverse as finishing the build of a ultraviolet telescope, studying photonics, observing atmospheres of distant planets, studying human biology and psychology in space flight, developing high speed cameras for use in military helicopters, modeling water on a national scale, and understanding gravitational waves and the nature of spacetime.

Build infrastructure and bridge gaps: TRIF investments fund state-of-the-art facilities, advanced technology, specialized instrumentation and equipment that helps the U of A deliver research results with real-world impact. TRIF also provides early-stage funding for promising projects in an unpredictable federal funding environment. This increases the likelihood of securing additional competitive funding.

The U of A invested 60% of its FY 2025 TRIF funds toward research on improving health and finding national security solutions. The university also invested significant TRIF funds towards research on water, environment, and energy.

These investments generated $321 million in outside related sponsored project funding, resulted in 8 startups, and supported 11,633 graduate and undergraduate students.

Exhibit U of A.1: FY 2025 Base Expenditure Summary

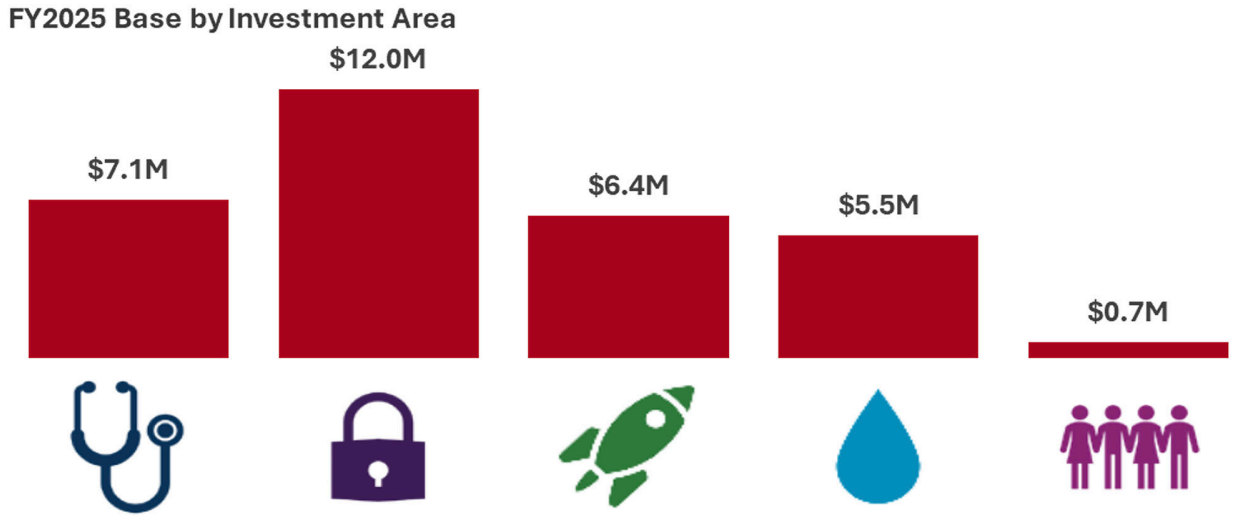


Table U of A.1: FY 2025 TRIF University Base Expenditures by Investment Area

Improving Health	$7,096,250
National Security Systems	$12,047,421
Space Exploration and Optical Solutions	$6,390,707
Water, Environment and Energy Solutions	$5,525,520
Workforce Development	$711,912
Total	**$31,771,810**

Exhibit U of A.2: FY 2025 All TRIF Expenditures by Investment Area

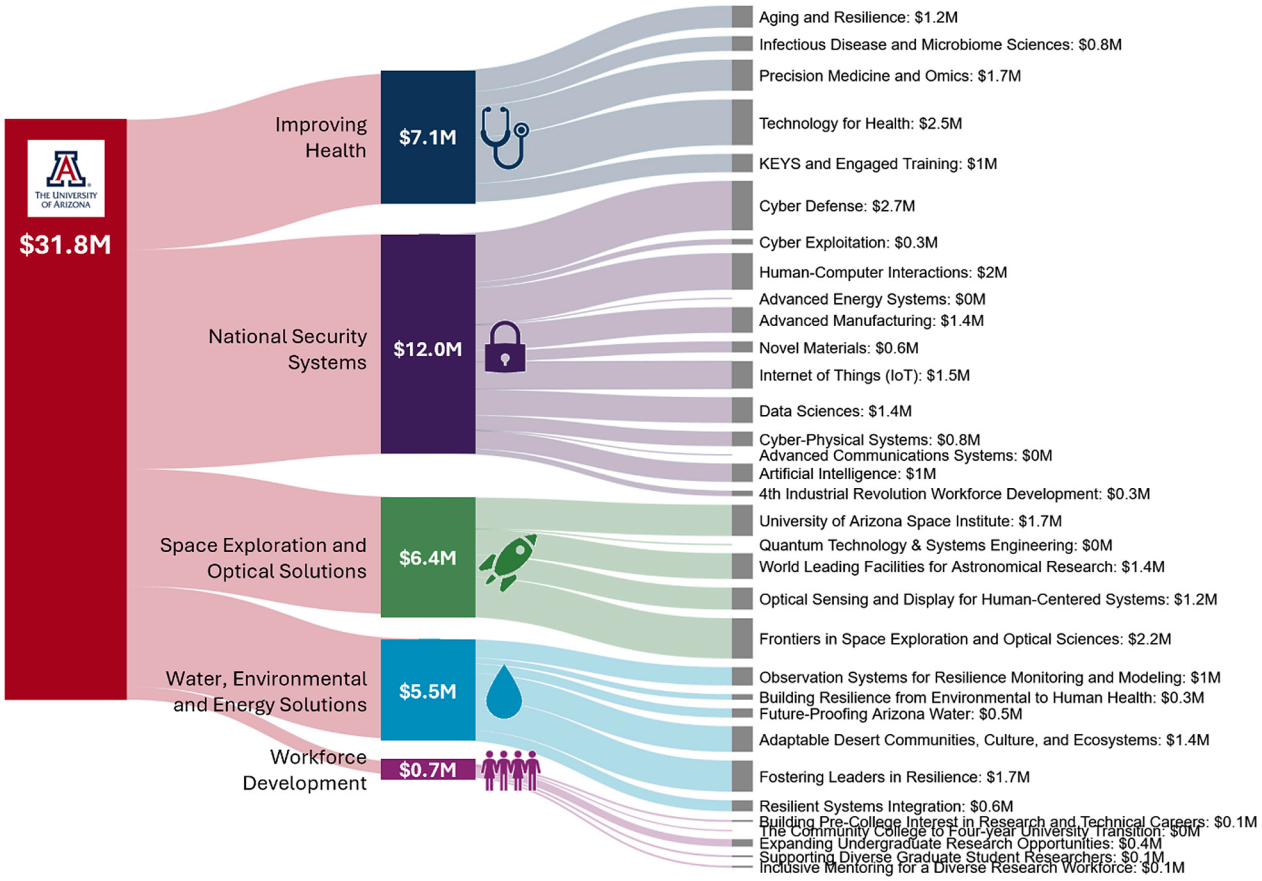
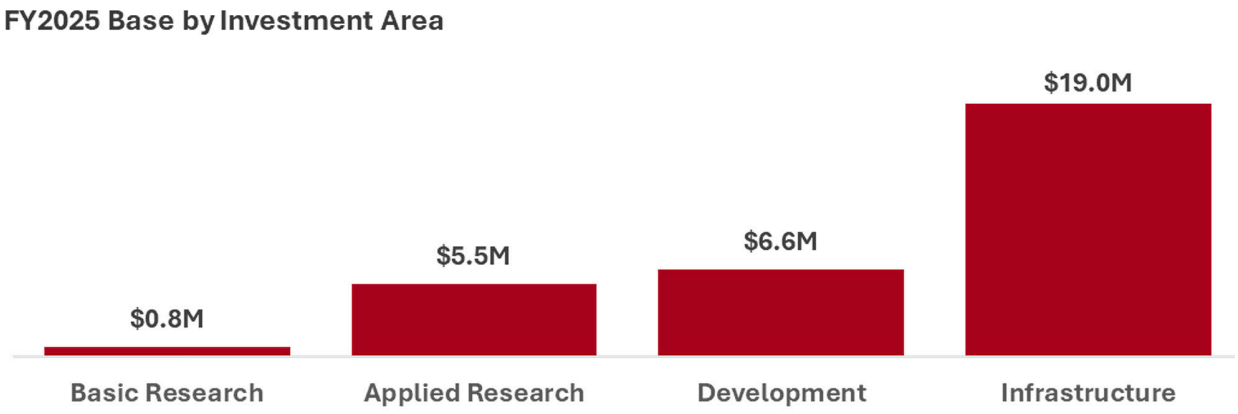


Table U of A.2: FY 2025 Performance Measures

Faculty Startup Package Expenses	$6,144,465
Postdocs Supported	382
Graduate Students	2,352
Undergraduate Students	9,281
Sponsored Project Funding	$320,542,494
Publications in Academic Peer-Reviewed Journals	950
Startups	8

Exhibit U of A.3: FY 2024 TRIF Expenditure by Research Category



APPENDIX

University Base Expenditures on Initiatives and Projects

University	Arizona State University
TRIF Investment Area	Improving Health
Program Name	ACCEL (Arizona Coalition for Comprehensive Evaluation of Long-COVID)

Problem Statement

There is growing recognition that survivors of COVID-19 infection are vulnerable to developing a wide range of post-infection problems (known as long-COVID) of unknown duration with implications for long-term care costs and disabilities affecting capacity to work. Long-COVID affects the cardiovascular system, lungs, joints, skin, GI tract and brain with widely differing effects in different individuals. There is an urgent need for new diagnostic tests and clinical assessment tools to predict which patients will develop Long-COVID and their prognosis.

Program Description

The Arizona Coalition for Comprehensive Evaluation of Long-COVID (ACCEL) is a multi-institution consortium led by ASU's Complex Adaptive Systems Initiative (CASI), in partnership with Abrazo Health, Dignity Health, Honor Health, Mayo Clinic, Valleywise Health, Veterans Administration, Arizona Department of Health Services, HealthCurrent, NAU, TGen-North and multiple units at ASU (Biodesign Institute, College of Health Solutions, Southwest Interdisciplinary Center (SIRC), College of Public Service and Community Solutions). Its goal is to establish collaborative research on COVID-19 immune responses to predict individuals at risk of severe COVID-19, death or development of long-COVID. CASI's role as founding sponsor of National Biomarker Development Alliance established protocols for biobanking of samples for multiOmics and standardized data formats for multi-institution data exchange that have been adopted by the ACCEL project.

What is the University's Advantage and/or Anticipated Funding Opportunities?

The scale of the patient populatoin suffering from long-COVID and its statewide impact will benefit from mobilizing tri-unviersity resources to generate the spectrum of clinical, research and computing skills required.
Long-COVID is attracting major federal funding. ASU and and the Institute for Future Health (a joint program of ASU and the University of Arizona) have strong competitive assts to pursue these fundign sources and provide a robust return on investment.

Is there an Arizona Specific Benefit or Impact?

Over 1 million Arizonans have been infected with COVID-19. Over 70,000 have been hospitalized and 18,000 have died. Based on the incidence of long-COVID across the U.S. and undected infections, the nation is potentially facing a formidable public health challenge of up to 1 million chronically ill individuals. Arizona will face a proportional burden and will need to mobilize new speciality clincis to meet the needs of these patients. Discovery of new diagnostic biomarkers as part of this project offers opportunities to develop intellectual property to promote collaborations with industry for commercialization and royalty revenues.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$712,323	$712,323	$712,323	$2,136,970
Applied Research	$712,323	$712,323	$712,323	$2,136,970
Development	$712,323	$712,323	$712,323	$2,136,970
Total	$2,136,970	$2,136,970	$2,136,970	$6,410,910

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	54	56	59	169
Graduate Students	254	266	266	800
Undergraduate Students	110	116	121	347
Sponsored Project Funding	$253,962	$266,660	$279,993	$800,615
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

University	Arizona State University
TRIF Investment Area	Improving Health
Program Name	ACCEL (Arizona Coalition for Comprehensive Evaluation of Long-COVID)

Progress Summary

George Poste, Regents Professor, was asked by Knowledge Enterprise leadership to develop a comprehensive analysis of ASU competitiveness in biomedical education, research, clinical partnerships and public health innovation, "Building World Class Capabilities in Biomedical Informatics and Artificial Intelligence at ASU." www.dropbox.com/scl/fi/eudm4431bn3q3uwu6mbke/BMIX-Summary-5.22.2024-final.pdf?rlkey=5l82soe5kg372xnt4exhy7kac&dl=0 Principal conclusions and recommendations are • The accelerating convergence of the biomedical sciences with engineering and AI poses an inflection point for all academic institutions. We must address these disruptive trends or become increasingly uncompetitive. • The future of biomedicine is data-centric, requiring sophisticated integration of multi-modal health data and investment in computing resources to support a learning health ecosystem. • Establish a pan-university understanding of future goals and evaluation metrics for ASU Health. • Strengthen cross-disciplinary collaboration and continued recruitment of new expertise in data science. Collaborations with Arizona biomedical institutions include • Planning committee member for ASU-Mayo Clinic Drug Discovery and Development • Awarded Mayo Clinic seed grant on seroepidemiological surveys of avian influenza infection in Arizona wild birds for pandemic risk monitoring • Collaboration with Mayo Clinic and VA on biomarker development for transthyretin-amyloidosis in heart failure and grants from Alnylam, Pfizer and BridgeBIO

How has the problem statement been addressed in the last year by this TRIF project?

We are expanding ASU research with private sector. This includes leading ASU negotiations with Caris Life Sciences to establish the new ASU-Caris Center for Precision Medicine for • Automation of liquid biopsy molecular profiling • High-throughput computer vision-based AI for digital pathology • AI analysis of petabyte scale genomic data from the Caris 900,000 cancer patient database • New education programs in precision health and AI-based health care • Discussions with BLOODPAC consortium on liquid biopsy standards

What, if anything, hasn't worked as well as was hoped?

Several aspects of the CASI precision medicine program were established as an ASU-U of A collaboration with equal TRIF funding from both institutions. Unanticipated fiscal constraints at U of A resulted in canceled funding, forcing realignment of priorities and staff terminations. Reductions in federal funding required a reallocation of funding, which halted planned recruitment of some project management staff.

Describe the Arizona benefit or impact of this TRIF project for the last year.

We aim to accelerate innovation at the crossroads of research, patient care and public health, with emphasis on AI to map altered gene regulatory networks in disease for personalized medicine tailored to individual genetic profiles and proactive disease risk mapping in Arizona's population. The complexity of these cross-disciplinary needs will require new multi-institutional collaborations and increased engagement with the private sector. There are opportunities for ASU to design new curricula to train future health care professionals to strengthen Arizona universities' competitiveness for public and private funding.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$453,381	$459,040	$614,062	$349,780	$1,876,263
Applied Research	$453,381	$459,040	$614,062	$349,780	$1,876,263
Development	$453,381	$459,040	$614,062	$349,780	$1,876,263
Total	$1,360,143	$1,377,120	$1,842,187	$1,049,340	$5,628,790

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	3	8	3	4	18
Graduate Students	26	51	17	26	120
Undergraduate Students	19	29	10	12	70
Sponsored Project Funding	$2,169,262	$2,660,919	$2,552,836	$2,546,061	$9,929,078
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

University	Arizona State University
TRIF Investment Area	Improving Health
Program Name	Biodesign Institute

Problem Statement

Emergent global challenges in medicine, environmental sustainability and national security continue to threaten the health of our communities and our planet. The Biodesign Institute at Arizona State University is committed to solving such challenges by developing rigorous, collaborative, nature-inspired science for the benefit of all life on Earth. By leveraging TRIF investment, Biodesign improves health, ensures security, sustains the planet and provides access and workforce development opportunities.

Program Description

As the premiere scientific research institute in one of the nation's fastest-growing research universities, the Biodesign Institute addresses an expansive array of global challenges by creating nature-inspired solutions to address society's greatest challenges in biomedical health, environmental sustainability and national security. Biodesign is poised to promote workforce and leadership development with academic and hands-on, laboratory enrichment experiences and education to advance research, technology and thought leadership in the state of Arizona, and to elevate and expand Arizona's highly skilled workforce. Voter-supported investment in university research pioneered at Biodesign allocates resources to promote access to highly skilled experts and technologies in state-of-the-art laboratories for high-impact research of societal value. In this way TRIF funding is a powerful driver of scientific excellence and enables multiple pathways to enrich the economy through higher education access for workforce development, with ASU Biodesign-specific programs in impactful areas.

What is the University's Advantage and/or Anticipated Funding Opportunities?

The ASU advantage for additional funding opportunities are many, including: 1. Expansion of COVID-19 testing success to a more generalized platform for developing new ways to rapidly diagnose and detect disease. 2. Expansion of the Neurodegenerative Disease Research Center (NDRC) under the leadership of Jeff Kordower. 3. In partnership with the ASU School for Complex Adaptive Systems, expand efforts in cybersecurity, artificial intelligence, deep learning and computational biology to reduce internet security threats and measure the impact of censorship on internet architecture. 4. Leverage TRIF funding to enable the formation of spinout companies. 5. Established the Biodesign Center for Sustainable Macromolecular Materials and Manufacturing (BCSM3) to focus on sustainable manufacturing and polymer chemistry, with goals of generation of sustainable, environmentally friendly materials. 6. Development of tabletop x-ray source capable of making molecular movies.

Is there an Arizona Specific Benefit or Impact?

Biodesign is committed to the creation, development and deployment of impactful programs to improve human health and economic opportunity in Arizona. TRIF funding to the Biodesign Institute would enhance the workforce and impact health in many areas, including: 1. Through Compact X-ray free electron laser/compact X-ray light source student internships, train the next generation of X-ray machinists, technologists and physicists. 2. Through internships and fellowships in the ASU Biodesign Clinical Testing Laboratory (ABCTL), train and educate workers to seek new technologies and solutions to respond to potential infectious viruses such as COVID-19 and its various strains. 3. Develop Biodesign workforce training opportunities in semiconductor science and sustainable manufacturing.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$4,620,982	$4,620,982	$4,620,982	$13,862,946
Basic Research	$0	$0	$0	$0
Applied Research	$2,138,000	$2,138,000	$2,138,000	$6,414,000
Development	$2,138,000	$2,138,000	$2,138,000	$6,414,000
Total	$8,896,982	$8,896,982	$8,896,982	$26,690,946

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	95	100	105	169
Graduate Students	415	436	436	1309
Undergraduate Students	159	167	176	502
Sponsored Project Funding	$56,867,053	$59,710,405	$62,695,925	$179,273,383
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	4	4	5	13

University	Arizona State University
TRIF Investment Area	Improving Health
Program Name	Biodesign Institute

Progress Summary

In the past year, TRIF funds have enabled the Compact X-ray free electron laser (CXFEL) project to achieve the first X-ray light, enabling the structure of a model protein to be solved during the past year. The team is beginning to conduct fundamental structural studies on molecules key to diseases including cancer. In addition, the project recruited a new Principal Investigator to lead the program upon the retirement of its initial leader, permitting a seamless transition. Our faculty continue to shine, as well. Two faculty from the Biodesign Center for Health Through Microbiomes Faculty won "40 under 40 Awards," and one also received a Fulbright Award. Biodesign Professor Bertram Jacobs was elected as a National Academy of Inventors (NAI) Fellow and Professors Chen, Green and Wang were elected as Members of the NAI.

How has the problem statement been addressed in the last year by this TRIF project?

The Biodesign Center for Health Through Microbiomes is involved in several notable clinical trials. One project is looking at the efficacy of new microbiome treatments for people with autism spectrum disorder (ASD). Another project in ongoing treatment efficacy evaluation involves the restoration of the gut microbiome in patients suffering from Pitt Hopkins Syndrome. If successful, these interventions have the potential to dramatically improve patient quality of life. Studies within the ASU-Banner Neurodegenerative Disease Research Center have shown that exposure to glyphosate, an active ingredient in weed and grass killers, can result in significant brain inflammation, and increase the risk of neurodegenerative disease and cause Alzheimer's Disease-like effects. Professor Bruce Rittmann, director of the Swette Center for Environmental Biotechnology won the International Water Association's Ardern-Lockett Award for demonstrating how microbials can be used to break down PFAS – also known as forever chemicals — in the environment.

What, if anything, hasn't worked as well as was hoped?

The Principal Investigator who led the $92M NSF Grant to construct the CXFEL instrument announced his retirement. However, thanks to TRIF support, Biodesign was able to recruit and seamlessly transition a new, outstanding Principal Investigator to lead the program.

Describe the Arizona benefit or impact of this TRIF project for the last year.

Tempe, Arizona-based company, Align Technologies, funded initial studies by the Biodesign Center for Sustainable Macromolecular Materials and Manufacturing, or SM3 to examine how to mitigate wear in dental materials. Following these initial studies, SM3 developed funding streams with both Cargill and Honeywell. Such industry partnerships support Biodesign's workforce development efforts and work to address novel, sustainable methods of manufacturing.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$3,270,007	$3,792,941	$3,969,415	$4,152,413	$15,184,776
Basic Research	$0	$0	$0	$0	$0
Applied Research	$2,115,861	$2,454,226	$2,568,414	$2,686,822	$5,875,785
Development	$2,115,861	$2,454,226	$2,568,414	$2,686,822	$9,825,323
Total	$7,501,729	$8,701,393	$9,106,242	$9,526,057	$34,835,421

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	121	123	98	126	468
Graduate Students	488	490	479	492	1949
Undergraduate Students	212	221	237	181	851
Sponsored Project Funding	$57,191,622	$67,901,312	$71,199,155	$66,248,497	$262,540,586
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

University	Arizona State University
TRIF Investment Area	Improving Health
Program Name	Office of Government and Community Engagement

Problem Statement

Decisions to pursue solutions to most pressing human health challenges are often informed by select organizations and committees with limited access by the broader research community. Moreover, securing federal research funding is highly competitive and becoming more and more challenging. To participate meaningfully in relevant discussions and secure funding to support research, ASU must conduct creative, coordinated efforts to establish the university as a thought leader in policy setting areas and increase federal support for research and research-related activities.

Program Description

The Office of Government & Community Engagement serves as the liaison to officials and agencies of the U.S. government, state of Arizona, Maricopa County, surrounding municipalities and communities, tribal nations, Mexico and cultural leaders. Our office establishes and maintains communication channels with policy-makers, sponsor agency officials and program staff to effectively represent our research capabilities, infrastructure and organizational strenths. We facilitate participation in priority-setting venues and recognition as a thought leader and valuable contributor to advances in science and technology in the national interest, enabling sustained growth in our research and development pursuits.

What is the University's Advantage and/or Anticipated Funding Opportunities?

ASU is developing new, cross-disciplinary teams and partnerships that position it well to participate in high-level discussions around use of novel technologies and analytical tools to address more complex health challenges than have been resolved to date. We are already seeing early evidence of realization of the need for such innovative approaches in recent funding opportunities, for which we are getting recognition. With appropriate outreach, ASU's Health Futures Center will provide facilities needed to increase our competitiveness in obtaining funding from the U.S. Department of health and Human Services, including NIH, CDC, HRSA and PCORI. In addition, coupling our broad biomedical expertise with artificial intelligence and machine learning is already enhancing our ability to compete for large, new funding opportunities that require this interdisciplinarity.

Is there an Arizona Specific Benefit or Impact?

Growth of the microelectronics industry in Arizona and other advanced technologies will be the beneficiaries of increased research efforts that depend on access to these tools, with corresponding positive economic impacts. ASU will also be a source for a highly skilled workforce in these areas, thereby providing a magnet for future industry growth. Arizona is home to rural and urban communities experiencing disproportionate health disparities based on multiple factors, many of which may be identified using advanced analytical tools such as artificial intelligence, which requires increased federal funding.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$0	$0	$0	$0
Applied Research	$304,000	$304,000	$304,000	$912,000
Development	$304,000	$304,000	$304,000	$912,000
Total	$608,000	$608,000	$608,000	$1,824,000

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	169
Graduate Students	0	0	0	0
Undergraduate Students	0	0	0	0
Sponsored Project Funding	$7,000,000	$7,350,000	$7,717,500	$22,067,500
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

University	Arizona State University
TRIF Investment Area	Improving Health
Program Name	Office of Government and Community Engagement

Progress Summary

The Health Observatory (HO) at ASU is a statewide platform that integrates diverse, trusted data to inform real-time decisions, advance health discoveries and make valuable social and economic data accessible. In FY25, the HO welcomed Dave Engelthaler as executive director and Dr. Rebecca Sunenshine as medical director. The team engaged with external partners including ADHS, Honor Health Research Institute and the Arizona State Hospital, identifying collaboration opportunities in infectious disease, behavioral health, substance use, health economics and analytics support. The AZ State Hospital is interested in HO's ability to provide analytics support broadly with patient data. Regular meetings with ASU Health and Decision Theater advanced health metrics tracking in Arizona. In FY25, nine external funding proposals totaling $112M were submitted, including a $100M MacArthur 100 and Change proposal on open-source heat mitigation mapping, as well as projects with NSF, NOAA/NIHHIS, Burroughs Wellcome Fund, Robert Wood Johnson Foundation, Pima County Health Department and U of A. Three projects totaling $1.2M have been awarded to date. ASU continues to support the development of advanced analytical tools and medical technologies to address health disparities in AZ communities. ASU's Health Futures Center hosts the MedTech Accelerator, an ASU-Mayo Clinic initiative aiding medical technology companies in bringing products to market. In 2025, 10 companies participated, with nearly half focusing on machine learning and AI-driven product design. ASU and Mayo Clinic completed a landscape assessment outlining drug discovery and development capabilities and opportunities across both institutions to determine areas for growth in advanced diagnostics. ASU Knowledge Enterprise Intrapreneurship Bootcamp is a new program in development to accelerate research-to-market outcomes through entrepreneurial practice and strategic IP alignment, in collaboration with Skysong Innovations. The bootcamp, delivered in partnership with Edson E+I, is a high-impact, 5-day accelerator that equips researchers with the tools to identify, validate and commercialize high-potential innovations.

How has the problem statement been addressed in the last year by this TRIF project?

ASU's Research Engagement Office (REO) is a forward-looking strategy team that diversifies faculty funding portfolios by bringing opportunities across many funding domains, including federal, corporate, philanthropic and international. By understanding the funding landscape and agency practices, REO aligns faculty health research with federal priorities, boosting funding access and involvement in science policy. REO monitors emerging opportunities (e.g., NIH, ARPA-H, Horizon Europe), gathers intelligence on priorities, maintains agency communications, and hosts think tanks and associations to enhance ASU's health research impact.

What, if anything, hasn't worked as well as was hoped?

Describe the Arizona benefit or impact of this TRIF project for the last year.

REO developed a capture playbook to strengthen ASU's positioning for funding success across multiple strategic areas prior to the release of requests for proposals. In collaboration with Knowledge Exchange for Resilience and ASU Health, REO developed a comprehensive heat research strategy and funding approach, including a $3M federal earmark request with the Office of Government and Community Engagement. REO developed and is executing a European strategy, which is currently preparing three Horizon Europe Health Cluster proposals (totaling $20M), partnering with 10 countries in Europe. Through April 2025, ASU submitted $775M in health-related proposals, a 10% increase from FY24. The vice president of research and the Global Security Initiative submitted an APRA-H Tier 4 proposal (~$50M) in April 2025, aiming to unite health care stakeholders on a secure, accountable platform for sustainable, federated clinical data sharing.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$0	$0	$0	$0	$0
Applied Research	$243,879	$301,940	$366,181	$500,000	$1,816,981
Development	$243,879	$301,940	$366,181	$500,000	$1,412,000
Total	$487,758	$603,880	$732,362	$1,000,000	$2,824,000

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	2	0	0	4	6
Graduate Students	11	0	0	16	27
Undergraduate Students	12	0	0	35	47
Sponsored Project Funding	$5,566,531	$4,503,005	$7,221,502	$7,370,249	$24,661,287
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

University	Arizona State University
TRIF Investment Area	Improving Health
Program Name	Research Computing

Problem Statement

The process of discovery is directly driven by the scale and pace of available simulation and analysis capacity on campuses. Research projects within Arizona increasingly rely on foundational and advanced research computing. Over 80% of the top-funded researchers at each of the state institutions are currently supported through research computing infrastructure and services. This percentage continues to increase as more research funding opportunities require not only research computing but also systematic support for data controls and regulations. Positioning our researchers for success in health, medical, defense and next-generation technologies research requires a scale of support only available at the statewide level, providing enhanced collaborative capability across all three universities.

Program Description

ASU Research Computing provides cutting-edge technology to support research and education while advancing the knowledge and understanding of deploying 21st-century cyberinfrastructure in a large public research university. Specifically, this program supports multidisciplinary research and education in science, technology, engineering and mathematics domains, including computational genomics, molecular dynamics, computational materials science, robotics and imaging. The program increases ASU's capacity for computationally enabled discovery and provides a federated access mechanism for extramural resource sharing across Arizona. Partnering with Dell Technologies, the ASU Research Computing Core Facility has established the ASU Center of Excellence in High Performance Computing and Artificial Intelligence. One of only three such centers in the United States, Research Computing currently enables nearly $1 billion in proposals and nearly $300 million in awards.

What is the University's Advantage and/or Anticipated Funding Opportunities?

Investment in Research Computing will unify, broaden and overarchingly lift all advanced computing capabilities across the state. Notably, investment of TRIF funds in this program will: - Directly enable ASU proposals totaling $2 million per year. - Precipitate large-scale federal infrastructure awards. - Increase percent conversion of faculty who have consumed research computing resources. - Increase engagement via training events reaching over 1,000 participants per year. - Shorten the time to achieving transformational research and scientific discovery.

Is there an Arizona Specific Benefit or Impact?

Research Computing has developed capacities in advanced computing and data for initiatives in health, sustainability, space exploration, national security and workforce development that directly benefit Arizona industries and the well-being of Arizona citizens. Notably: - Federally regulated secure computing environment for the Global Security Initiative. - Advanced data movement network for the Lunar Reconnaissance Orbiter Camera. - Developing the Health Futures Computational Facility in partnership with Mayo Clinic. - Supporting artificial intelligence/machine learning-driven research in resilience science. - Exploring opportunities to engage our tribal communities in workforce development opportunities (e.g., data sciences) and identifying innovative solutions to accessing technological resources. - Developing innovative technology capabilities around hybrid cloud. - Training students and faculty on the latest technologies, emphasizing the use of this vital technology to undergraduate and graduate students, and creating a more competitive workforce in the future. - Partnerships with local industry innovators in developing novel cloud-based research-computing-as-a-service business models.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$765,000	$765,000	$765,000	$2,295,000
Applied Research	$765,000	$765,000	$765,000	$2,295,000
Development	$765,000	$765,000	$765,000	$2,295,000
Total	$2,295,000	$2,295,000	$2,295,000	$6,885,000

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	110	116	121	169
Graduate Students	633	665	665	1996
Undergraduate Students	217	228	239	684
Sponsored Project Funding	$47,441,365	$49,813,433	$52,304,105	$149,558,903
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	3	3	3	9

University	Arizona State University
TRIF Investment Area	Improving Health
Program Name	Research Computing

Progress Summary

Arizona State University Research Computing (RC) expanded instructional and research impact while operating the Sol supercomputer at record scale, with over 800 ASU researchers running thousands of AI models weekly. Sol continues to appear in the global Top500 ranking, a distinction achieved by only a few university systems, and sustained record utilization in FY25 at roughly 10–12 million CPU hours each month. RC grew hands-on training across dozens of courses and workshops spanning health AI, imaging, bioinformatics and data science. Sol supported open foundation-model development in medical imaging and powered Arizona-focused modeling in urban climate and watershed hydrology. RC deepened engagement with the National AI Research Resource (NAIRR) Pilot to broaden access to national computing and datasets. Secure and regulated services remained a core focus through the KE Secure Cloud, especially the Aloe supercomputer, enabling HIPAA-aligned analytics and collaborative health research.

How has the problem statement been addressed in the last year by this TRIF project?

The problem statement calls for campus-scale compute, fast data and compliant environments to remain competitive in health, medical and next-generation research. Research Computing addressed this through three thrusts. The first is expanding secure and regulated capacity. We are extending KE Secure Cloud advanced computing services to accommodate new federal requirements, including CMMC 2.0 for research using controlled unclassified information, vital to ASU's work in defense, chips, manufacturing and related sectors. The Aloe supercomputer and private secure cloud continued to provide HIPAA-aligned workflows and protected analytics. The second is scaling AI and instruction on Sol. RC introduced many new AI/ML software stacks, tuned scheduling and storage for model training and inference at scale, and delivered high-throughput classroom support so more Arizona learners can practice on real systems. The third is leveraging partnerships and national resources. Participation in the NAIRR Pilot and collaborations across colleges lowered barriers for teams applying AI to clinical, public health and life science datasets. Together, these efforts connect cyberinfrastructure directly to decision-relevant science and health outcomes.

What, if anything, hasn't worked as well as was hoped?

Exploding AI demand stresses supercomputer capacity, power, cooling and storage. RC is prioritizing secure capacity, efficiency and training while collaborating on energy-use analyses and operational adjustments to sustain health-related computing amid these constraints.

Describe the Arizona benefit or impact of this TRIF project for the last year.

RC's secure health data capabilities enable HIPAA-aligned analytics for clinical and public health partners statewide, expanding Arizona's data-driven health and translational AI capacity. High utilization of Sol translates into faster time-to-insight for investigators working on imaging, precision health and population-scale analytics. Classroom use builds a durable workforce pipeline as students and trainees move into Arizona industry, health care systems and government with real experience in advanced computing. Compliance-ready services, including preparation for CMMC 2.0, strengthen Arizona's competitiveness for federal and industry projects in defense, semiconductors and manufacturing. RC-enabled heat, air quality and water modeling supports state and municipal planning. In outreach, the Quantum Collaborative met with the City of Gilbert and The Connective to brief city leaders on quantum information science and emerging technologies, building regional literacy and positioning Arizona communities to benefit from future capabilities.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$765,000	$785,548	$809,446	$781,548	$3,141,542
Applied Research	$765,000	$785,548	$809,446	$781,548	$2,619,650
Development	$765,000	$785,548	$809,446	$781,548	$3,141,542
Total	$2,295,000	$2,356,644	$2,428,338	$2,344,644	$9,424,626

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	137	126	102	124	489
Graduate Students	872	870	828	714	3284
Undergraduate Students	334	349	370	274	1327
Sponsored Project Funding	$47,601,576	$67,903,303	$63,344,770	$56,163,154	$235,012,803
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

University	Arizona State University
TRIF Investment Area	Improving Health
Program Name	Skysong Innovations

Problem Statement

ASU researchers are tackling some of the world's biggest challenges, from sustainable resources and carbon capture to cancer detection and treatment. Their post-research challenge comes in finding the right partners, strategic investments and experienced entrepreneurial leaders needed to move those innovations into successful commercial application. Skysong Innovations (SI) identifies those technologies with broad potential and coordinates with the right partners to bring these innovations into the marketplace. From pulling water out of thin air to re-engineering a virus to attack cancer, ASU researchers have worked with Skysong Innovations to spin out dozens of companies that have the potential to revolutionize the way we navigate the global challenges of the 21st century.

Program Description

SI is ASU's exclusive intellectual property management and technology transfer organization (TTO). Since 2003, SI has provided the ASU research community with the support and expertise needed to turn their research discoveries into commercial opportunities. SI has long been one of the top-performing university TTOs in terms of researcher inventions disclosed, licensing deals signed and startups launched per research dollar. For the third consecutive year, ASU is in the top 10 for U.S. patents issued to U.S. universities — and 11th worldwide — according to an annual ranking of the top universities by the National Academy of Inventors (NAI) and the Intellectual Property Owners Association (IPO).In FY20, ASU researchers working with SI continued to set new benchmarks, submitting 306 invention disclosures and launching 19 new startups. ASU startups also raised more than $120 million in external funding in FY20. Moreover, when the COVID-19 pandemic first emerged, SI began fast-tracking innovations to prevent, diagnose or treat the disease. To date, SI has licensed eight ASU-developed COVID technologies to companies.

What is the University's Advantage and/or Anticipated Funding Opportunities?

SI has worked for years to help ASU startups connect with investors. In that regard, SI regularly interacts with venture-capital firms, angel-investment groups, and other potential investors around the globe to showcase ASU startups and technologies. All told, ASU researchers working with SI have launched more than 170 startups, which in turn have attracted nearly $1 billion in venture capital and other funding. Because experience has taught us that many investors are wary of giving money to companies led by inexperienced founders, we created a special program called the ASU Startup Mill. The ASU Startup Mill connects ASU companies with successful entrepreneurs and experienced corporate executives who can provide advice, support and – in some cases – even take positions running these startups. SI is also the ASU lead behind the ASU-Mayo MedTech Accelerator, which brings together the recognized world leader in patient care, education, and research.

Is there an Arizona Specific Benefit or Impact?

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$490,538	$490,538	$490,538	$1,471,613
Applied Research	$490,538	$490,538	$490,538	$1,471,613
Development	$490,538	$490,538	$490,538	$1,471,613
Total	$1,471,613	$1,471,613	$1,471,613	$4,414,840

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	169
Graduate Students	0	0	0	0
Undergraduate Students	0	0	0	0
Sponsored Project Funding	$0	$0	$0	$0
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	5	5	5	15

University	Arizona State University
TRIF Investment Area	Improving Health
Program Name	Skysong Innovations

Progress Summary

Skysong Innovations remained a high-impact tech-transfer organization in FY25, capturing a record 330 new ASU innovations, securing an all-time high 200 new U.S. patents and closed 65 new standalone licensing deals — not counting additional licenses granted in industry-sponsored research agreements. Within these licensing activities, SI advanced the launch of 21 new startups founded on ASU innovations ranging from voice authentication platforms to therapeutics for traumatic brain injuries. Of the 21 new companies, 18 are based in Arizona. These output levels for innovations, patents, licensing deals and startups place ASU within the top 10 of institutions without medical schools, according to data published by the Association of University Technology Managers. According to FY23 data, ASU was one of only three such institutions to rank in the top five across all four categories — alongside MIT and Purdue. In addition, FY25 saw continued growth for ASU startup fundraising efforts, including $65 million in outside investment raised. To date, the historical running total of venture capital investments and other funding reported by more than 270 total ASU startups launched in SI's history exceeds $1.5 billion.

How has the problem statement been addressed in the last year by this TRIF project?

Skysong Innovation's productivity in FY25 involved many innovations, patents, licensing deals and startups directed to improving health, evidenced by the 137 new life science invention disclosures and 88 new life science U.S. patents. In FY25, notable examples include several ASU startup companies launched through SI. Peptide Binders is developing a new type of therapy with an initial focus on traumatic brain injury. REDX Diagnostics is creating technology for rapid, on-site tests that can accurately detect foodborne illnesses and infectious diseases in both humans and animals. Other startups include a company using artificial intelligence to help doctors more precisely locate seizures during epilepsy surgery, another developing wearable devices that can detect life-threatening conditions in real time, and one pioneering carbon-neutral food production that requires no farmland and produces no waste. In addition to startups, SI helped secure U.S. patents for breakthrough inventions such as a device that can detect migraines through speech, a facial mask that kills bacteria and viruses, and a new treatment method for Pitt Hopkins Syndrome. SI also continues to co-lead the successful Mayo-ASU MedTech Accelerator. The accelerator's growing reputation shines a global spotlight on Arizona's accelerating life-sciences industries. To date, the accelerator has graduated 51 companies from all over the globe, several of which have moved to Arizona. Collectively, these companies have raised $325 million in outside investment to help their health solutions reach patients.

What, if anything, hasn't worked as well as was hoped?

Describe the Arizona benefit or impact of this TRIF project for the last year.

According to Rounds Consulting Group, Skysong Innovations' efforts from FY14 to FY23 "have generated nearly $2.5B in economic activity in Arizona." This economic activity included "13,270 job-years from FY14 to FY23 (this is equivalent to an average of 1,327 persons working full-time each year over the 10-year period)" as well as "$846.3M in labor income" and "$80.7M in state and local taxes." SI's continued outputs in FY25, including facilitating the launch of 21 new startup companies — 18 of which are Arizona-based — and an additional $65 million raised by existing ASU startups in FY25, will further bolster this economic impact. In that regard, Rounds projects Skysong Innovations activity will generate nearly $3.4B in economic activity throughout Arizona.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$490,538	$490,538	$490,538	$490,538	$1,962,152
Applied Research	$490,538	$490,538	$490,538	$490,538	$2,054,178
Development	$490,538	$490,538	$490,538	$490,538	$1,962,152
Total	$1,471,614	$1,471,614	$1,471,614	$1,471,614	$5,886,456

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	0	0	0
Graduate Students	0	0	0	0	0
Undergraduate Students	0	0	0	0	0
Sponsored Project Funding	$0	$0	$0	$0	$0
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	6	6	4	3	19

University	Arizona State University
TRIF Investment Area	National Security Systems
Program Name	Global Security Initiative

Problem Statement

Today's national and global security challenges are highly complex and interconnected, including protecting information networks (such as those found in critical infrastructure), optimizing human-robot teams, combatting mis- and disinformation, leveraging massive amounts of complex data for effective decision making, and developing transition pathways to application. These challenges require both developing advanced mission-focused research capabilities and creating novel training environments.

Program Description

ASU's Global Security Initiative (GSI) brings together unique ASU research, education, and programming capabilities to address national and global security challenges. GSI has three pillars of activity: research, education and engagement. The research pillar establishes interdisciplinary teams to work on the most challenging problems in security. Currently, GSI has four centers: Center for Cybersecurity and Digital Forensics (CDF), Center for Human, AI, and Robot Teaming (CHART), Center on Narrative, Disinformation, and Strategic Influence (NDSI), and Center for Accelerating Operational Efficiency (CAOE), a U.S. Department of Homeland Security (DHS) Center of Excellence (COE). GSI also manages the Cybersecurity Education Consortium (CEC), an interface between industry and academia to facilitate a robust talent pipeline for cybersecurity jobs in Arizona and across the nation. In addition, GSI supports ASU's Center for Wireless Information Systems and Computational Architectures (WISCA), which builds novel computational architectures that require significantly less power while improving computational ability.

What is the University's Advantage and/or Anticipated Funding Opportunities?

GSI has strategically aligned ASU capabilities with national security needs in cybersecurity, human/AI teaming, analytics and narrative analysis, which has resulted in large-scale externally funded awards and recognition by government and academic partners of ASU's unique strengths in these areas. GSI is also creating a unique role for ASU in the education domain, addressing the need to expand STEM education to ensure our future national security. One of GSI's measures of impact is NSF HERD Department of Defense research expenditures ranking. In the last five years, largely through strategic investment in GSI focus areas, ASU's DoD HERD expenditures grew by more than 50%. Assuming the current investment level and other complimentary university activities, we expect the DoD HERD expenditures to continue to grow another approximately 20% by 2024.

Is there an Arizona Specific Benefit or Impact?

1. The Global Security Initiative is improving state and the national cyber-readiness by providing hands-on learning activities for all skill levels and age groups, including: - Free resources for Arizona's middle school and high school teachers to implement in their classrooms, such as a cybersecurity curriculum for middle school students and access for high school students to the U.S. Cyber Range. The U.S Cyber Range is a virtual environment in which students can practice cybersecurity skills and learn how to better protect themselves and their information online. - A free educational platform, called pwn.college, aimed at college students but available to anyone. The platform guides emerging members of the cybersecurity community through increasingly sophisticated learning modules centered around real-world exercises to develop the cybersecurity skill set today's employers need. 2. Research done in GSI's cybersecurity center impacts and is informed by connections with Arizona-based industries, and helps protect the intellectual property of Arizona-based companies. Citizens of Arizona are also protected from cyber-threats more effectively due to this research, which ranges from Internet of Things (IoT) device security to browser security and beyond. 3. Research and national leadership in GSI's Center for Human AI Robot Teaming positions Arizona as a leader and innovator in creating and informing the future of work given increased adoption of autonomy by various industries. 4. A dedicated security entity within the university helps to establish Arizona as a forward-thinking, security-conscious state that can serve as a model for others, as the threats to our nation continue to evolve.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$0	$0	$0	$0
Applied Research	$1,249,000	$1,249,000	$1,249,000	$3,747,000
Development	$1,249,000	$1,249,000	$1,249,000	$3,747,000
Total	$2,498,000	$2,498,000	$2,498,000	$7,494,000

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	42	45	47	169
Graduate Students	383	402	402	1207
Undergraduate Students	140	147	154	441
Sponsored Project Funding	$39,723,704	$41,709,889	$43,795,383	$125,228,976
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	2	2	2	6

University	Arizona State University
TRIF Investment Area	National Security Systems
Program Name	Global Security Initiative

Progress Summary

The Global Security Initiative's (GSI) strategy of anticipating emerging national security challenges, identifying relevant technical strengths within ASU, and then helping to develop and capture opportunities for impact continues to yield impressive results. ASU's Department of Defense (DoD) research expenditures more than tripled from fiscal year 2018 through fiscal year 2025 — including 70% growth in the last year alone. ASU's national security science and technology portfolio is advancing critical technology areas such as advanced software, artificial intelligence, next-generation wireless communications and microelectronics. Products developed at ASU are in use in government agencies and the private sector. Additionally, GSI centers develop novel learning platforms and educational opportunities, bringing state-of-the-art learning to all levels, including Arizona high schoolers.

How has the problem statement been addressed in the last year by this TRIF project?

ASU is now a recognized national leader in advancing the state-of-the-art in critical technology areas such as wireless communications, cybersecurity, human-AI teaming and microelectronics, with large-scale federally-funded projects and close partnerships with industry leaders in each area. For instance, GSI faculty and ASU students developed a new AI-enabled cybersecurity system as part of a multi-year DoD challenge. The system was one of seven finalists out of 42 teams in the Defense Advanced Research Project Agency's (DARPA) AI Cyber Challenge, and uses AI to automatically identify and patch real-world vulnerabilities in software. ASU secured a $24M contract from the DoD to provide research support on irregular warfare topics such as economic statecraft, emerging technologies and international lawfare. With an industry partner, GSI developed new technology to identify AI-generated or AI-manipulated content through a DoD research award. The program is now being deployed. Funded by a $4.3M DARPA award, ASU is working with the DoD to develop new systems to objectively assess team performance competencies to determine combat readiness, adaptability and recovery. An $8M DoD award is funding work to significantly reduce the time it takes to reverse-engineer cyberphysical systems like drones and patch vulnerabilities.

What, if anything, hasn't worked as well as was hoped?

The federal funding landscape has shifted, but defense and national security challenges remain a priority of the U.S. government. ASU remains focused on advancing critical technologies for national security, and will work even closer with government and industry partners to ensure technology advancements created in the university are transitioned into practice in both the government and private sector.

Describe the Arizona benefit or impact of this TRIF project for the last year.

ASU's proven ability to advance technology for the national security mission benefits local industry and enhances Arizona's reputation as a hub for both technology and defense. Local industry leaders such as PayPal, General Dynamics, and L3Harris have partnered with ASU to produce ground-breaking research. These research efforts are also helping to generate Arizona's future technology workforce, providing ASU students the experience and skills needed to succeed in today's rapidly evolving tech sector, and also reaching other learners across Arizona. For example, 23 Phoenix-area high schoolers spent eight weeks working with PhD student mentors to design and implement cybersecurity research projects and learn more about the cybersecurity field as a profession.

Investment Detail	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$0	$0	$0	$0	$0
Applied Research	$1,231,677	$1,271,884	$1,247,049	$1,224,383	$3,529,162
Development	$1,231,677	$1,271,884	$1,247,049	$1,224,383	$4,974,993
Total	$2,463,354	$2,543,768	$2,494,098	$2,448,766	$9,949,986

Performance Measures	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	34	18	11	19	82
Graduate Students	342	316	274	267	1199
Undergraduate Students	93	62	80	66	301
Sponsored Project Funding	$27,998,805	$41,711,737	$46,144,184	$35,673,401	$151,528,127
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

University	Arizona State University
TRIF Investment Area	National Security Systems
Program Name	Research Development

Problem Statement

Increasing the diversity, reach, quality and impact of ASU's faculty, staff and student research activities contributes to the strength of our regional economy and improves our national standing in higher education.

Program Description

Research Development is responsible for increasing the size of ASU's research enterprise through a community of practice around early positioning and competitiveness of proposals for funding from federal agencies. This is accomplished through strategic intelligence of funding opportunities and improved teaming, outreach and training during research-related events, transparent and equitable management of limited funding opportunities and internal seed grants programs, and professional proposal management for large and complex funding proposals.

What is the University's Advantage and/or Anticipated Funding Opportunities?

Research Development is responsible for dissemination of hundreds of limited funding opportunities to the university, providing hundreds of documents in support of strategic decision-making for leaders, bringing together hundreds of researchers to discuss competitive funding solicitations, and supporting millions of dollars' worth of proposals from ASU. This work increases the overall ability of ASU to reach aggressive goals for research expenditures.

Is there an Arizona Specific Benefit or Impact?

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$41,010	$41,010	$41,010	$123,030
Applied Research	$41,010	$41,010	$41,010	$123,030
Development	$41,010	$41,010	$41,010	$123,030
Total	$123,030	$123,030	$123,030	$369,089

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	169
Graduate Students	0	0	0	0
Undergraduate Students	3	3	3	9
Sponsored Project Funding	$40,000,000	$42,000,000	$44,100,000	$126,100,000
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

University	Arizona State University
TRIF Investment Area	National Security Systems
Program Name	Research Development

Progress Summary

Research Development (RD) advances ASU's mission and benefits Arizona by supporting strategic research initiatives across the university and in collaboration with institutions within the state and nationwide. The office has played a critical role in securing some of the most competitive and high-value research awards in Arizona's history, including major wins in sustainability, microelectronics, semiconductors, and areas aligned with state and national priorities. In addition to supporting research teams in the development and execution of complex proposals, RD offers a robust calendar of events that connect researchers with funding agencies and equip them with the tools to create competitive submissions. The office delivers timely, actionable analyses of the funding landscape and emerging trends, enabling ASU to remain responsive to evolving priorities. RD also manages institutionally limited solicitations, prestigious national nomination competitions and multiple internal seed grant programs that catalyze early-stage research and interdisciplinary collaboration.

How has the problem statement been addressed in the last year by this TRIF project?

In the past year, RD has strengthened ASU's grant readiness by offering targeted programming, expert services and strategic proposal support. RD hosted 31 events engaging more than 1,246 stakeholders. Nine events focused on competitive national funding programs, 11 provided strategic collaboration planning and 11 provided training on best practices for writing and submitting proposals. These events, widely promoted across ASU, helped faculty engage with funding opportunities early and strategically. RD's weekly funding newsletter, distributed to more than 3,379 subscribers, ensured broad, timely access to upcoming opportunities. This past year, Limited Submissions distributed nearly 140 funding solicitations through the RD newsletter and direct outreach. A total of 222 applicants engaged with these opportunities, resulting in 164 approved submissions to sponsors, representing approximately $1 billion in potential funding. RD uses the same highly efficient and successful system to manage many other opportunities, including prestigious national nominations and internal seed grants that are part of the ASU Mayo Clinic Alliance. RD also supported 24 large-scale proposals totaling nearly $380 million and developed 36 custom graphics for 16 of these submissions. Editing support was provided for 220 projects, including grant proposals, manuscripts and book proposals. In the area of national security systems, RD helped submit 5 major proposals totaling $135 million. Two have been awarded, and the third recently completed a successful site visit.

What, if anything, hasn't worked as well as was hoped?

Describe the Arizona benefit or impact of this TRIF project for the last year.

RD plays a central role in advancing ASU's research portfolio, directly impacting Arizona's economy and contributing to ASU's national standing among top research institutions. This year, RD supported research efforts in mission-critical industries including health, microelectronics, sustainability and national security, areas that are essential to Arizona's future and elevate ASU's national visibility. This year, RD supported the successful proposal for SHIELD USA, a $100 million project funded by the National Institute of Standards and Technology (NIST). Led by ASU in collaboration with Deca Technologies, SHIELD USA established a new national consortium for advanced semiconductor packaging. This is headquartered in Phoenix, Arizona, creating a powerful hub for innovation, workforce development and regional economic growth. RD's strategic analysis and coordination efforts helped position ASU as the lead institution, aligning Arizona's strengths in microelectronics with national investment priorities.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$53,621	$66,105	$53,051	$63,797	$236,574
Applied Research	$53,621	$66,105	$53,051	$63,797	$1,190,520
Development	$53,621	$66,105	$53,051	$63,797	$236,574
Total	$160,863	$198,315	$159,153	$191,391	$709,722

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	0	0	0
Graduate Students	0	0	1	0	1
Undergraduate Students	0	0	1	0	1
Sponsored Project Funding	$675,000	$100,000	$17,500,000	$125,000,000	$143,275,000
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

University	Arizona State University
TRIF Investment Area	National Security Systems
Program Name	Skysong Innovations

Problem Statement

ASU researchers are tackling some of the world's biggest challenges, from sustainable resources and carbon capture to cancer detection and treatment. Their post-research challenge comes in finding the right partners, strategic investments and experienced entrepreneurial leaders needed to move those innovations into successful commercial application. Skysong Innovations (SI) identifies those technologies with broad potential and coordinates with the right partners to bring these innovations into the marketplace. From pulling water out of thin air to re-engineering a virus to attack cancer, ASU researchers have worked with Skysong Innovations to spin out dozens of companies that have the potential to revolutionize the way we navigate the global challenges of the 21st century.

Program Description

SI is ASU's exclusive intellectual property management and technology transfer organization (TTO). Since 2003, SI has provided the ASU research community with the support and expertise needed to turn their research discoveries into commercial opportunities. SI has long been one of the top-performing university TTOs in terms of researcher inventions disclosed, licensing deals signed and startups launched per research dollar. For the third consecutive year, ASU is in the top 10 for U.S. patents issued to U.S. universities — and 11th worldwide — according to an annual ranking of the top universities by the National Academy of Inventors (NAI) and the Intellectual Property Owners Association (IPO).In FY20, ASU researchers working with SI continued to set new benchmarks, submitting 306 invention disclosures and launching 19 new startups. ASU startups also raised more than $120 million in external funding in FY20. Moreover, when the COVID-19 pandemic first emerged, SI began fast-tracking innovations to prevent, diagnose or treat the disease. To date, SI has licensed eight ASU-developed COVID technologies to companies.

What is the University's Advantage and/or Anticipated Funding Opportunities?

SI has worked for years to help ASU startups connect with investors. In that regard, SI regularly interacts with venture-capital firms, angel-investment groups, and other potential investors around the globe to showcase ASU startups and technologies. All told, ASU researchers working with SI have launched more than 170 startups, which in turn have attracted nearly $1 billion in venture capital and other funding. Because experience has taught us that many investors are wary of giving money to companies led by inexperienced founders, we created a special program called the ASU Startup Mill. The ASU Startup Mill connects ASU companies with successful entrepreneurs and experienced corporate executives who can provide advice, support and – in some cases – even take positions running these startups. SI is also the ASU lead behind the ASU-Mayo MedTech Accelerator, which brings together the recognized world leader in patient care, education, and research.

Is there an Arizona Specific Benefit or Impact?

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$110,955	$110,955	$110,955	$332,865
Applied Research	$110,955	$110,955	$110,955	$332,865
Development	$110,955	$110,955	$110,955	$332,865
Total	$332,865	$332,865	$332,865	$998,595

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	169
Graduate Students	0	0	0	0
Undergraduate Students	0	0	0	0
Sponsored Project Funding	$0	$0	$0	$0
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	5	5	5	15

University	Arizona State University
TRIF Investment Area	National Security Systems
Program Name	Skysong Innovations

Progress Summary

Skysong Innovations remained a high-impact tech-transfer organization in FY25, capturing a record 330 new ASU innovations, securing an all-time high 200 new U.S. patents and closed 65 new standalone licensing deals — not counting additional licenses granted in industry-sponsored research agreements. Within these licensing activities, SI advanced the launch of 21 new startups founded on ASU innovations ranging from voice authentication platforms to therapeutics for traumatic brain injuries. Of the 21 new companies, 18 are based in Arizona. These output levels for innovations, patents, licensing deals and startups place ASU within the top 10 of institutions without medical schools, according to data published by the Association of University Technology Managers. According to FY23 data, ASU was one of only three such institutions to rank in the top five across all four categories — alongside MIT and Purdue. In addition, FY25 saw continued growth for ASU startup fundraising efforts, including $65 million in outside investment raised. To date, the historical running total of venture capital investments and other funding reported by more than 270 total ASU startups launched in SI's history exceeds $1.5 billion.

How has the problem statement been addressed in the last year by this TRIF project?

In FY25, SI secured nine new invention disclosures and seven new U.S. patents with potential application to national security systems. Select FY25 examples include an exclusive option with ASU startup OriginStory (voice-authentication technology to distinguish between human and machine-produced voices); new invention disclosures concerning a new method for error pattern correcting codes for use in communication systems; safe and trustworthy programmable artificial intelligence systems; as well as several U.S. patents covering methods for on-chip polarization detection.

What, if anything, hasn't worked as well as was hoped?

Describe the Arizona benefit or impact of this TRIF project for the last year.

According to Rounds Consulting Group, Skysong Innovations' efforts from FY14 to FY23 "have generated nearly $2.5B in economic activity in Arizona." This economic activity included "13,270 job-years from FY14 to FY23 (this is equivalent to an average of 1,327 persons working full-time each year over the 10-year period)" as well as "$846.3M in labor income" and "$80.7M in state and local taxes." SI's continued outputs in FY25, including facilitating the launch of 21 new startup companies — 18 of which are Arizona-based — and an additional $65 million raised by existing ASU startups in FY25, will further bolster this economic impact. In that regard, Rounds projects Skysong Innovations activity will generate nearly $3.4B in economic activity throughout Arizona.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$110,955	$110,955	$110,955	$110,955	$443,820
Applied Research	$110,955	$110,955	$110,955	$110,955	$1,295,012
Development	$110,955	$110,955	$110,955	$110,955	$443,820
Total	$332,865	$332,865	$332,865	$332,865	$1,331,460

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	0	0	0
Graduate Students	0	0	0	0	0
Undergraduate Students	0	0	0	0	0
Sponsored Project Funding	$0	$0	$0	$0	$0
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	5	3	2	1	11

University	Arizona State University
TRIF Investment Area	Space Exploration and Optical Solutions
Program Name	Interplanetary Initiative

Problem Statement

Humankind is compelled to explore space and will have a space future. Most efforts to prepare for this space future are aimed toward incremental science in narrow disciplines. They struggle to cope with the larger picture or, alternatively, only look at the larger societal impacts without being connected to real scientific endeavors. However, humankind's space future requires fusing disciplines together for these efforts to succeed.

Program Description

The interplanetary Initiative is transforming both how we educate the next generation and how we fundamentally conduct research while finding common cause in an essential challenge for humanity: our space future. Space exploration is a compelling, freeing vehicle for ideation about the future of society and education. To build a positive space future, people will need to embrace and know how to tackle unsolved problems. ASU is uniquely prepared to create thoughtful, communicative, transdisciplinary teams including scientists, engineers, psychologists, sociologists, artists, public relations experts, historians and beyond. The interplanetary Initiative is creating and implementing novel pan-university learning programs centered on open inquiry and launching new research driven by interdisciplinary teams tackling some of the biggest questions about space exploration. The implementation and scaling of our unique teaming and learning processes will make problem-solving and knowledge creation accessible to all of society.

What is the University's Advantage and/or Anticipated Funding Opportunities?

The Interplanetary Initiative helps ASU drive forward (and ultimately scale) new models of learning and research that support an inclusive and sustainable space future. The program also explores new organizational models for advancing ASU's mission. The initiative's experimental processes and programs, in addition to the interdisciplinary and cross-sector community of thought leaders which it has nurtured and grown, puts ASU in a competitive position for high-impact partnerships and funding opportunities in the space sector, such as its partnership with XPRIZE.

Is there an Arizona Specific Benefit or Impact?

The initiative's novel learning programs, such as its Technological Leadership B.S. and the OpenCitizen program, will directly benefit learners and businesses based in Arizona. For example, OpenCitizen meets learners wherever they are — in the home or the workplace — and connects their learning experience to what matters most to them in their communities. OpenCitizen's local problem solving focus benefits Arizona by empowering its citizens to make positive changes in their community while gaining new skills. The Technological Leadership B.S., which has just completed its first year and offers a radically different learning experience in which students direct their own learning through research processes, enrolled 18 students living in Arizona. Moreover, the Interplanetary Initiative strengthens ASU's relationships with the robust aerospace industry in Arizona though workforce development and research partnerships.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$133,333	$133,333	$133,333	$400,000
Applied Research	$133,333	$133,333	$133,333	$400,000
Development	$133,333	$133,333	$133,333	$400,000
Total	$400,000	$400,000	$400,000	$1,200,000

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	2	2	2	169
Graduate Students	6	6	6	18
Undergraduate Students	64	67	71	202
Sponsored Project Funding	$5,089,714	$5,344,200	$5,611,410	$16,045,324
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

University	Arizona State University
TRIF Investment Area	Space Exploration and Optical Solutions
Program Name	Interplanetary Initiative

Progress Summary

Empowered by TRIF support, the Interplanetary Initiative advanced new models to prepare humankind for a space future. We sustained a broad learning portfolio, with strong retention in Tech Leadership degrees, expanded research pathways for undergraduates, and created high school engagement via OpenCitizen and early development of a space-focused Universal Learner Course. The Interplanetary Lab exceeded engagement goals, added projects, and marked its fifth anniversary while leveraging ~$8M in infrastructure and process development. Faculty, students and partners advanced a robust pilot project portfolio, supported by improved milestone tracking and evaluation for scale-up. Our Space-Edge accelerator, a 12-week program to propel businesses into the space economy, completed its first cohort with 17 teams. Our ASU Space Collective convened 300 leaders at the Arizona Space Summit to strategize on Arizona's space economy. Finally, we expanded our reach with Space for Humans on YouTube. We exceeded digital engagement targets across social media, newsletters, and web platforms, amplifying inclusive futures in space and on Earth.

How has the problem statement been addressed in the last year by this TRIF project?

We addressed the challenge of preparing for humankind's space future, which requires fusing disciplines rather than working in silos, by engaging over 1,000 learners from K–12 through professional levels. Tech Leadership degrees sustained high retention while shifting toward a space-focused curriculum, and the undergraduate research program expanded into the Interplanetary Lab, linking STEM training with live mission projects. The Lab added 80 students and five clubs, serving as a hub for many pilot research projects. We advanced over a dozen interdisciplinary projects, collaborating with 70+ organizations, the Space-Edge accelerator and the Arizona Space Summit. Seven major initiatives bridged education, research and industry, reaching 10,000+ people through in-person events and digital channels. The launch of Space for Humans further connected societal benefit with scientific endeavor, ensuring the human dimension remains linked with technical progress.

What, if anything, hasn't worked as well as was hoped?

Challenges center on sustaining enrollment growth in Tech Leadership degrees, which we are addressing through new curricular changes to make the program more space-focused. Professional learning courses generated strong interest but limited conversions from digital marketing; we are shifting to high-touch, network-based recruitment. Pilot projects made steady progress but have not yet secured follow-on funding; each is being evaluated for scale-up while engaging new collaborators. The Interplanetary Lab exceeded engagement goals but fell short of revenue and fundraising targets, prioritizing external contracts and proposals. Engagement programs like Space for Humans and the Arizona Space Summit set strong baselines but need broader audiences and sponsorship to expand impact.

Describe the Arizona benefit or impact of this TRIF project for the last year.

We strengthened Arizona's role in the space economy by convening the third Arizona Space Summit, bringing together 300 leaders statewide and producing a report to guide strategy. Our Arizona-based Space-Edge accelerator completed its first cohort with 17 teams, including local companies. We hosted the annual Space Futures Convening, which brought top experts to Arizona to work with local stakeholders on long-term development goals. We also engaged educators by launching a summer institute that provided middle and high school teachers across multiple counties with professional development. These efforts position Arizona as a hub for space innovation, entrepreneurship and education.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$133,272	$133,851	$127,775	$133,397	$528,295
Applied Research	$133,272	$133,851	$127,775	$133,397	$1,339,771
Development	$133,272	$133,851	$127,775	$133,397	$528,295
Total	$399,816	$401,553	$383,326	$400,191	$1,584,886

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	1	1	1	0	3
Graduate Students	4	4	7	2	17
Undergraduate Students	18	18	12	13	61
Sponsored Project Funding	$5,522,827	$953,655	$4,478,246	$3,913,637	$14,868,365
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

University	Arizona State University
TRIF Investment Area	Space Exploration and Optical Solutions
Program Name	Research Development

Problem Statement

Increasing the diversity, reach, quality and impact of ASU's faculty, staff and student research activities contributes to the strength of our regional economy and improves our national standing in higher education.

Program Description

Research Development is responsible for increasing the size of ASU's research enterprise through a community of practice around early positioning and competitiveness of proposals for funding from federal agencies. This is accomplished through strategic intelligence of funding opportunities and improved teaming, outreach and training during research-related events, transparent and equitable management of limited funding opportunities and internal seed grants programs, and professional proposal management for large and complex funding proposals.

What is the University's Advantage and/or Anticipated Funding Opportunities?

Research Development is responsible for dissemination of hundreds of limited funding opportunities to the university, providing hundreds of documents in support of strategic decision-making for leaders, bringing together hundreds of researchers to discuss competitive funding solicitations, and supporting millions of dollars' worth of proposals from ASU. This work increases the overall ability of ASU to reach aggressive goals for research expenditures.

Is there an Arizona Specific Benefit or Impact?

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$22,989	$22,989	$22,989	$68,967
Applied Research	$22,989	$22,989	$22,989	$68,967
Development	$22,989	$22,989	$22,989	$68,967
Total	$68,967	$68,967	$68,967	$206,902

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	169
Graduate Students	0	0	0	0
Undergraduate Students	3	3	3	9
Sponsored Project Funding	$40,000,000	$42,000,000	$44,100,000	$126,100,000
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

University	Arizona State University
TRIF Investment Area	Space Exploration and Optical Solutions
Program Name	Research Development

Progress Summary

Research Development (RD) advances ASU's mission and benefits Arizona by supporting strategic research initiatives across the university and in collaboration with institutions within the state and nationwide. The office has played a critical role in securing some of the most competitive and high-value research awards in Arizona's history, including major wins in sustainability, microelectronics, semiconductors, and areas aligned with state and national priorities. In addition to supporting research teams in the development and execution of complex proposals, RD offers a robust calendar of events that connect researchers with funding agencies and equip them with the tools to create competitive submissions. The office delivers timely, actionable analyses of the funding landscape and emerging trends, enabling ASU to remain responsive to evolving priorities. RD also manages institutionally limited solicitations, prestigious national nomination competitions and multiple internal seed grant programs that catalyze early-stage research and interdisciplinary collaboration.

How has the problem statement been addressed in the last year by this TRIF project?

In the past year, RD has strengthened ASU's grant readiness by offering targeted programming, expert services and strategic proposal support. RD hosted 31 events engaging more than 1,246 stakeholders. Nine events focused on competitive national funding programs, 11 provided strategic collaboration planning and 11 provided training on best practices for writing and submitting proposals. These events, widely promoted across ASU, helped faculty engage with funding opportunities early and strategically. RD's weekly funding newsletter, distributed to more than 3,379 subscribers, ensured broad, timely access to upcoming opportunities. This past year, Limited Submissions distributed nearly 140 funding solicitations through the RD newsletter and direct outreach. A total of 222 applicants engaged with these opportunities, resulting in 164 approved submissions to sponsors, representing approximately $1 billion in potential funding. RD uses the same highly efficient and successful system to manage many other opportunities, including prestigious national nominations and internal seed grants that are part of the ASU Mayo Clinic Alliance. RD also supported 24 large-scale proposals totaling nearly $380 million and developed 36 custom graphics for 16 of these submissions. Editing support was provided for 220 projects, including grant proposals, manuscripts, and book proposals. In the area of space exploration, RD supported the editing of one journal manuscript and two proposals totaling $470,000.

What, if anything, hasn't worked as well as was hoped?

Describe the Arizona benefit or impact of this TRIF project for the last year.

RD supports ASU faculty in securing competitive federal funding from agencies such as NASA, enabling Arizona-based researchers to lead cutting-edge space science and technology initiatives. By providing proposal strategy, editing and management support, RD helps faculty strengthen their grantsmanship and enhance their competitiveness for high-profile programs. These efforts position Arizona as a leader in the national space research ecosystem, attract federal investment to the state and drive innovation that supports local industries and inspires the next generation of scientists and engineers.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$30,059	$37,057	$29,739	$35,763	$132,618
Applied Research	$30,059	$37,057	$29,739	$35,763	$1,138,924
Development	$30,059	$37,057	$29,739	$35,763	$132,618
Total	$90,177	$111,171	$89,217	$107,289	$397,854

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	0	0	0
Graduate Students	0	0	1	0	1
Undergraduate Students	0	0	1	0	1
Sponsored Project Funding	$300,000	$5,000,000	$0	$0	$5,300,000
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

University	Arizona State University
TRIF Investment Area	Space Exploration and Optical Solutions
Program Name	Space Technology and Science Initiative (NewSpace)

Problem Statement

Morgan Stanley predicts that by 2040, the space economy will be over $1 trillion. The exponential growth in the commercial space industry provides an enormous opportunity for universities to partner with commercial space companies. ASU's expertise in space science and technology and a growing commercial space industry presence provide multiple entry points for partners to engage and see mutual benefits. NewSpace works across the university on numerous commercial space projects, including satellite communication and ground stations, DOD space opportunities, continued growth in NASA funding, development of a spaceport in Arizona, space industry presence on campus, commercial remote sensing projects for Arizona, and ASU exposure at industry events.

Program Description

The ASU Space Technology and Science ("NewSpace") Initiative was established in 2013. The Initiative was designed to develop and integrate the commercial space industry with the space science and technology community at ASU. Leveraging heritage experts from ASU for space and space relevant science and technology growth, we have been successful in securing a number of new space-related projects on campus, including a NASA-funded deep space satellite mission to orbit the Moon for mapping of lunar polar hydrogen and other programs focused on space-related sensors, instruments and spacecraft systems. ASU NewSpace is supporting the growth of the Arizona space industry through ASU student capstone programs, the establishment of a space business entrepreneurship course for students, and partnerships with industry to enable access to the unique space-relevant facilities available on campus. We also focus on developing an ASU-led satellite communication and tracking ground station, smallsat instrument development and technology advancement, industry sponsored senior design/capstone course growth, and Arizona NASA Space Grant mentorship.

What is the University's Advantage and/or Anticipated Funding Opportunities?

ASU has over 300 investigators that submit proposals to NASA and other space-related funding sources. Leveraging and growing this space researcher cohort has been a focus at ASU NewSpace. Incorporating our 400+ industry partners into funding proposal development, we directly enabled the submission of over $60 million in proposals to federally sponsored opportunities in FY21, leading to over $1.5 million in awards last year. We forecast that through ASU NewSpace there will continue to be growth in proposals annually of $40-$75 million, along with an increase in our win rate on awards.

Is there an Arizona Specific Benefit or Impact?

Yes. ASU NewSpace has cultivated relationships with more than 60 Arizona-based companies or institutions in the space industry. These industry relationships have resulted in multiple sub-contracts to NASA-funded projects, multiple ASU senior design/capstone projects and multiple public-facing events through organizations like AZ Commerce Authority, the City of Tempe, the Greater Phoenix Economic Council, AZ Tech Council and others. These benefits and impact will continue to grow as ASU NewSpace expands its ability to assemble ASU experts and commercial space industry partners to pursue new funding opportunities. These efforts will enable deep relationships to benefit the students, faculty and facilities at ASU along with the growing Arizona space industry.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$0	$0	$0	$0
Applied Research	$200,000	$200,000	$200,000	$600,000
Development	$200,000	$200,000	$200,000	$600,000
Total	$400,000	$400,000	$400,000	$1,200,000

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	1	169
Graduate Students	6	9	9	27
Undergraduate Students	40	42	44	126
Sponsored Project Funding	$1,500,000	$2,500,000	$4,000,000	$8,000,000
Publications in Academic Peer-Reviewed Journals	1	1	2	4
Startups	0	0	1	1

University	Arizona State University
TRIF Investment Area	Space Exploration and Optical Solutions
Program Name	Space Technology and Science Initiative (NewSpace)

Progress Summary

In FY25, the ASU Space Technology and Science (NewSpace) Initiative significantly advanced Arizona's standing as a space industry leader by expanding strategic partnerships, securing major research awards and enhancing national visibility. ASU/NewSpace exhibited at key industry conferences, engaging thousands and showcasing ASU's research and workforce capabilities. ASU/NewSpace leadership within the AZ Technology Council, the Commercial Space Federation (CSF) and the AZ Space Commission strengthened policy awareness and industry connections, including hosting a CSF Industry Day in D.C. and leading the CSF Space Exploration Council. Key research collaborations with AZ space industry partners resulted in significant awards and proposals from USSF and NASA. These efforts underscore ASU's role in fostering innovation, developing a skilled workforce and solidifying Arizona's position at the forefront of the national space economy.

How has the problem statement been addressed in the last year by this TRIF project?

In FY25, ASU/NewSpace advanced Arizona's position as a hub for the commercial space industry by strengthening partnerships, expanding research collaborations and elevating ASU's visibility. Through deliberate alignment with industry and government priorities, we helped catalyze competitive awards, workforce development and state-level strategic positioning. In FY25 ASU/NewSpace directly supported 21 proposals for $66.3M for Arizona, with $22.3M in awarded projects. ASU/NewSpace exhibited at major conferences reaching thousands of industry leaders, innovators, students and policymakers. Specifically, at SmallSat 2024, ASU/NewSpace engaged more than 500 visitors around Arizona's growing satellites sector. At the American Geophysical Union meeting, over 1,000 visitors connected with ASU faculty in planetary science and technology. And at the 40th Space Symposium, ASU/NewSpace showcased alongside AZ firms PADT, Blackstar, Qwaltec and KinetX, drawing 1,500+ visitors and underscoring the state's integrated industry-academia presence in the space sector. Strategic engagement in FY25 has further deepened ASU's space industry leadership. For example, ASU/NewSpace director Jim Bell was appointed by Governor Hobbs to the newly reconstituted AZ Space Commission. ASU/NewSpace co-chaired the AZ Technology Council's Aerospace, Aviation, Space, and Defense (AASD) Committee and sustained its role as the only academic Executive Member of the CSF, hosting an Industry Day in D.C., convening 30 member companies, and moderating a national policy panel with over 300 attendees. Additional milestones included a FreeFall Aerospace MOU and a Space Force Association employer event connecting AZ companies with more than 50 ASU students. Faculty advanced federally funded collaborations with Rocket Lab, Astrobotic and Lunar Outpost ($100K for Mars and lunar technologies); Planet Labs ($1.6M for climate and infrastructure projects); Alphacore ($85K for detectors); Solestial and RIT ($3M for photovoltaics); and Qwaltec and Radiation Monitoring Devices ($1.4M for lunar sensors).

What, if anything, hasn't worked as well as was hoped?

Describe the Arizona benefit or impact of this TRIF project for the last year.

In FY25, ASU/NewSpace continued to advance Arizona's role as a destination and partner for the space industry, strengthening over 10 federally funded industry partnerships, broadening to over 25 research collaborations and elevating ASU's national visibility at leading conferences and consortia directly to over 3,000 participants. These accomplishments reflect a deliberate alignment of university strengths with space industry and government priorities, helping catalyze workforce development, major awards and long-term strategic positioning for the state.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$0	$0	$0	$0	$0
Applied Research	$200,101	$249,706	$249,999	$274,922	$1,548,125
Development	$200,101	$249,706	$249,999	$274,922	$974,728
Total	$400,202	$499,412	$499,998	$549,844	$1,949,456

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	1	1	2
Graduate Students	8	11	16	16	51
Undergraduate Students	48	46	41	62	197
Sponsored Project Funding	$1,211,333	$3,219,408	$37,997,087	$20,529,282	$62,957,110
Publications in Peer-Reviewed Journals	0	1	2	10	13
Startups	0	0	0	0	0

University	Arizona State University
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Center for Bio-mediated and Bio-Inspired Geotechnics (CBBG)

Problem Statement

Through the Center for Bio-mediated and Bio-Inspired Geotechnics (CBBG), Arizona State University is the international leader in appling the emerging field of biogeotechnics to develop sustainable and resilient geotechnical solutions for civil infrastructure systems. Through direct application of and by mimicking biological processes abiotically, CBBG seeks to reduce the life cycle costs and environmental and social impacts of construction, operation, and maintenance of infrastructure systems that build on, in, and with earthen materials.

Program Description

Led by ASU, CBBG is a National Science Foundation Gen-3 Engineering Research Center and includes three other leading public Universities: Georgia Institute of Technology, New Mexico State University and the University of California at Davis. CBBG has four technological thrusts: Geological Hazard Mitigation; Environmental Protection and Ecological Restoration; Infrastructure Construction Methods and Materials; and Subsurface Exploration and Excavation. CBBG also has a focus on Innovation, Diversity and Inclusion, and Education that includes a robust K-12 outreach program and a Research Experience for Teachers (K-14) program that has a strong emphasis on participants from underrepresented groups.

What is the University's Advantage and/or Anticipated Funding Opportunities?

ASU is uniquely suited to lead CBBG because of its emphasis on transdisciplinary and use-inspired research, sustainable development, local impact and social embeddedness, and global outreach. With its focus on bio-mediatation, bio-inspiration and earthen (geologic) materials, CBBG research is by nature a transdisciplinary endeavor. Its progress is facilitated by ASU's ability to foster and support interdisciplinary work. All CBBG projects must be targeted towards sustainable development of civil infrastructure, i.e., must be use-inspired, whether it be focused on fundamental knowledge development or integration of a new technology into civil infrastructure systems. And all CBBG projects must be supported by a life cycle sustainability assessment (LCSA) that documents potential contributions of the project to the triple bottom line of social, environmental and financial benefit.

Is there an Arizona Specific Benefit or Impact?

TRIF support for CBBG has many direct and indirect benefits for Arizona. Direct benefits include research on problems of major importance to the health and well-being of Arizona citizens such as fugitive dust control and remediation of groundwater impacted by chlorinated solvents, education and training for Arizona's engineering workforce, training and curriculum development for local K-14 schools, and entrepreneurial opportunities for startup businesses. Indirect benefits for Arizona not only include contributions to sustainability and resilience of civil infrastructure systems across the U.S. and worldwide but also research on global problems of concern to major Arizona-based industries such as mitigation of the impacts of mining on groundwater and enhanced management of methane emissions at landfills.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$400,000	$400,000	$400,000	$1,200,000
Basic Research	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0
Development	$0	$0	$0	$0
Total	$400,000	$400,000	$400,000	$1,200,000

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	4	4	4	169
Graduate Students	19	20	20	60
Undergraduate Students	12	12	13	37
Sponsored Project Funding	$2,205,548	$2,315,826	$2,431,617	$6,952,991
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

University	Arizona State University
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Center for Bio-mediated and Bio-Inspired Geotechnics (CBBG)

Progress Summary

TRIF was used to support a variety of activities in the last year of the 10-year NSF funding window for CBBG. Significant TRIF expenditures included salary support far the industrial liaison officer and project coordinator for facilitation of the weekly CBBG seminar series and for the education director emeritus for support of the summer Research Experience for Teachers/Research Experience for Undergraduates/Young scholar programs. TRIF also funded maintenance and repair of laboratory and field equipment used in the summer programs and in the research project on mitigation of fugitive dust. The largest TRIF expenditure was support of the Year 9 Annual Meeting at Georgia Tech, necessitated after NSF unexpectedly directed CBBG to hold the annual meeting at a partner university rather than at ASU as done for the previous eight Annual Meetings.

How has the problem statement been addressed in the last year by this TRIF project?

CBBG continued the development of cost-effective and environmentally protective bio-mediated and bio-inspired technologies for infrastructure construction, natural hazard mitigation, environmental protection and ecological restoration. The International Conference on Bio-mediated and Bio-inspired Geotechnics, held at ASU in May 2025, clearly established ASU as the world leader in this emerging field of biogeotechnical engineering.

What, if anything, hasn't worked as well as was hoped?

Translation of CBBG technologies to practice has been slower than anticipated. This has been attributed to the risk-averse nature of municipal agencies. However, progress has been made in this respect and industrial partners have begun to show interest in CBBG technologies. Development and implementation of the CBBG biogeotechnologies for both municipal and commercial partners will continue even after the end of NSF funding for center administration.

Describe the Arizona benefit or impact of this TRIF project for the last year.

CBBG developed technologies that addressed several critical problems in Arizona, including fugitive dust control, remediation of groundwater impacted by chlorinated hydro-carbons, and zero-water-loss ground-coupled heat pump systems for large-scale industrial cooling systems. CBBG research on mitigation of fugitive dust, an important Arizona-centric issue, has led to almost $1 million in additional support for a test section on fallow farmland in Pinal County. ASU also recently received an $800,000 award from the Department of Defense for field testing of its fugitive dust mitigation technology in Yuma and development of guidance documents on using this technology. CBBG biocementation technology is gaining traction with commercial partners. ASU recently consummated a licensing agreement for manufacture of biocemented building blocks using the patented CBBG-developed technology that provides a cost-effective and sustainable (low carbon) alternative to some of the 1.3 billion blocks manufactured in the U.S. annually using portland cement. CBBG research on ground-coupled heat pumps, a zero water loss system for industrial facilities, is attracting interest among local industries with large cooling loads (e.g., data centers). CBBG also continued its efforts to build the Arizona workforce with graduates schooled in development of sustainable and resilient civil infrastructure and to reach out to K-12 schools and community colleges to inspire a new generation of geotechnical professionals. By the end of Year 10, CBBG programs had reached over 13,000 students and 4,000 teachers through over 400 outreach events, including lab tours, museums, science centers and exchange programs. An average of 28 people per year have participated in the CBBG Research Experiences for Teachers, Research Experiences for Undergraduates and Young Scholars (for high school students) programs. More than 10,000 individuals attended over 350 webinars, seminars and workshops.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$195,572	$281,075	$166,257	$193,283	$836,187
Basic Research	$0	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0	$1,073,102
Development	$0	$0	$0	$0	$0
Total	$195,572	$281,075	$166,257	$193,283	$836,187

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	2	2	3	1	8
Graduate Students	20	24	23	13	80
Undergraduate Students	17	18	28	17	80
Sponsored Project Funding	$4,410,534	$2,776,910	$3,273,312	$2,146,609	$12,607,365
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

University	Arizona State University
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Collaborative Research Infrastructure and Core Facilities

Problem Statement

As the state of Arizona positions itself to be a leader in the research areas targeted by TRIF, it is imperative that we maintain and enhance our core infrastructure that supports these initiatives. We have taken steps toward developing a statewide network to promote awareness of shared resources across the state. We have leveraged federal funding to the extent possible to secure advanced and highly specialized technologies. Just as important are our fundamental capabilities and personnel that form the backbone of our core infrastructure. TRIF funding is an essential component of our overall funding strategy to maintain an appropriate refresh rate of these broadly-impactful fundamental capabilities.

Program Description

Core Facilities mission: To facilitate the expansion and enhancement of ASU's research enterprise by providing technical and scientific services to support faculty research objectives and enable success. Strategy: 1. Maintain state-of-the-art facilities and expert staff to support technologies and applications aligned with ASU's strategic research goals. 2. Provide effective access (physical, financial, training, workflows) and maintain customer-focused orientation. 3. Increase awareness of capabilities through marketing, communications and promotional efforts. 4. Engage industry and non-profit partners to fully leverage resources and maintain fiscal sustainability.

What is the University's Advantage and/or Anticipated Funding Opportunities?

ASU is uniquely poised to advance research and secure external funding in key areas that are enabled largely by core facilities. Given federal funding initiatives, our geographical location, and strength in advanced materials, solar, power electronics and other related areas, there is significant opportunity for expanding partnerships within the semiconductor industry as companies establish a presence in the Phoenix metro area. These will be supported by our NanoFab, Eyring Materials Center, Advanced Electronics and Photonics, and Solar Fab facilities. In addition to funding in the semiconductor space, ASU's strong clinical partnerships with multiple health care organizations provides a unique opportunity to competitively pursue National Institutes of Health funding through the Clinical and Translational Science Award program, including our ability to understand the nature of diseases such as COVID-19 and respond with new diagnostics, vaccines and therapeutics depends on us having the most current tools at our disposal for investigating these problems.

Is there an Arizona Specific Benefit or Impact?

By nature, core facilities train a high volume of university students, staff and faculty, as well as industry partners, and thereby contribute significantly to hands-on workforce development. Many of our student trainees move on to work in local industry as scientists and engineers, utilizing the skill sets they develop under our training programs.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$1,600,000	$1,600,000	$1,600,000	$4,800,000
Basic Research	$670,128	$670,128	$670,128	$2,010,383
Applied Research	$670,128	$670,128	$670,128	$2,010,383
Development	$670,128	$670,128	$670,128	$2,010,383
Total	$3,610,383	$3,610,383	$3,610,383	$10,831,149

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	159	167	175	169
Graduate Students	696	731	731	2195
Undergraduate Students	332	349	366	1047
Sponsored Project Funding	$61,072,281	$64,125,895	$67,332,189	$192,530,365
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	5	6	6	17

University	Arizona State University
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Collaborative Research Infrastructure and Core Facilities

Progress Summary

ASU'S Knowledge Enterprise Core Facilities have continued to remain agile to adapt to the evolving landscape of research and industry collaborations. Over FY25, we have seen significant growth in microelectronics and health-related utilization, while other areas such as advanced materials and biosciences remained steady. A total of 724 ASU students, staff and faculty were trained during a total of 1,591 training sessions. Core Facilities supported a total of 525 sponsored ASU research projects with total expenditures of $87 million, while also supporting 93 Arizona-based companies.

How has the problem statement been addressed in the last year by this TRIF project?

Investments have been focused on target areas aligned with federal funding and industry partnership opportunities. We have continued to monitor areas of capital equipment infrastructure risk and have also targeted those for proactive refresh.

What, if anything, hasn't worked as well as was hoped?

Investments in solar cell development and testing capabilities have been juxtaposed to trends in federal investment. We are evaluating and preparing to realign to shifting federal priorities.

Describe the Arizona benefit or impact of this TRIF project for the last year.

By far, the largest areas of impact on Arizona have been microelectronics and health. Both are key facets in strengthening Arizona's economy while improving quality of life for Arizonans. By providing services and equipment to 93 Arizona companies, we enhance their capabilities, competitiveness and potential to grow the state economy.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$4,000,000
Basic Research	$670,128	$870,551	$870,127	$870,127	$3,280,933
Applied Research	$670,128	$870,551	$870,127	$870,127	$2,613,357
Development	$670,128	$870,551	$870,127	$870,127	$3,280,933
Total	$3,010,384	$3,611,653	$3,610,381	$3,610,381	$13,842,799

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	139	142	103	0	384
Graduate Students	594	656	615	0	1865
Undergraduate Students	274	313	334	0	921
Sponsored Project Funding	$61,102,505	$76,391,393	$83,944,915	$87,675,497	$309,114,310
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

University	Arizona State University
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Global Futures Laboratory Programming

Problem Statement

The Emergence of the Julie Ann Wrigley Global Futures Laboratory at ASU is rooted in the conviction that we can and must make a meaningful contribution to ensuring a habitable planet and a future in which well-being is attainable for all mankind. This laboratory draws from ASU's deep commitment to use-inspired research, our ongoing work in sustainability and service to the global community in which we live. We are running out of time on many fronts, and need to address problems with urgency, sometimes within only a few years or decades. Water, Energy and Environmental Systems are key drivers to a more sustainable future.

Program Description

This laboratory draws from ASU's deep commitment to use-inspired research, our ongoing work in sustainability and service to the global community in which we live. TRIF funding supports multiple programs focused on new energy systems, decisions systems and water related research.

What is the University's Advantage and/or Anticipated Funding Opportunities?

The Julie Ann Wrigley Global Futures Laboratory leverages the tools and expertise of transdisciplinary research institutes, centers and facilities across ASU to generate new ideas and solve problems. We work in networks and in close exchange with the people affected by problems to combine knowledge and develop solutions on multiple scales. Our New Energy Systems efforts — carbon capture, synthetic fuels, energy transition — have funding opportunities from the Department of Energy (DOE), Carbon Collect and National Science Foundation (NSF). Our Decisions Systems project — complex systems thinking, convergence research, data visualization and modeling — may attract funding from State Department/USGS, Helios Foundation, Rockefeller Foundation and DOE. Our Water research — building on the Action for Water Equity (AWE) NSF award to create a center-level effort — may draw additional investment from the NSF.

Is there an Arizona Specific Benefit or Impact?

Multiple AZ specific benefits and impacts exist through this programming, including: New Energy Systems: - Commercializing (manufacture and deployment) of the mechanical trees in Arizona. - Through federal grants and local funding, develop technology, partnerships and investment base to support hydrogen and synthetic fuels industry in Arizona. - Working through partnerships that include, Arizona Thrives, the Navajo Nation, APS, SRP, and local NGOs support the economic transition from coal to alternative energy sources including support to affected communities. - Grow the Just Energy Transition Center as the primary mechanism for creating opportunities for redevelopment in rural and tribal communities.
Decision Systems: - Leverage and expand recent Decision Theater work involving the integration and analysis of food, energy, and water supply chains to develop a scalable prototype initially focused on Maricopa County with the objective of building economic system reliance able to sustain the Continuity of the Economy (COTE) in the face of significant human-induced or natural disasters (e.g. the consequence of cyberattacks). - Partner with cognizant national topic leaders and integrate the perspectives and data of faculty, State, County, and industry leaders, with the goal to attract approximately $10 million in funding while establishing Arizona as a U.S. leader in efforts to develop economic resilience and sustain continuity of the economy in the face of major disruptions.
Water: - Significantly expand ASU water initiatives including western water resilience and innovation ecosystem by engaging more than 100 faculty and attracting $25 million in external funding with the goal of improving water sustainability and bringing jobs and greater water access and equity to urban and rural communities.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$0	$0	$0	$0
Applied Research	$2,643,000	$2,643,000	$2,643,000	$7,929,000
Development	$1,321,500	$1,321,500	$1,321,500	$3,964,500
Total	$3,964,500	$3,964,500	$3,964,500	$11,893,500

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	44	46	49	169
Graduate Students	217	228	228	684
Undergraduate Students	148	156	163	467
Sponsored Project Funding	$25,819,327	$27,110,293	$28,465,808	$81,395,428
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	2	2	2	6

University	Arizona State University
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Global Futures Laboratory Programming

Progress Summary

Throughout FY25, the Global Futures Laboratory at ASU continued to deliver Arizona-focused solutions in water, energy and environment, directly benefiting communities, industry and government. The Arizona Water Innovation Initiative advanced four community projects and launched the Arizona Water Files series to strengthen statewide water literacy. Researchers piloted a closed-loop brine recovery to reduce desalination waste in metro Phoenix, while partnering with Arizona Department of Environmental Quality on a multi-agency initiative to monitor and address harmful ozone pollution. ASU secured $11.2M — plus $11.2M match — from the Department of Energy to launch the Southwest Direct Air Capture Hub, positioning Arizona as a leader in carbon removal and clean-air innovation. Decision Theater's CuRVE tool advanced complex decision-making by visualizing Colorado River shortage scenarios for utilities, tribes and industries.

How has the problem statement been addressed in the last year by this TRIF project?

The problem statement calls for urgent, use-inspired action to ensure a habitable future. In FY25, the Global Futures Laboratory delivered such action through community deployment, scientific measurement and decision support. In terms of water resilience, The Arizona Water Innovation Initiative funded four community-driven projects and launched an effort to translate complex policy into practical guidance for residents. To stretch existing water supplies, ASU and partners are piloting a system to reduce desalination waste streams in metro Phoenix. Recognizing ozone as a rising public-health risk, ADEQ and ASU launched a coordinated ground-level ozone research initiative for Maricopa and parts of Pinal counties. ASU and collaborators received $11.2M in federal funding — plus matching — to develop a Southwest Direct Air Capture Hub. Decision Theater's CuRVE platform translated complex Colorado River scenarios into interactive visuals so Arizona cities, tribal nations, farmers and industries can plan for shortages. Together, these advances connect use-inspired research to deployments, policy-ready evidence and decision tools, directly addressing the lab's charge to act within years to decades on water, energy and environmental risks in Arizona.

What, if anything, hasn't worked as well as was hoped?

While the Global Futures Laboratory made strong advances, several efforts remain in progress. The Southwest Direct Air Capture Hub is still in planning, with no capture facilities yet operating. The closed-loop brine recovery pilot showed promise but faces cost and waste-management hurdles before wide adoption. Finally, Decision Theater/CuRVE equips stakeholders with scenarios, but actual outcomes depend on broader political, economic and hydrological forces beyond the tools themselves.

Describe the Arizona benefit or impact of this TRIF project for the last year.

TRIF investments helped turn science into direct benefits for Arizona families, farmers and businesses — cleaner air, smarter water use and a stronger economy. Community grants and the Arizona Water Files raised water literacy while funding local projects across towns statewide. A Phoenix-area brine-recovery pilot showcased how to improve water reuse. ADEQ–ASU ozone research targets hyperlocal drivers of unhealthy air in Maricopa and Pinal counties, informing near-term mitigation to protect residents. Direct Air Capture Hub planning seeded Arizona's role in CO_2 removal, jobs and supply chains. Decision Theater/CuRVE equipped Arizona utilities, tribes and growers to navigate Colorado River shortages with data-driven choices. ASU's Futures Engine awarded $1.5M in funding to eight startups, including three Arizona-based ones, accelerating breakthrough solutions in water, energy, and CO_2 capture. These companies are already leveraging $16.4M in outside investment, positioning the Southwest, and Arizona, as a leader in emerging markets that drive economic growth, resilience and jobs.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$0	$0	$0	$0	$0
Applied Research	$2,768,412	$2,670,554	$2,725,407	$2,854,352	$6,695,866
Development	$1,384,206	$1,335,277	$1,362,703	$1,412,176	$5,494,362
Total	$4,152,618	$4,005,831	$4,088,110	$4,266,528	$16,513,087

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	40	55	44	63	202
Graduate Students	209	221	233	274	937
Undergraduate Students	136	148	252	209	745
Sponsored Project Funding	$30,970,246	$57,383,206	$38,516,106	$48,116,394	$174,985,952
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

University	Arizona State University
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	MacroTechnology Works Site Development

Problem Statement

In developing a strategy for the MacroTechnology Works (MTW) site, we took on the mission "To become the engine of semiconductor and energy materials and device research in the US and a national resource for advancing new technologies to pilot scale." ASU has developed a model to realize this mission, leveraging the MTW site and the unique facilities and equipment available there to enable a collaborative university/startup/industry research model. Defining elements for this model include: strong core facilities for democratized research; small "proprietary" faculty and industry labs for unique toolsets; key corporate partners that enhance our capabilities and engage in joint research; a lease + user fees + research collaboration model that provides options that fit the scale of the partner; and undergraduate, graduate, and employee training.

Program Description

The 5 major components of the program are: 1. Strong core facilities provide users with access to capital equipment within the core. This allows industry partners to access non-proprietary toolsets on a fee for service basis, and allows startups and smaller companies access to industry-scale tools. 2. The MTW site has highly configurable space within cleanroom environments that allow small proprietary lab spaces to operate on site. These labs are available as leased spaces for industry partners and are required to also commit to funding research activities. 3. Key corporate partners provide opportunities to enhance access to state of the art tools for materials deposition, etch, and characterization and provide opportunities for industry relevant research activities. 4. Engaging with companies at various scales is enabled via a scalable model that engages partners in leased space, core facilities usage, and research collaboration that provides a win-win opportunity for ASU researchers to participate in value added research that aligns with industry needs. 5. Undergraduate, grad student, and post doc participation in research projects and training on industry relevant tools helps to prepare the next generation semiconductor workforce.

What is the University's Advantage and/or Anticipated Funding Opportunities?

With recent announcements of new semiconductor fabs being built in the valley, Arizona has an opportunity to become the hub of semiconductor research and innovation in the U.S. ASU has a robust pipeline of semiconductor research and has key partnerships in place to expand the ecosystem in Arizona. ASU researchers engaged in programs at MTW are currently funded at ~$25 million per year, and we expect federal and industry funding for semiconductors to grow. Our projections are amplified by the federal requests for funding via the CHIPS act which addresses supply chain shortages in the wake of the COVID pandemic. ASU is expecting to participate in a number of large scale opportunities related to manufacturing and supply chain working with Arizona industry partners including a NIST-sponsored Manufacturing USA Institute and a DOD-sponsored National Network for Microelectronics Research and Development.

Is there an Arizona Specific Benefit or Impact?

There are several impacts to Arizona. Research activities at ASU can be tied directly in intellectual property (IP) generation and oftentimes to startup companies, jobs and wealth creation. ASU is engaged with eight Arizona-based startups at MTW already. Student engagement in research opportunities provides experiential learning and results in better trained employees. With recent announcements of new fab facility construction in the state there is a heavy demand for employees in the semiconductor industry, well beyond the needs within the fabs as suppliers across the supply chain also increase staffing.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0
Development	$1,000,000	$1,000,000	$1,000,000	$3,000,000
Total	$1,000,000	$1,000,000	$1,000,000	$3,000,000

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	5	5	5	169
Graduate Students	20	20	20	60
Undergraduate Students	0	0	0	0
Sponsored Project Funding	$30,000,000	$33,000,000	$37,000,000	$100,000,000
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	9	11	12	32

University	Arizona State University
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	MacroTechnology Works Site Development

Progress Summary

In FY25, the MacroTechnology Works (MTW) site has made great strides in advancing our mission to become a premier semiconductor and energy materials and device research location in the U.S., as well as a national resource to speed new technologies to the pilot scale. For instance, the Applied Materials (AMAT), Materials To Fab construction of Phase 1 has been completed and we have started to place AMAT 300mm wafer processing tools. We also accelerated our research programs with AMAT. We expanded upon our $100 million, Department of Defense-funded Microelectronics Commons Southwest Advanced Prototyping Hub (SWAP Hub) with a Department of Commerce-funded project focused on organic packages. The Substrate-based Heterogeneous Integration Leadership Demonstration for the USA (SHIELD USA) is another 5 year, $100 million project that expands upon capabilities at the MTW site. The two core facilities on site — Solar Fab and Advanced Electronics and Photonics facilities — have seen continued growth this year, with $1,647, 854 of total sales in FY25, representing 27% year-over-year growth.

How has the problem statement been addressed in the last year by this TRIF project?

We continue to support the ecosystem through a service model that includes access to capital equipment and skilled personnel alongside private leased space. Our partnerships with industry and academia to pursue research funding opportunities expand the innovation pipeline, provide students with hands-on experience and bring jobs to Arizona. The SWAP Hub is completing tool installations and growing capabilities offered to the community, and the advanced packaging pilot capability is expected to complete installation and come online at the end of calendar year 2025. SHIELD is similarly bringing additional capabilities online, mainly through developing novel, industry leading capabilities on the existing tools in FY25, and with new tools coming online in FY26.

What, if anything, hasn't worked as well as was hoped?

Describe the Arizona benefit or impact of this TRIF project for the last year.

With two leading edge node manufacturing sites, an ever expanding ecosystem, two $100 million-scale federal awards for microelectronics expansion, and the announcement of the Natcast Advanced Packaging Prototype Facility in the ASU research park, MTW has established the valley as the leading edge of semiconductors in the U.S. This has led to increased interest by the semiconductor industry in Arizona. New industry partners are locating here, current industry partners are expanding, and ASU is expanding our workforce development programs to meet those demands.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$0	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0	$1,073,102
Development	$1,001,818	$1,000,000	$1,000,000	$1,000,000	$4,001,818
Total	$1,001,818	$1,000,000	$1,000,000	$1,000,000	$4,001,818

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	18	16	16	24	74
Graduate Students	217	232	220	279	948
Undergraduate Students	28	0	0	63	91
Sponsored Project Funding	$17,406,135	$18,535,741	$38,547,604	$20,994,366	$95,483,846
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	8	8	0	16

University	Arizona State University
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Materials of the Universe

Problem Statement

Space exploration is now pursued actively in both the private and government sectors. The discovery of complexities in our solar system and of thousands of remarkably diverse exoplanets raises both fundamental and practical questions. To understand planets, we need to combine knowledge from fields ranging from astrophysics to geochemistry to materials science. We need to answer materials-based questions, such as determining the detailed structure, composition and evolution of distant planets based on a few observed properties. At the same time, we need better materials for space exploration — solving problems like finding more sensitive spectroscopic detectors, building more robust space vehicles, and extracting and utilizing extraterrestrial resources.

Program Description

The Navrotsky Eyring Center for Materials of the Universe (MotU) addresses the two challenges above — understanding planets and improving materials for space exploration — by an interdisciplinary program involving about 20 faculty from the School of Molecular Sciences (SMS), the School of Earth and Space Exploration (SESE) the Department of Physics, and the School for Engineering of Matter, Transport, and Energy (SEMTE). A major thermodynamics and high-temperature materials laboratory has been established by the MotU director, Alexandra Navrotsky, who joined ASU in 2019, and further strengthened by the hire of Professor Hongwu Xu, arriving this fall. Four additional MotU faculty positions are planned in the College of Arts and Sciences, with two searches commencing imminently. A major NSF proposal for a high-pressure center has been submitted, thus adding emphasis to materials under extreme conditions relevant to planetary systems — high temperature, high pressure, radiation fields, etc. Faculty in different fields are co-supervising graduate students. Seminars, courses and workshops have been held and are being developed.

What is the University's Advantage and/or Anticipated Funding Opportunities?

ASU has unique strengths in astrophysics, planetary exploration (both orbiters and landers), experimental geochemistry and thermodynamics, electron microscopy and fundamental theory, with a distinguished history of collaboration in solid state science. There are funding opportunities from NSF, DOE, NASA and DOD, and a number of proposals have already been submitted and some funded. A large private gift to support MotU, partly now and partly as a bequest, has been finalized.

Is there an Arizona Specific Benefit or Impact?

With growing high tech and space related industries in Arizona, MotU will have increasing opportunities for collaboration with industry. The growing industrial sector will have access to ASU facilities and uniquely trained students who will function at the interface of space science, physical science and engineering.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$106,667	$106,667	$106,667	$320,000
Applied Research	$106,667	$106,667	$106,667	$320,000
Development	$106,667	$106,667	$106,667	$320,000
Total	$320,000	$320,000	$320,000	$960,000

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	2	2	2	169
Graduate Students	2	2	2	6
Undergraduate Students	0	0	0	0
Sponsored Project Funding	$381,034	$400,085	$420,090	$1,201,209
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

University	Arizona State University
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Materials of the Universe

Progress Summary

In FY25, Materials of the Universe (MotU) produced numerous publications sharing important advances in materials. In particular, our research advanced the understanding of materials for batteries and materials with unusual thermal characteristics, as well as new types of zeolites — materials with cavities that are used industrially in catalysis and separation/purification processes — and deeper knowledge of perovskites, which are materials with great promise in efficient solar energy applications. In addition to the many practical applications of these materials, this research as well as accompanying work in the newly established, fully operational Facility for Open Research in a Compressed Environment (FORCE) will help us understand, in much greater detail, what planets are made of and how they form.

How has the problem statement been addressed in the last year by this TRIF project?

MotU and FORCE research directly address these problems by providing fundamental data, both experimental and computational, essential to understanding planetary chemistry and physics and for developing methodology essential to future space exploration. FORCE can achieve the extreme pressures and temperatures involved in planetary processes, enabling the creation of new models that can be applied to data obtained from planetary observation and analysis.

What, if anything, hasn't worked as well as was hoped?

There have been minor adjustments to experimental procedures to account for various rates of reaction and intermediate reaction products but none of these have required major rethinking. High pressure technology is continuing to be developed and optimized.

Describe the Arizona benefit or impact of this TRIF project for the last year.

With growing high tech and space related industries in Arizona, MotU has increasing opportunities for collaboration with industry. The growing industrial sector will have access to ASU facilities and uniquely trained students who will function at the interface of space science, physical science and engineering. MotU has achieved national and international prominence during its brief existence as evidenced by the awards bestowed upon Professor Alexandra Navrotsky (including a new material named after her), the creation of FORCE as a national facility at ASU, and the ability to attract new faculty of the highest caliber to the center. This focuses the attention of the materials community — and the associated battery, solar and advanced materials industries — on Arizona, making it an increasingly attractive place to locate such activity.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$70,794	$96,729	$106,666	$77,650	$351,839
Applied Research	$70,794	$96,729	$106,666	$77,650	$1,221,546
Development	$70,794	$96,729	$106,666	$77,650	$351,839
Total	$212,382	$290,187	$319,998	$232,950	$1,055,517

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	6	5	6	5	22
Graduate Students	5	7	8	9	29
Undergraduate Students	2	0	0	0	2
Sponsored Project Funding	$444,000	$772,643	$1,697,012	$471,912	$3,385,567
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

University	Arizona State University
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	NSF Nanosystems Engineering Research Center for Off-Grid Nanotechnology Enabled Water Treatment (NEWT)

Problem Statement

The vision of the Nanosystems Engineering Research Center for Nanotechnology-Enabled Water Treatment Systems (NEWT) is to enable access to water of suitable quality almost anywhere in the world by developing next-generation, easy-to-deploy modular treatment systems enabled by nanotechnology. These efforts both protect human lives and support sustainable economic development.

Program Description

NEWT aims to develop new technologies to purify drinking and industrial waters. Initially funded in 2015, we are renewed through 2025. As NEWT approaches self-sufficiency, we are request funding to continue discovery of new treatment technologies that will stimulate the many industrial partners with breakthrough science. This compliments our strong success in industrial members then funding associated projects. Personnel time and material funds will be used to support multiple NEWT faculty on high-risk science that will collect preliminary data for new extramural funding proposals, and funds to demonstrate technology translation using our mobile testbed. The NEWT faculty and student team has been amazingly successful with new patents, start-ups and STTR awards – and having the ability to translate to the testbed has proven essential in these higher TRL endeavors. The NEWT team leads and participates in a broad range of outreach, education and diversity activities.

What is the University's Advantage and/or Anticipated Funding Opportunities?

ASU has lead recruitment and collaboration with over 25 industrial members of NEWT. Annually these industrial members fund an additional $1 million at ASU in research through NEWT. The NEWT research has been leveraged to be part of a recent NIH MEMCARE Center with Harvard and Yale, and a new NSF Science and Technology Center to be launched in October 2021. Within NEWT we are on the verge of a new project with the Gates Foundation for reuse of greywater inside homes, and use of the reused water for sanitation. This is considered a high-risk, high-tech solution that Gates is providing to NEWT and considerable follow-on funding and industrial spinouts are expected.

Is there an Arizona Specific Benefit or Impact?

The industrial members increase visibility of ASU researchers, and are enabling us to recruit even more Arizona-based industrial members who are struggling with on-site water reuse challenges that they must address to meet corporate sustainability goals. Experience by the ASU team in working with industry is demonstrating our ability to solve real-world problems, rapidly, and provide actionable information for companies. Two start-up companies in Arizona related to NEWT technology have advanced funding from NASA and hire employees in Arizona. In addition to working with industry, our technologies are being integrated into water solutions for rural communities to provide clean drinking water. Annually we bring undergraduates from Arizona Community colleges and high school teachers from Arizona into our research labs for organized, paid, summer research experiences.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$35,000	$35,000	$35,000	$105,000
Basic Research	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0
Development	$0	$0	$0	$0
Total	$35,000	$35,000	$35,000	$105,000

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	4	4	4	169
Graduate Students	19	20	20	60
Undergraduate Students	12	12	13	37
Sponsored Project Funding	$2,205,548	$2,315,826	$2,431,617	$6,952,991
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

University	Arizona State University
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	NSF Nanosystems Engineering Research Center for Off-Grid Nanotechnology Enabled Water Treatment (NEWT)

Progress Summary

NEWT aims to develop new technologies to purify drinking and industrial waters. Initially funded in 2015, we were renewed through 2025. As NEWT approaches self-sufficiency, we are seeking funding to continue discovery of new treatment technologies that will stimulate our many industrial partners with breakthrough science. This complements our strong success in industrial members then funding associated projects. Personnel time and material funds will be used to support multiple NEWT faculty on high-risk science that will collect preliminary data for new extramural funding proposals and demonstrate technology translation using our mobile testbed. The NEWT faculty and student team has been amazingly successful with new patents, startups and STTR awards – and having the ability to translate to the testbed has proven essential in these higher TRL endeavors. The NEWT team leads and participates in a broad range of outreach and education activities. This successful 10-year program concluded July 31, 2025. We held a "graduation" event with NSF in May 2025 that was coupled with a D.C.-based stakeholder event with key industrial partners, federal funding programs, NGO partners and elected government offices.

How has the problem statement been addressed in the last year by this TRIF project?

ASU has led recruitment and collaboration with over 25 industrial members of NEWT. Annually, these industrial members fund an additional $1M in research at ASU through NEWT. NEWT research has been leveraged to be part of a recent NIH MEMCARE Center with Harvard and Yale. NEWT also received $2.5M from the Gates Foundation for reuse of greywater inside homes and use of the reused water for sanitation. This is considered a high-risk, high-tech solution, and we expect considerable follow-on funding and industrial spinouts. The NEWT model of early-stage research support in parallel with roadmapping and mobile demonstration facilities also served as the model for the Global Center for Water Technology, which is one of the pillars of the $40M Arizona Water Innovation Initiative. Paul Westerhoff, deputy director of NEWT, serves as director of the new center. Additionally, Westerhoff was part of the water innovation working group that contributed to ASU winning the NSF Futures Engine in the Southwest, with up to $160M in funding over 10 years.

What, if anything, hasn't worked as well as was hoped?

Describe the Arizona benefit or impact of this TRIF project for the last year.

Our industrial members increase visibility of ASU researchers and are enabling us to recruit even more Arizona-based industrial members who are struggling with onsite water reuse challenges that they must address to meet corporate sustainability goals. The ASU team's experience in working with industry demonstrates our ability to solve real-world problems, rapidly, and provide actionable information for companies. Five start-up companies in Arizona related to NEWT technology have advanced funding from NASA and other sources and have hired employees in Arizona. In addition, our technologies are being integrated into water solutions for rural communities to provide clean drinking water. Annually we bring undergraduates from Arizona community colleges and high school teachers from Arizona into our research labs for organized, paid summer research experiences.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$35,000	$35,034	$36,154	$32,966	$139,154
Basic Research	$0	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0	$1,073,102
Development	$0	$0	$0	$0	$0
Total	$35,000	$35,034	$36,154	$32,966	$139,154

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	7	6	3	3	19
Graduate Students	25	22	21	7	75
Undergraduate Students	12	8	5	4	29
Sponsored Project Funding	$1,461,643	$1,326,696	$983,378	$745,032	$4,516,749
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

University	Arizona State University
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Research Development

Problem Statement

Increasing the diversity, reach, quality and impact of ASU's faculty, staff and student research activities contributes to the strength of our regional economy and improves our national standing in higher education.

Program Description

Research Development is responsible for increasing the size of ASU's research enterprise through a community of practice around early positioning and competitiveness of proposals for funding from federal agencies. This is accomplished through strategic intelligence of funding opportunities and improved teaming, outreach and training during research-related events, transparent and equitable management of limited funding opportunities and internal seed grants programs, and professional proposal management for large and complex funding proposals.

What is the University's Advantage and/or Anticipated Funding Opportunities?

Research Development is responsible for dissemination of hundreds of limited funding opportunities to the university, providing hundreds of documents in support of strategic decision-making for leaders, bringing together hundreds of researchers to discuss competitive funding solicitations, and supporting millions of dollars' worth of proposals from ASU. This work increases the overall ability of ASU to reach aggressive goals for research expenditures.

Is there an Arizona Specific Benefit or Impact?

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$201,189	$201,189	$201,189	$603,566
Applied Research	$201,189	$201,189	$201,189	$603,566
Development	$201,189	$201,189	$201,189	$603,566
Total	$603,566	$603,566	$603,566	$1,810,698

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	169
Graduate Students	0	0	0	0
Undergraduate Students	3	3	3	9
Sponsored Project Funding	$40,000,000	$42,000,000	$44,100,000	$126,100,000
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

University	Arizona State University
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Research Development

Progress Summary

Research Development (RD) advances ASU's mission and benefits Arizona by supporting strategic research initiatives across the university and in collaboration with institutions within the state and nationwide. The office has played a critical role in securing some of the most competitive and high-value research awards in Arizona's history, including major wins in sustainability, microelectronics, semiconductors and areas aligned with state and national priorities. In addition to supporting research teams in the development and execution of complex proposals, RD offers a robust calendar of events that connect researchers with funding agencies and equip them with the tools to create competitive submissions. The office delivers timely, actionable analyses of the funding landscape and emerging trends, enabling ASU to remain responsive to evolving priorities. RD also manages institutionally limited solicitations, prestigious national nomination competitions and multiple internal seed grant programs that catalyze early-stage research and interdisciplinary collaboration.

How has the problem statement been addressed in the last year by this TRIF project?

In the past year, RD has strengthened ASU's grant readiness by offering targeted programming, expert services and strategic proposal support. RD hosted 31 events engaging more than 1,246 stakeholders. Nine events focused on competitive national funding programs,11 provided strategic collaboration planning and 11 provided training on best practices for writing and submitting proposals. These events, widely promoted across ASU, helped faculty engage with funding opportunities early and strategically. RD's weekly funding newsletter, distributed to more than 3,379 subscribers, ensured broad, timely access to upcoming opportunities. This past year, Limited Submissions distributed nearly 140 funding solicitations through the RD newsletter and direct outreach. A total of 222 applicants engaged with these opportunities, resulting in 164 approved submissions to sponsors, representing approximately $1 billion in potential funding. RD uses the same highly efficient and successful system to manage many other opportunities, including prestigious national nominations and internal seed grants that are part of the ASU Mayo Clinic Alliance. RD also supported 24 large-scale proposals totaling nearly $380 million and developed 36 custom graphics for 16 of these submissions. Editing support was provided for 220 projects, including grant proposals, manuscripts and book proposals. In water, environment, and energy solutions, RD supported the submission of nine proposals totaling $100 million and edited 24 additional proposals and manuscripts valued at $57 million.

What, if anything, hasn't worked as well as was hoped?

Describe the Arizona benefit or impact of this TRIF project for the last year.

ASU has long been a national leader in sustainability research, and Research Development continues to build on that legacy by supporting high-impact proposals focused on water, environmental resilience and energy innovation. In the past year, RD supported the submission of nine proposals totaling over $100 million in these areas, positioning Arizona to address urgent environmental and energy challenges. Among these was the NSF Research Infrastructure - Scaling Capacity for Coral Research grant, a significant award that establishes Arizona-based labs as key contributors to global sustainability science. This grant not only accelerates climate and oceanic research, but also ensures that Arizona remains a hub for innovation in water, environment and energy. Through strategic support, RD helps bring critical funding to the state, enabling scientific breakthroughs, workforce development and regional solutions that have far-reaching impact.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$263,058	$324,302	$260,265	$312,983	$1,160,608
Applied Research	$263,058	$324,302	$260,265	$312,983	$1,649,143
Development	$263,058	$324,302	$260,265	$312,983	$1,160,608
Total	$789,174	$972,906	$780,795	$938,949	$3,481,824

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	0	0	0
Graduate Students	0	0	1	0	1
Undergraduate Students	0	0	1	0	1
Sponsored Project Funding	$487,025,000	$437,000,000	$358,000,000	$0	$1,282,025,000
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

University	Arizona State University
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Skysong Innovations

Problem Statement

ASU researchers are tackling some of the world's biggest challenges, from sustainable resources and carbon capture to cancer detection and treatment. Their post-research challenge comes in finding the right partners, strategic investments and experienced entrepreneurial leaders needed to move those innovations into successful commercial application. Skysong Innovations (SI) identifies those technologies with broad potential and coordinates with the right partners to bring these innovations into the marketplace. From pulling water out of thin air to re-engineering a virus to attack cancer, ASU researchers have worked with Skysong Innovations to spin out dozens of companies that have the potential to revolutionize the way we navigate the global challenges of the 21st century.

Program Description

SI is ASU's exclusive intellectual property management and technology transfer organization (TTO). Since 2003, SI has provided the ASU research community with the support and expertise needed to turn their research discoveries into commercial opportunities. SI has long been one of the top-performing university TTOs in terms of researcher inventions disclosed, licensing deals signed and startups launched per research dollar. For the third consecutive year, ASU is in the top 10 for U.S. patents issued to U.S. universities — and 11th worldwide — according to an annual ranking of the top universities by the National Academy of Inventors (NAI) and the Intellectual Property Owners Association (IPO). In 2020, ASU was issued 140 U.S. patents, tied with the University of Florida, up from 137 the previous year, and just one spot behind Harvard. Other U.S. universities in the top 10 include MIT, Stanford, and Caltech. Tsinghua University in Beijing was the only non-U.S. university to surpass ASU on the global list.

What is the University's Advantage and/or Anticipated Funding Opportunities?

SI has worked for years to help ASU startups connect with investors. In that regard, SI regularly interacts with venture-capital firms, angel-investment groups, and other potential investors around the globe to showcase ASU startups and technologies. All told, ASU researchers working with SI have launched more than 170 startups, which in turn have attracted nearly $1 billion in venture capital and other funding. Because experience has taught us that many investors are wary of giving money to companies led by inexperienced founders, we created a special program called the ASU Startup Mill. The ASU Startup Mill connects ASU companies with successful entrepreneurs and experienced corporate executives who can provide advice, support and even take positions running these startups. In FY21, SI advanced sponsored research providing over $30 million in funding for ASU, resolving IP and other substantive issues as part of the agreements.

Is there an Arizona Specific Benefit or Impact?

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$521,683	$521,683	$521,683	$1,565,049
Applied Research	$521,683	$521,683	$521,683	$1,565,049
Development	$521,683	$521,683	$521,683	$1,565,049
Total	$1,565,049	$1,565,049	$1,565,049	$4,695,148

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	169
Graduate Students	0	0	0	0
Undergraduate Students	0	0	0	0
Sponsored Project Funding	$0	$0	$0	$0
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	5	5	5	15

University	Arizona State University
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Skysong Innovations

Progress Summary

SI remained a high-volume, high-impact technology transfer organization in FY25, including setting new internal records for innovations captured and patents secured. In FY25, SI captured 330 new ASU innovations, secured 200 new U.S. patents, and closed 65 new standalone licensing deals (not counting additional licenses granted in industry-sponsored research agreements). Within these licensing activities, SI advanced the launch of 21 new startup companies founded on ASU innovations ranging from voice authentication platforms to therapeutics for traumatic brain injuries. Of the 21 new companies, 18 (over 85%) are based in Arizona. These output levels for innovations, patents, licensing deals, and startups have historically placed ASU within the top 10 of institutions without medical schools, according to data published by the Association of University Technology Managers (AUTM). According to FY23 data, ASU was one of only three such institutions to rank in the top 5 across all four categories—MIT and Purdue were the only other such institutions. Among all 191 institutions reporting FY23 data to AUTM (including those with medical schools), ASU ranked #21 in invention disclosures, #6 in patents, #11 in options and patent licensing deals, and #5 in startups. In addition, FY25 saw continued growth for ASU startup fundraising efforts, including $65 million in outside investment raised. To date, the historical running total of venture capital investments and other funding reported by ASU startups (more than 270 total launched during SI's history) exceeds the $1.5 billion mark.

How has the problem statement been addressed in the last year by this TRIF project?

In FY25, SI secured seven new invention disclosures and one new U.S. patents covering water innovations, 17 new invention disclosures and 12 new U.S. patents covering other environmental innovations, and 16 new invention disclosures and 10 new U.S. patents covering energy innovations. Startup examples include Tributary, which develops technologies to reduce risk of forest fires; Barge SWIFT, software for real-time maritime barge traffic analytics, and ongoing activities related to ASU spinout Carbon Collect Ltd., which passively removes carbon dioxide from air. SI also secured a software license agreement to Arizona Department of Environmental Quality for software tools to analyze and assess the vulnerability of natural resources and human populations to adverse outcomes and U.S. patents covering multijunction solar cells, photovoltaic management systems, optical fibers for water treatment, and materials for calcium batteries; as well as new patent applications directed to approaches for eliminating PFAS contaminants from water, and hydrogels for dust suppression.

What, if anything, hasn't worked as well as was hoped?

Describe the Arizona benefit or impact of this TRIF project for the last year.

According to Rounds Consulting Group, "The cumulative efforts of Skysong Innovations spanning a decade, from FY14 to FY23, have generated nearly $2.5B in economic activity in Arizona." This economic activity included "13,270 job-years from FY14 to FY23 (this is equivalent to an average of 1,327 persons working full-time each year over the 10-year period)" as well as "$846.3M in labor income" and "$80.7M in state and local taxes." SI's continued outputs in FY25, including facilitating the launch of 21 new startup companies (18 of which are based in Arizona) and an additional $65 million raised by existing ASU startups in FY25, will further bolster this economic impact. In that regard, Rounds projects, "Over the next decade, from FY24 to FY33, Skysong Innovations activity is projected to produce nearly $3.4B in economic activity throughout Arizona."

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$521,683	$521,683	$521,683	$521,683	$2,086,732
Applied Research	$521,683	$521,683	$521,683	$521,683	$2,116,468
Development	$521,683	$521,683	$521,683	$521,683	$2,086,732
Total	$1,565,049	$1,565,049	$1,565,049	$1,565,049	$6,260,196

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	0	0	0
Graduate Students	0	0	0	0	0
Undergraduate Students	0	0	0	0	0
Sponsored Project Funding	$0	$0	$0	$0	$0
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	5	6	5	0	16

University	Arizona State University
TRIF Investment Area	Workforce Development
Program Name	Corporate Engagement and Strategic Partnerships

Problem Statement

ASU is an institution that prioritizes use-inspired research, student experiential learning, student success and community embeddedness. This requires a deep understanding of the needs of the external community and the agility, commitment and will to mobilize university resources to match and problem-solve in real time. ASU's Corporate Engagement and Strategic Partnerships team builds long-term, mutually beneficial partnerships that help Arizona's constituents and the entire U.S. economic ecosystem.

Program Description

Corporate Engagement and Strategic Partnerships advances university-wide research and education efforts in key sectors such as semiconductors, sustainability, health futures and workforce development. The program facilitates complex engagements to leverage the abilities of the community, the university and our business collaborators while supporting all stakeholders. Our work is individualized, transformative and impactful to best support all involved, especially Arizona. By expanding and diversifying the workforce, developing novel solutions to complex challenges, and finding innovative approaches to advancing research and development initiatives, Corporate Engagement and Strategic Partnerships infuses ASU's productivity and innovation into the economy through intentional engagement and partnership.

What is the University's Advantage and/or Anticipated Funding Opportunities?

ASU's advantage is the university's vast resources and networks across Arizona. Through one-of-a-kind academic-corporate partnerships, corporate collaborators can access ASU's world-class faculty and student talent, cutting-edge research and development, and state-of-the-art facilities. Corporate Engagement and Strategic Partnerships provides partners with an institutional commitment to collaboration, growth and impact on a global scale, coupled with a response time that is required for industry engagement. Anticipated funding opportunities are broad given the different assets and clients we serve. Funding will come in the form of direct industry-sponsored research projects, consortium fees, corporate philanthropy, leases paid in Innovation Zones at ASU, fees for custom academic or non-credit programs and/or federally sponsored research, with corporate partners as supporters or subcontractors.

Is there an Arizona Specific Benefit or Impact?

There are significant impacts and benefits to Arizona. The work performed by the Corporate Engagement and Strategic Partnerships team supports economic and community development groups to recruit companies to relocate or expand their business in Arizona. Recent examples include the $20 billion Intel expansion, $8 million investment by Applied Materials and the $32 billion TSMC location to Arizona, creating over 3,000 jobs in the state. We will also create opportunities to increase technological access throughout the state through public-private partnerships with industry giants such as Dell and Verizon, organizations that have prioritized closing the digital divide and providing access to remote and rural areas.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$0	$0	$0	$0
Applied Research	$500,000	$500,000	$500,000	$1,500,000
Development	$500,000	$500,000	$500,000	$1,500,000
Total	$1,000,000	$1,000,000	$1,000,000	$3,000,000

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	1	1	1	169
Graduate Students	5	6	6	19
Undergraduate Students	2	2	2	6
Sponsored Project Funding	$107,000	$112,000	$118,000	$337,000
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

University	Arizona State University
TRIF Investment Area	Workforce Development
Program Name	Corporate Engagement and Strategic Partnerships

Progress Summary

CESP continued to create impactful partnerships between ASU and the community. Mayo Clinic and ASU Alliance for Health Care hosted the sixth MedTech Accelerator cohort. Ten companies from five countries participated in the program, with three of the companies pursuing relocation to Phoenix. Additional efforts include launching a new Certified Registered Nurse Anesthetist program and the Advanced Analysis for Precision Cancer Therapy (ADAPT) program, which was awarded $5.25M by ARPA-H. HonorHealth was announced as the primary clinical affiliate partner for the ASU School of Medicine and Advanced Engineering (SMAE). ASU and HH will implement workforce development expansion strategies in health care, advancing predictive analytics and clinical research. Phoenix Children's and ASU are developing a strategy to advance key priorities and support workforce development and clinical research. PC agreed to conduct clerkships for ASU SMAE. Partnership with Deca Technologies led to a $100M award to lead the SHIELD USA project, part of CHIPS National Advanced Packaging Manufacturing Program (NAPMP). More than a dozen corporate and academic partners are involved. We also secured commitment from Natcast to locate the CHIPS for America advanced packaging piloting facility at the ASU research park. This would be an estimated $4B investment, positioning Arizona as a national hub for semiconductor innovation. The Southwest Advanced Prototyping (SWAP) Hub secured five projects for a total of $21.3M. More than 200 partners are involved in the Hub. ASU's collaboration with Applied Materials expanded, with research funding increasing from $558,000 to over $5M, supporting over 30 workshops, 26 proposals and 25 projects involving over 30 graduate students. AMAT became the strategic tenant at MacroTechnology Works. Applied Materials has now invested over $400M into Arizona. ASU and TSMC continued to strengthen their partnership. The second annual TSMC Day brought over 400 students to celebrate the partnership and share ongoing research efforts. ASU hosted campus visits for TSMC to explore new engagement pathways and select four new Joint Development Projects, representing a $1M investment over two years. The project launch is expected in fall 2025. Additionally, ASU housed 120 TSMC interns, supporting workforce development. The NSF Futures Engine in the Southwest awarded eight grants to startups in the sustainability industry, with more than 160 partners involved.

How has the problem statement been addressed in the last year by this TRIF project?

CESP was instrumental in securing multiple high-level awards and facility locations this year, advancing Arizona as a national hub for semiconductors. The team leveraged its extensive partner network to support bids. CESP focused efforts on relationships with health partners, in pursuit of ASU's mission to serve the health of our community. We also stewarded strategic partnerships with adidas, Applied Materials, APS, Freeport-McMoRan, Intel, Major League Baseball, NXP, PepsiCo, Planet, Raytheon, SEMI Foundation, SRP, TSMC and more.

What, if anything, hasn't worked as well as was hoped?

Describe the Arizona benefit or impact of this TRIF project for the last year.

Securing location of the Natcast facility is estimated to bring $4B to the AZ economy. CESP aided the university in winning $80.7M in industry sponsored research. ASU secured 34 new-company locates at Innovation Zones. CESP secured $56.7M in federal funding awards through the SWAP, SHIELD and NSF Futures initiatives CESP and the Office of Economic Development created a Tenant Benefits Package offering discounts on ASU services to attract local, out-of-state and international companies to co-locate within the ASU Innovation Zones to further enhance the Arizona economy.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$0	$0	$0	$0	$0
Applied Research	$541,262	$488,894	$486,930	$444,770	$2,059,134
Development	$541,262	$488,894	$486,930	$444,770	$1,961,856
Total	$1,082,524	$977,788	$973,860	$889,540	$3,923,712

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	1	1	1	0	3
Graduate Students	7	3	1	0	11
Undergraduate Students	43	20	21	0	84
Sponsored Project Funding	$174,994	$5,116,196	$140,000	$0	$5,431,190
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

University	Arizona State University
TRIF Investment Area	Workforce Development
Program Name	J. Orin Edson Entrepreneurship + Innovation Institute

Problem Statement

Funding is needed to stimulate new collaborations with academic units, provide entrepreneurial training and development opportunities, and to supply the related material resources needed to continue to strengthen Arizona's entrepreneurial community and ecosystem.

Program Description

The J. Orin Edson Entrepreneurship + Innovation Institute (Edson E+I) stimulates new collaborations with academic units to add dimension to both the student and faculty experience and development that lead to both personal and professional positive outcomes as well as economic and community development outcomes. Through TRIF funding, we have supported collaborations in business, creative arts enterprises, engineering, health innovation, and sustainability and piloted a number of new initiatives that have since led to additional funding.

What is the University's Advantage and/or Anticipated Funding Opportunities?

Edson E+I believes in ASU's charter of excellence with inclusion and impact at scale and its design aspirations including valuing entrepreneurship. Edson E+I supports over 50,000 square feet of place-based innovation spaces across five locations. These spaces provide co-working, events and exhibitions, and amenities spaces for emerging ventures and community-based partners including entrepreneur support organizations to convene, network, and strengthen the entrepreneurial community and ecosystem. With academic collaborations, entrepreneurial training and development, and a place-based innovation spaces network as continued resources, Edson E+I has raised $40.4 million in additional funding including two endowed funds of $11.5 million over the last five years.

Is there an Arizona Specific Benefit or Impact?

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$0	$0	$0	$0
Applied Research	$400,000	$400,000	$400,000	$1,200,000
Development	$400,000	$400,000	$400,000	$1,200,000
Total	$800,000	$800,000	$800,000	$2,400,000

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	169
Graduate Students	2	2	2	6
Undergraduate Students	6	7	7	20
Sponsored Project Funding	$3,508,580	$3,684,009	$3,868,209	$11,060,798
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

University	Arizona State University
TRIF Investment Area	Workforce Development
Program Name	J. Orin Edson Entrepreneurship + Innovation Institute

Progress Summary

The J. Orin Edson Entrepreneurship + Innovation Institute (Edson E+I) operates Place-Based Innovation Spaces (PBIS) as vital entry points for entrepreneurs across Arizona. Supported by TRIF, these spaces (850 Phoenix Bioscience Core, 1951@SkySong, ASU Chandler Innovation Center, Fusion on First and The Studios @ Mesa City Center) provide collaborative environments where early-stage entrepreneurs access training, mentorship and resources. In FY25, the PBIS network hosted more than 1,540 events and engaged 1,966 unique entrepreneurs and community members, equipping them with practical skills, stronger networks and greater readiness for growth while achieving an 80% utilization rate. Serving as the top of the funnel for ASU's broader Innovation Zones, the community entrepreneurship team and PBIS network activate inclusive pathways into Arizona's entrepreneurial ecosystem, advancing workforce development and creating on-ramps for ventures that drive jobs, revenue and long-term economic impact.

How has the problem statement been addressed in the last year by this TRIF project?

Edson E+I leverages TRIF support to connect academic research, student ventures and community entrepreneurs with the skills and resources needed to thrive. Faculty innovation programs such as Lab2Launch and the Inventors Series accelerated the transition of research to market, supporting more than 110 faculty-founded ventures that attracted $100 million in investment in FY25. Student-focused initiatives like Venture Devils and Blackstone LaunchPad engaged over 544 active student ventures, distributed $382,000 in non-dilutive funding and placed students in 40 paid internships with Arizona startups, ensuring real-world experience and career readiness. The Inferno Invitational Startup Cup united student entrepreneurs from ASU, U of A, NAU, GCU and MCCCD, awarding $100,000 in mentorship and $40,000 in-kind support. Targeted programs like Creative Spark, SPORTx and Student-Made expanded entrepreneurial opportunities to student-athletes, creatives and makers, broadening pathways into Arizona's innovation economy. Community-focused initiatives amplified these impacts. For example, the Small Business Academy, sponsored by SRP, trained more than 480 entrepreneurs, enhancing procurement readiness and awarding $20,000 in direct venture funding. The Chandler Endeavor Venture Innovation Incubator supported more than 2,650 entrepreneurs and community members, generating $1.6 million in revenue, securing over $926,000 in capital and creating 109 new jobs in the local economy. Place-Based Innovation Spaces further strengthened Arizona's entrepreneurial infrastructure, hosting more than 1,540 events and supporting nearly 2,000 entrepreneurs with mentorship, training and resources. Beyond higher education and business support, youth pipeline programs such as Invention Convention Arizona and Verizon Innovative Learning Labs reached nearly 13,000 Arizona students in FY25, building digital skills, creative confidence and entrepreneurial mindsets in K–12 classrooms. Collectively, these efforts demonstrate how funding has been applied to strengthen Arizona's innovation ecosystem by fostering academic collaboration, expanding entrepreneurial training and equipping diverse populations with practical, transferable skills. The result is measurable workforce development — new ventures launched, jobs created, contracts secured and thousands of individuals empowered with the skills and confidence to contribute to Arizona's long-term economic growth and resilience.

What, if anything, hasn't worked as well as was hoped?

Describe the Arizona benefit or impact of this TRIF project for the last year.

In the past year, TRIF funding supported Arizona's entrepreneurial ecosystem — creating 100+ jobs and $1.6M in revenue, and strengthening 480+ small businesses. These outcomes led to continued Chandler Endeavor funding and new awards for ACA's Venture Start and Goodyear's Innovation Hub, expanding statewide impact.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$0	$0	$0	$0	$0
Applied Research	$399,012	$493,755	$446,850	$453,420	$1,925,534
Development	$399,012	$493,755	$446,850	$453,420	$1,793,037
Total	$798,024	$987,510	$893,700	$906,840	$3,586,074

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	0	0	0
Graduate Students	0	1	19	0	20
Undergraduate Students	53	65	64	0	182
Sponsored Project Funding	$11,520,000	$15,250,001	$17,417,918	$0	$44,187,919
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

University	Arizona State University
TRIF Investment Area	Workforce Development
Program Name	Research Development

Problem Statement

Increasing the diversity, reach, quality and impact of ASU's faculty, staff and student research activities contributes to the strength of our regional economy and improves our national standing in higher education.

Program Description

Research Development is responsible for increasing the size of ASU's research enterprise through a community of practice around early positioning and competitiveness of proposals for funding from federal agencies. This is accomplished through strategic intelligence of funding opportunities and improved teaming, outreach and training during research-related events, transparent and equitable management of limited funding opportunities and internal seed grants programs, and professional proposal management for large and complex funding proposals.

What is the University's Advantage and/or Anticipated Funding Opportunities?

Research Development is responsible for dissemination of hundreds of limited funding opportunities to the university, providing hundreds of documents in support of strategic decision-making for leaders, bringing together hundreds of researchers to discuss competitive funding solicitations, and supporting millions of dollars' worth of proposals from ASU. This work increases the overall ability of ASU to reach aggressive goals for research expenditures.

Is there an Arizona Specific Benefit or Impact?

ASU's research portfolio directly impacts the regional economy and contributes to ASU's national ranking among institutions of higher education.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$60,306	$60,306	$60,306	$180,917
Applied Research	$60,306	$60,306	$60,306	$180,917
Development	$60,306	$60,306	$60,306	$180,917
Total	$180,917	$180,917	$180,917	$542,751

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	169
Graduate Students	0	0	0	0
Undergraduate Students	3	3	3	9
Sponsored Project Funding	$40,000,000	$42,000,000	$44,100,000	$126,100,000
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

University	Arizona State University
TRIF Investment Area	Workforce Development
Program Name	Research Development

Progress Summary

Research Development (RD) advances ASU's mission and benefits Arizona by supporting strategic research initiatives across the university and in collaboration with institutions within the state and nationwide. The office has played a critical role in securing some of the most competitive and high-value research awards in Arizona's history, including major wins in sustainability, microelectronics, semiconductors and areas aligned with state and national priorities. In addition to supporting research teams in the development and execution of complex proposals, RD offers a robust calendar of events that connect researchers with funding agencies and equip them with the tools to create competitive submissions. The office delivers timely, actionable analyses of the funding landscape and emerging trends, enabling ASU to remain responsive to evolving priorities. RD also manages institutionally limited solicitations, prestigious national nomination competitions and multiple internal seed grant programs that catalyze early-stage research and interdisciplinary collaboration.

How has the problem statement been addressed in the last year by this TRIF project?

In the past year, RD has strengthened ASU's grant readiness by offering targeted programming, expert services, and strategic proposal support. RD hosted 31 events engaging more than 1,246 stakeholders. Nine events focused on competitive national funding programs, 11 provided strategic collaboration planning and 11 provided training on best practices for writing and submitting proposals. These events, widely promoted across ASU, helped faculty engage with funding opportunities early and strategically. RD's weekly funding newsletter, distributed to more than 3,379 subscribers, ensured broad, timely access to upcoming opportunities. This past year, Limited Submissions distributed nearly 140 funding solicitations through the RD newsletter and direct outreach. A total of 222 applicants engaged with these opportunities, resulting in 164 approved submissions to sponsors, representing approximately $1 billion in potential funding. RD uses the same highly efficient and successful system to manage many other opportunities, including prestigious national nominations and internal seed grants that are part of the ASU Mayo Clinic Alliance. RD also supported 24 large-scale proposals totaling nearly $380 million and developed 36 custom graphics for 16 of these submissions. Editing support was provided for 220 projects, including grant proposals, manuscripts and book proposals. In workforce development, RD supported the submission of 10 proposals worth approximately $40 million through proposal management and editing services.

What, if anything, hasn't worked as well as was hoped?

The rapidly evolving funding landscape has presented challenges in maintaining stability and long-term planning. As priorities shift, RD has had to remain agile and responsive to uncertainty. This required quick pivots and proactive engagement with faculty and staff. RD has addressed these challenges by providing timely analyses, curated resources and strategic guidance to help the ASU research community stay informed and aligned with emerging opportunities, while maintaining a strong sense of direction and purpose amid change.

Describe the Arizona benefit or impact of this TRIF project for the last year.

All proposals supported by RD incorporate mentoring plans that emphasize hands-on training. RD collaborates closely with academic units and local industry partners to ensure strong teaming potential and real-world impact. One successful initiative is a chiplet-focused program developed in partnership with local microelectronics companies and an international university. This collaboration has created a specialized training curriculum in semiconductor technology that culminates in Arizona-based internships, strengthening the talent pipeline and forging international partnerships that benefit both Arizona's economy and global research ties.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$78,851	$97,209	$78,014	$93,816	$347,890
Applied Research	$78,851	$97,209	$78,014	$93,816	$1,245,769
Development	$78,851	$97,209	$78,014	$93,816	$347,890
Total	$236,553	$291,627	$234,042	$281,448	$1,043,670

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	0	0	0
Graduate Students	0	0	2	0	2
Undergraduate Students	0	0	1	0	1
Sponsored Project Funding	$212,078,593	$84,895,000	$5,500,000	$0	$302,473,593
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

University	Arizona State University
TRIF Investment Area	Workforce Development
Program Name	Skysong Innovations

Problem Statement

ASU researchers are tackling some of the world's biggest challenges, from sustainable resources and carbon capture to cancer detection and treatment. Their post-research challenge comes in finding the right partners, strategic investments and experienced entrepreneurial leaders needed to move those innovations into successful commercial application. Skysong Innovations (SI) identifies those technologies with broad potential and coordinates with the right partners to bring these innovations into the marketplace. From pulling water out of thin air to re-engineering a virus to attack cancer, ASU researchers have worked with Skysong Innovations to spin out dozens of companies that have the potential to revolutionize the way we navigate the global challenges of the 21st century.

Program Description

SI is ASU's exclusive intellectual property management and technology transfer organization (TTO). Since 2003, SI has provided the ASU research community with the support and expertise needed to turn their research discoveries into commercial opportunities. SI has long been one of the top-performing university TTOs in terms of researcher inventions disclosed, licensing deals signed and startups launched per research dollar. For the third consecutive year, ASU is in the top 10 for U.S. patents issued to U.S. universities — and 11th worldwide — according to an annual ranking of the top universities by the National Academy of Inventors (NAI) and the Intellectual Property Owners Association (IPO). Other U.S. universities in the top 10 include MIT, Stanford, and Caltech. Tsinghua University in Beijing was the only non-U.S. university to surpass ASU on the global list. In FY20, ASU researchers working with SI continued to set new benchmarks, submitting 306 invention disclosures and launching 19 new startups. ASU startups also raised more than $120 million in external funding in FY20.

What is the University's Advantage and/or Anticipated Funding Opportunities?

SI has worked for years to help ASU startups connect with investors. In that regard, SI regularly interacts with venture-capital firms, angel-investment groups, and other potential investors around the globe to showcase ASU startups and technologies. All told, ASU researchers working with SI have launched more than 170 startups, which in turn have attracted nearly $1 billion in venture capital and other funding. Because experience has taught us that many investors are wary of giving money to companies led by inexperienced founders, we created a special program called the ASU Startup Mill. The ASU Startup Mill connects ASU companies with successful entrepreneurs and experienced corporate executives who can provide advice, support and – in some cases – even take positions running these startups. SI is also the ASU lead behind the ASU-Mayo MedTech Accelerator, which brings together the recognized world leader in patient care, education, and research.

Is there an Arizona Specific Benefit or Impact?

SI has annually commissioned the Seidman Research Institute to perform an economic impact analysis of ASU's tech transfer activities. The most recent report found that during the time period 2016-2020, as a result of the operations of SI and the Arizona-based ASU-linked companies, Arizona's economy gained a cumulative: • $717.8 million in gross state product • $477.9 million in labor income • 7,059 job years • $64 million in state and local tax revenues By 2025, Seidman projects the economic impact of SI and these ASU-linked companies will exceed $2.3 billion, with the vast majority of that impact in Arizona.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$19,466	$19,466	$19,466	$58,397
Applied Research	$19,466	$19,466	$19,466	$58,397
Development	$19,466	$19,466	$19,466	$58,397
Total	$58,397	$58,397	$58,397	$175,192

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	169
Graduate Students	0	0	0	0
Undergraduate Students	0	0	0	0
Sponsored Project Funding	$0	$0	$0	$0
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	5	5	5	15

University	Arizona State University
TRIF Investment Area	Workforce Development
Program Name	Skysong Innovations

Progress Summary

SI remained a high-impact tech-transfer organization in FY25. SI captured 330 new ASU innovations (record), secured 200 new U.S. patents (record), and closed 65 new standalone licensing deals (not counting additional licenses granted in industry-sponsored research agreements). Within these licensing activities, SI advanced the launch of 21 new startup companies founded on ASU innovations ranging from voice authentication platforms to therapeutics for traumatic brain injuries. Of the 21 new companies, 18 (over 85%) are based in Arizona. These output levels for innovations, patents, licensing deals, and startups have historically placed ASU within the top 10 of institutions without medical schools, according to data published by the Association of University Technology Managers (AUTM). According to FY23 data, ASU was one of only three such institutions to rank in the top 5 across all four categories—MIT and Purdue were the only other such institutions. In addition, FY25 saw continued growth for ASU startup fundraising efforts, including $65 million in outside investment raised. To date, the historical running total of venture capital investments and other funding reported by ASU startups (more than 270 total launched during SI's history) exceeds the $1.5 billion mark.

How has the problem statement been addressed in the last year by this TRIF project?

Innovations with the potential to benefit society are generated at ASU, and SI secures patent protection for these innovations over a multi-year process before the U.S. Patent Office. While SI works to secure patent protection, it executes strategic marketing campaigns and closes licensing deals with industry partners. Those industry partners then attempt to bring ASU innovations to market. In today's technology commercialization landscape, new startup companies are an industry-preferred vehicle for derisking early-stage innovations by moving them deeper into product development. As a result, each year SI advances the launch of many new startup companies founded to commercialize ASU innovations. After doing so, SI helps connect the ASU startups with management candidates and fundraising opportunities. When a startup secures funding, the chain of events that began with ASU innovation culminates in local economic impact as the company creates new jobs and contributes to the Arizona economy.

What, if anything, hasn't worked as well as was hoped?

Describe the Arizona benefit or impact of this TRIF project for the last year.

According to Rounds Consulting Group, "The cumulative efforts of Skysong Innovations spanning a decade, from FY14 to FY23, have generated nearly $2.5B in economic activity in Arizona." This economic activity included "13,270 job-years from FY14 to FY23 (this is equivalent to an average of 1,327 persons working full-time each year over the 10-year period)" as well as "$846.3M in labor income" and "$80.7M in state and local taxes." SI's continued outputs in FY25, including facilitating the launch of 21 new startup companies (18 of which are based in Arizona) and an additional $65 million raised by existing ASU startups in FY25, will further bolster this economic impact. In that regard, Rounds projects, "Over the next decade, from FY24 to FY33, Skysong Innovations activity is projected to produce nearly $3.4B in economic activity throughout Arizona." This means, as summarized by Rounds, "The total 20-year cumulative economic impact of Skysong Innovations-linked startups is equal to $5.9B. Approximately 31,730 job-years with an associated $2B in wages have and will be supported by Skysong Innovations-linked startups between FY14 and FY33."

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$19,466	$19,466	$19,466	$19,466	$77,864
Applied Research	$19,466	$19,466	$19,466	$19,466	$1,112,034
Development	$19,466	$19,466	$19,466	$19,466	$77,864
Total	$58,398	$58,398	$58,398	$58,398	$233,592

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	0	0	0
Graduate Students	0	0	0	0	0
Undergraduate Students	0	0	0	0	0
Sponsored Project Funding	$0	$0	$0	$0	$0
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	3	3	5	0	11

University	Arizona State University
TRIF Investment Area	Workforce Development
Program Name	The Luminosity Lab

Problem Statement

The current university systems within the United States lack effective student engagement models that provide undergraduate students with meaningful applied research and development opportunities. Opportunities, when they do exist for undergraduates, are often not relevant to the technical and real challenges of the 21st century. As a result, the United States stands to lose its position as the world leader in innovation and R&D.

Program Description

Having designed and successfully launched The Luminosity Lab, a novel model of student-led research and development, Luminosity now aspires to launch a consortium, in which ASU-powered Luminosity labs will be chartered at academic institutions around the country. These labs, powered by ASU, will engage exceptional talent at each hosting institution within our unique model of student-led R&D to focus on moonshot projects and impacting society. These labs will scale ASU's access to student talent, corporate partners and academic institutions across the globe.

What is the University's Advantage and/or Anticipated Funding Opportunities?

ASU will retain the IP generated throughout the network and serve as the prime recipient of all sponsored research that is executed within the consortium. This model, which is the first of its kind, will scale ASU's patent numbers and sponsored research dollars exponentially. This embedded model is net revenue generating and funded pilots are underway. Each new lab will bring in resources to offset its costs. However, the program will require initial investment to get established and support staffing requirements.

Is there an Arizona Specific Benefit or Impact?

This nationwide program will be powered by ASU and its home base will be established within Arizona. Arizona and ASU will benefit tremendously from the expansion of the brand, as well as the resulting IP, talent and corporate partnerships. Our hope is to make Arizona the home for all spinout companies that are generated from this national innovation network.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$166,667	$166,667	$166,667	$500,000
Applied Research	$166,667	$166,667	$166,667	$500,000
Development	$166,667	$166,667	$166,667	$500,000
Total	$500,000	$500,000	$500,000	$1,500,000

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	169
Graduate Students	1	1	1	4
Undergraduate Students	12	13	13	38
Sponsored Project Funding	$139,851	$146,844	$154,186	$440,881
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

University	Arizona State University
TRIF Investment Area	Workforce Development
Program Name	The Luminosity Lab

Progress Summary

Bolstered by TRIF support, the Luminosity Lab expanded its impact and national recognition, strengthened its student-led model, and continued laying the foundation for an ASU-powered consortium around the world in the last year. Luminosity students competed in national and global innovation competitions, secured internships and jobs at leading companies and launched student-led ventures at an accelerated pace. For instance, a Luminosity team was one of only six funded in NASA's largest student research competition, the BIG Idea Challenge, in which the team earned the Systems Engineering Award for its inflatable lunar landing-pad system. Additionally, Luminosity launched Interstellar, broadening global student engagement and building a scalable pipeline for the consortium to develop talent, advance student-led research and development, and launch student-led ventures. Luminosity teams achieved global visibility, with three teams reaching the semi-finals of the Red Bull Global Innovation Challenge, while student-led startups advanced to the semi-finals of the Global Hult Prize and received invitations to present at the prestigious International Astronautical Congress in Sydney, Australia. Finally, Luminosity was recognized by Congressman Greg Stanton for its contributions to the Congressional App Challenge.

How has the problem statement been addressed in the last year by this TRIF project?

Luminosity addresses the gap in meaningful undergraduate applied research and development models by embedding students in interdisciplinary, sponsor-facing projects with clear deliverables and stakeholder feedback — paired with a structured research and development program. Students progress through a pathway that includes applying research to solve complex challenges; rapid skills development aligned to industry needs; production-ready systems thinking (systems engineering, product development, data/AI, embedded systems, human factors); and rigorous project management. This year, teams advanced solutions across space systems, health innovation, sustainability, education, entrepreneurship and emerging technologies — moving from concept to prototype and venture opportunities. Students carried those skills into internships and full-time roles at leading companies and founded ventures. In Arizona, partnerships with Phoenix Children's Hospital, Axon and MedAire provided authentic operational contexts — while producing employer-ready prototypes, test reports, technical briefs, code repositories and more. As a result, students not only researched and developed solutions to complex challenges; they also secured internships and full-time positions or founded ventures, directly advancing TRIF's workforce-development goals.

What, if anything, hasn't worked as well as was hoped?

Describe the Arizona benefit or impact of this TRIF project for the last year.

Luminosity delivers concentrated value to Arizona by converting student-led research and development into workforce, venture and partner outcomes. Student-led ventures with Arizona roots — Verdantt, Breath EV, Melts, KiP, Orbitscape, LunaRights and Axio — progressed toward commercialization, creating pathways for new jobs and investment. Luminosity hosted an ARPA-H Health Symposium in Arizona to connect federal priorities with local capabilities, and the annual Luminosity Expo drew 175+ registered participants, featuring panels on space, entrepreneurship, government innovation and emerging tech — showcasing Arizona as a hotbed for student-driven research and development, attracting sponsors, mentors and talent to ASU. Beyond higher education, Luminosity broadened the pipeline through over ten individual K-12 STEM engagements, including the Illuminate High School Program, which connects Arizona students to university-level research and ASU pathways.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$169,365	$163,398	$170,109	$160,619	$663,491
Applied Research	$169,365	$163,398	$170,109	$160,619	$1,403,086
Development	$169,365	$163,398	$170,109	$160,619	$663,491
Total	$508,095	$490,194	$510,327	$481,857	$1,990,473

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	0	0	0
Graduate Students	3	3	3	0	9
Undergraduate Students	33	47	30	0	110
Sponsored Project Funding	$990,000	$2,541,241	$404,602	$0	$3,935,843
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

University	Arizona State University
TRIF Investment Area	Workforce Development
Program Name	Vice President for Research

Problem Statement

When faculty are developing proposals, evaluation plans are often required, yet many faculty do not have the expertise to create a comprehensive and competitive evaluation component. However, having a well-developed evaluation plan aligned with educational and broader impact goals is an essential component needed to secure funding for sponsored projects.

Program Description

CREST (College Research and Evaluation Services Team) within the ASU Knowledge Enterprise provides technical assistance and evaluation planning at the pre-award stage at no cost to faculty members and staff. CREST includes three full-time evaluation professionals with advanced degrees, graduate level training in evaluation and global experiences in evaluation methods. Expertise includes quantitative and qualitative analysis data collection for needs assessments, implementation and impact evaluations. CREST currently supports the evaluation of 29 projects totaling over $50 million in funding from the National Science Foundation, U.S. Department of Education, National Institutes of Health, the ASU Foundation, and state and national philanthropic organizations.

What is the University's Advantage and/or Anticipated Funding Opportunities?

CREST completed evaluation sections of 59 grant proposals over FY21. This same level of work is expected in FY22. The total potential revenue generated through funding if all grants were awarded would be over $25 million.

Is there an Arizona Specific Benefit or Impact?

With the grant funding on projects, the overwhelming majority need to provide educational services to K-16 students. These students primarily reside within Arizona and receive free, high-quality educational outreach they may otherwise not have had available. K-12 teachers from Arizona also have opportunities to participate in paid professional development to increase their pedagogical skills and technical knowledge to bring back to their classrooms.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$0	$0	$0	$0
Applied Research	$140,000	$140,000	$140,000	$420,000
Development	$140,000	$140,000	$140,000	$420,000
Total	$280,000	$280,000	$280,000	$840,000

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	169
Graduate Students	0	0	0	0
Undergraduate Students	100	105	110	315
Sponsored Project Funding	$362,414	$380,535	$399,562	$1,142,511
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

University	Arizona State University
TRIF Investment Area	Workforce Development
Program Name	Vice President for Research

Progress Summary

Over the course of FY25, the College Research and Evaluation Services Team (CREST) assisted with 42 grant proposals by providing comprehensive evaluation plans. These evaluation plans aligned with broader impact activities and were a requirement of the grant solicitation. Proposals were submitted to a variety of government agencies including the National Science Foundation, United States Department of Education, the U.S. State Department, State of Arizona, and internal ASU grants. Additionally, CREST participated in three professional development workshops across ASU. All of these services were provided at no cost to faculty as they were funded through these investment dollars. CREST also supported 41 ongoing grants with evaluation services. Data collected from these grants was analyzed and interpreted for principal investigators to continuously improve their educational components as well as examine the impact of the program on participant gains in knowledge, skills, and behavior. In all, over 100 teachers in Arizona were provided no-cost or stipend based professional development and over 200 students across the region were engaged in STEM programs to increase workforce development skills needed for the future.

How has the problem statement been addressed in the last year by this TRIF project?

CREST assisted with 42 grant proposals by developing evaluation plans for the broader impacts sections of submitted proposals. CREST has been available to assist with any faculty or staff inquiry on evaluation services. Moreover, CREST provided three professional development workshops for faculty at ASU. These included a panel discussion with the FA24 Writing Cohort, Social Sciences and Humanities Division focused on evaluation in October 2024, a Research Development seminar in April 2025, and Evaluation Plans for CAREER Grants to an ASU NSF CAREER Writing Cohort in May 2025.

What, if anything, hasn't worked as well as was hoped?

FY25 was challenging given most of CREST's evaluation work was with grants serving undergraduate students who are typically not engaged in STEM fields and we will need to adapt to changing federal funding priorities.

Describe the Arizona benefit or impact of this TRIF project for the last year.

Through grant funding of awarded proposals, CREST collaborates with multiple groups to evaluate the implementation and impact of educational activities. The majority of grants were focused on STEM education, and included a range of direct benefits to Arizona. For instance, nine high school students participated in a year-long game-based program teaching about water challenges in Arizona. More than 100 teachers, primarily in Title I schools enrolled in a 10-month program that provided master's level education about integrating civics education into their lesson planning. Eight STEM undergraduate students participated in an International Research Experience program while 18 STEM undergraduate students participated in lab-based Research Experience programs at ASU and NAU. We supported 18 undergraduate students from migrant farm families in Arizona in a support/transition program at ASU. Seven teachers benefited from a Research Experience for Teachers within ASU lab settings. Seven ASU graduate student trainees went through a yearlong biomedical program with Mayo Clinic. 185 students based across the Southwest region, with over 100 in Arizona higher education institutions received financial and educational support through a Louis Stokes Alliance grant. Lastly, a community-based grant with the College of Health Solutions examined how independent living services supported young adults with neurodivergence. These data are currently being used for decision making at the local level, and led to a donor providing low-income stipends to ten residents for housing at First Place Arizona.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$0	$0
Basic Research	$0	$0	$0	$0	$0
Applied Research	$126,753	$164,763	$145,388	$398,631	$1,598,486
Development	$126,753	$164,763	$145,388	$398,631	$835,535
Total	$253,506	$329,526	$290,776	$797,262	$1,671,070

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	10	0	0	0	10
Graduate Students	152	0	0	0	152
Undergraduate Students	62	24	31	0	117
Sponsored Project Funding	$450,854	$1,824,571	$4,087,910	$0	$6,363,335
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	Northern Arizona University
TRIF Investment Area	Improving Health
Program Name	Biotechnology and Bioengineering

Problem Statement

The Challenge: Developing new technologies to address critical medical needs of Arizona and the nation. The need for innovative solutions to medical problems is ever-present in society. Arizona has significant areas of medical need common to our civilian and veteran populations. As a single example, the NIH has dedicated programs to spur the development of tools and rehabilitation strategies to prevent ambulatory decline in aging populations, and the DoD has a need for similar technologies to aid human performance of service members and recovery of injured veterans. Technologies that respond to current and emergent needs of civilians that are also positioned to serve the needs of deployed military and injured veterans represent highly attractive investment areas for the state.

Program Description

The Bioengineering and Biotechnology initiative is supported by a recently established PhD program in Bioengineering and by researchers in diverse departments, including Biological Sciences, Applied Physics & Materials Sciences, Chemistry, Health Sciences, Athletic Training, and Mechanical Engineering, which form collaborative interdisciplinary groups to carry out basic and applied research in areas including personal bionics and wearable robotics, rehabilitation, hearing improvement, development of materials and devices for biocompatible implants, sensors, wound healing agents, and other medical devices. NAU researchers are positioned well to partner with faculty at other in-state institutions to further develop research programs and provide experiential learning opportunities for our students in this broader area.

What is the University's Advantage and/or Anticipated Funding Opportunities?

As the home of the medical devices division of industry pioneer W.L. Gore, Flagstaff is a center of innovation within the state for bioengineering and medical devices. Previous program investment enabled NAU to contribute to these fields while concurrently training students to meet the workforce needs of these industries. NAU will draw from expertise in the departments of Biological Sciences, Chemistry, Mechanical Engineering, and Applied Physics & Materials Sciences to pursue external funding opportunities in Defense as well as NIH. Skills of NAU researchers participating in this program complement larger programs at our partner institutions in the state, and collaborative projects among universities are likely to yield further positive outcomes and expanded research opportunities for our students, in turn providing graduates strong fundamental skills for employment in the biotechnology or medical devices industries.

Is there an Arizona Specific Benefit or Impact?

Wearable technology and sensors, precision medicine, and medical device development are a focus of the Bioengineering and Biotechnology program, and NAU will continue to develop important intellectual property and licensable technology in these areas. Ongoing work within this program has fostered SBIR/STTR grants and start-up companies based on NAU technology, and further investment will continue to expand these opportunities. Arizona in general and Flagstaff in particular is home to many industries that require skilled workers in medical devices and translational biotechnology research. Investments in bioengineering and biotechnology are catalyzing discoveries that improve lives, foster economic growth and provide cutting-edge training for a diverse population of students who will join Arizona's workforce.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$416,500	$512,500	$0	$929,000
Basic Research	$263,704	$128,489	$153,267	$545,460
Applied Research	$117,450	$0	$0	$117,450
Development	$0	$0	$0	$0
Total	$797,654	$640,989	$153,267	$1,591,910

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$416,500	$0	$0	$929,000
Postdocs Supported	3	4	6	13
Graduate Students	18	19	19	59
Undergraduate Students	30	35	40	105
Sponsored Project Funding	$1,502,864	$1,552,940	$1,587,303	$4,643,107
Publications in Academic Peer-Reviewed Journals	22	24	26	72
Startups	0	0	1	1

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	Northern Arizona University
TRIF Investment Area	Improving Health
Program Name	Biotechnology and Bioengineering

Progress Summary

NAU's Bioengineering and Biotechnology program continues to grow as a hub for innovation and student training. Program researchers have released the world's first comprehensive open-source exoskeleton framework, that is now freely available to researchers and developers working in the field of assistive mobility technology. Efforts to prevent and treat noise-induced hearing loss are also underway in the program, as well as the development of new medical devices for the treatment of strokes. These projects reflect the program's commitment to improving quality of life, while also training students for impactful careers in biotechnology and engineering.

How has the problem statement been addressed in the last year by this TRIF project?

Over the past year, TRIF funding has enabled NAU researchers to address critical health and mobility challenges, particularly for aging and mobility-limited populations. The open-source exoskeleton framework developed by researchers in the program widens access to assistive technology, and a new NSF-funded collaboration exploring muscle function aims to inform the design of better rehabilitation tools. Researchers also secured support from the Department of Defense to study and mitigate noise-induced hearing loss. These projects build on a foundation of innovation in biomechanics, wearable technology, and medical devices. TRIF funds supported faculty startups, pilot projects, and instrumentation, enhancing the competitiveness of external grant applications. Undergraduate and graduate students benefited from direct and indirect TRIF support, gaining hands-on experience in cutting-edge bioengineering research.

What, if anything, hasn't worked as well as was hoped?

Continued recruitment of talented graduate students remains a priority for the program as researchers work to strengthen the pipeline of skilled professionals in biotechnology. While regional infrastructure to support biotech startups is gradually developing, it remains relatively limited, and as such presents some barriers to seamless commercialization of developed technology. Program researchers rely substantially on funding from the National Institutes of Health, and they face ongoing challenges in adapting to the evolving priorities and expectations of this key federal agency. Despite these challenges, the program remains committed to advancing biotechnology through innovation and collaboration.

Describe the Arizona benefit or impact of this TRIF project for the last year.

The Bioengineering and Biotechnology program at NAU continues to deliver tangible benefits to Arizona. The development of assistive mobility technologies and stroke treatment devices has the potential to improve health outcomes for residents across the state, and helps position Arizona as a leader in accessible health technology innovation. The program also plays a vital role in preparing students for careers in Arizona's growing biotech and healthcare sectors, with expanded training and experiential learning opportunities. Licensing and commercialization efforts support the local economy, while TRIF investments ensure that Arizona remains at the forefront of bioengineering research and education.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$80,908	$164,754	$252,821	$165,179	$663,662
Basic Research	$478,478	$180,437	$94,520	$102,809	$856,244
Applied Research	$85,288	$0	$0	$0	$85,288
Development	$0	$0	$0	$0	$0
Total	$644,674	$345,191	$347,341	$267,988	$1,605,194

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$95,521	$170,178	$94,521	$102,809	$463,029
Postdocs Supported	4	3	5	3	15
Graduate Students	37	24	23	33	117
Undergraduate Students	43	22	35	57	157
Sponsored Project Funding	$2,467,362	$3,353,368	$7,745,971	$2,383,734	$15,950,435
Publications in Peer-Reviewed Journals	52	27	43	69	191
Startups	1	0	0	1	2

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	Northern Arizona University
TRIF Investment Area	Improving Health
Program Name	Community Health Research

Problem Statement

The Challenge: Reducing health disparities in rural and underserved populations. Many prevalent diseases in America disproportionately affect minority and underserved/rural populations, and this trend is often magnified in the southwest. In Arizona, the mortality rates associated with diabetes are nearly eight-fold higher than the state average for Native American communities and two-fold higher for Hispanic/Latino populations. A 2020 CDC report also found that Native Americans have higher incident rates of many cancers compared to non-Hispanic White people (www.cdc.gov/cancer/dcpc/ research/articles/cancer-AIAN-US.htm). The factors that contribute to health inequity are multifaceted and require a coordinated and interdisciplinary response.

Program Description

The Community Health Research program will further develop NAU's nationally recognized capacity to produce translational health research and discoveries in community-based healthcare research, precision and personalized medicine, infectious disease control, and partnership-based clinical research for the diverse populations of Arizona and beyond. The program supports a wide range of research into chronic health conditions such as cardiac disease, obesity, dental health, communicative disabilities, , cancer, health informatics, and wellness training research, among others. Faculty across departments in the College of Health & Human Services, the College of Engineering, Informatics & Applied Sciences, the College of the Environment, Forestry & Natural Sciences, and the College of Social & Behavioral Sciences work in collaborative, interdisciplinary groups to transform evidence-based bioscience and health care applications to improve lives and foster economic growth in Arizona and beyond.

What is the University's Advantage and/or Anticipated Funding Opportunities?

Previous investment into this program has paid dividends via the establishment of the Center for Health Equity Research (CHER) and the Southwest Heath Equity Research Collaborative (SHERC); moreover, NAU has a longstanding focus on basic science impacting cancer health disparities, community health and student training through the Partnership for Native American Cancer Prevention (NACP), which is a partnership with the University of Arizona Cancer Center (UACC) funded by the National Cancer Institute. Achieving health equity, eliminating disparities, and improving population health is a of the goal of the Health People 2030 initiative set forth by the Department of Health and Human Services. Together, Community Health researchers equip Native American, Hispanic and other diverse students with high impact multidisciplinary training that prepares them for a wide variety of solutions-oriented jobs in critical areas of need.

Is there an Arizona Specific Benefit or Impact?

Investment into the Community Health Research program serves to help address health disparities in underserved populations throughout the state and trains diverse students for careers in health-related occupations. Program researchers and their mentees are spearheading interdisciplinary and culturally informed and appropriate efforts to find community-driven solutions to address health inequities wherever they exist in Arizona and beyond. By building valuable partnerships with local and regional healthcare providers, research institutions and tribal communities, program researchers are making important developments in community and behavioral health sciences, which are particularly important for rural Arizona communities that do not have the same access to public health resources as do individuals in Phoenix or Tucson.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$60,000	$60,000	$0	$120,000
Basic Research	$359,788	$385,467	$459,800	$1,205,055
Applied Research	$0	$0	$0	$0
Development	$0	$0	$0	$0
Total	$419,788	$445,467	$459,800	$1,325,055

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	4	5	7	13
Graduate Students	22	27	27	77
Undergraduate Students	15	18	22	55
Sponsored Project Funding	$3,539,802	$3,381,061	$3,217,860	$10,138,723
Publications in Academic Peer-Reviewed Journals	40	44	48	132
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	Northern Arizona University
TRIF Investment Area	Improving Health
Program Name	Community Health Research

Progress Summary

Program researchers continued to lead in the areas of community-based health research and translational health research. The program hosts research from faculty within the Center for Community Health and Engage Research (CHER) and the Partnership for Native American Cancer Prevention (NACP). Investment of TRIF serves the spectrum of communities in Arizona by supporting research and workforce training across the urban and rural areas of the state. Program researchers continue to acquire significant external funding for NAU. The NIH-supported Southwest Health Equity Research Collaborative (SHERC) provided resources for many faculty and students to conduct community health research, while NACP successfully renewed funding from the National Cancer Institute to continue its important work. These efforts have developed valuable research collaborations across disciplines, both within and outside of NAU, enabled early-stage investigators to successfully write and receive awards, and provided many training opportunities for undergraduate and graduate researchers.

How has the problem statement been addressed in the last year by this TRIF project?

TRIF funding supported the programs goals to address community health concerns in rural and urban populations across the state. The Community Health program hosts three of NAU's extramurally funded centers and scientific initiatives (Center for Native American Health Equity, SHERC, and NACP) which all have core principles in health workforce training and community engagement. Recent investments have enabled telehealth innovations for speech therapy and mental health, mindfulness-based interventions for rural mothers, and water quality research in Native communities. TRIF funds enabled the program to continue to develop, manage, and support its graduate and certificate programs as well as to provide mentorship of early career faculty, postdocs, and students in advanced research methods.

What, if anything, hasn't worked as well as was hoped?

The program continues to face ongoing challenges in faculty recruitment and retention due to competitive salary demands and the rising cost of living in Arizona, presenting challenges to the program's ability to expand its research capacity. Program researchers have worked tirelessly to build trusted relationships with major federal funding agencies, including the National Institutes of Health and the National Cancer Institute, and these partnerships have been essential to the development of foundational research initiatives within this program. Uncertainty in federal funding streams and shifting agency priorities now pose a threat to the sustainability of these efforts. Despite this, program researchers remain committed to advancing the program's mission through leveraging statewide and national partnerships to drive future success.

Describe the Arizona benefit or impact of this TRIF project for the last year.

The goal of the Community Health program is to improve the health and wellbeing of all Arizonans, and investment from TRIF has had a direct impact on the attainment of this goal. The program's work has significantly benefited Arizona by enhancing health education and outreach in tribal and rural communities. Investments to the program have supported faculty recruitment, student training, and data science capacity building, which in turn has strengthened the state's health research infrastructure. Policy-relevant findings, such as support for the Navajo Nation's Healthy Diné Nation Act and studies on healthcare access during COVID-19, informed decision-making across the state. Research findings were disseminated to state agencies, tribal councils, and healthcare providers, fostering collaboration and trust. The Community Health Research program is a core component of NAU's research enterprise, and TRIF funding has enabled program researchers to continue to deliver upon this important mission for the state.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$86,010	$210,555	$520,235	$362,809	$1,179,609
Basic Research	$478,478	$120,348	$104,659	$63,313	$766,798
Applied Research	$0	$0	$0	$0	$0
Development	$0	$0	$0	$0	$0
Total	$564,488	$330,903	$624,894	$426,122	$1,946,407

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$110,297	$63,313	$173,610
Postdocs Supported	1	1	1	2	5
Graduate Students	24	18	69	76	187
Undergraduate Students	31	21	36	34	122
Sponsored Project Funding	$10,068,685	$6,465,580	$3,081,155	$3,439,676	$23,055,096
Publications in Peer-Reviewed Journals	42	45	44	90	221
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	Northern Arizona University
TRIF Investment Area	Improving Health
Program Name	Pathogen Genomics

Problem Statement

The Challenge: Rapidly characterize outbreaks of pathogens to inform and enable community response. The COVID-19 pandemic illustrated that rapid detection of microbial pathogens is critical to an informed community response. Although the pandemic illuminated the need for screening in the eyes of many Americans, rapid and reliable detection strategies are also crucial for doctors to prescribe appropriate antibiotic regimens and to identify emerging biothreats. In Arizona, environmental monitoring of pathogens found in soil or animal hosts (e.g. Valley fever, West Nile virus) is necessary to inform appropriate community responses. New detection and mitigation strategies will be a national priority and the need for skilled professionals to collect and interpret this data has never been more important.

Program Description

Northern Arizona University's program in Pathogen Genomics research is primarily carried out through the world-renowned Pathogen and Microbiome Institute (PMI), with complementary research in this area in the Department of Biological Sciences and School of Informatics, Computing & Cyber Systems. Major focus areas include the evolution, ecology, and epidemiology of human and animal pathogens spanning those involved in hospital-acquired infections, to anthrax, plague, biological warfare agents, to virulent viral pathogens such as COVID-19. Research strengths encompass microbiology, high throughput genetics and genomics analysis, bioinformatics and drug development. Cutting-edge research efforts are also contributing to our understanding of the human microbiome through identification and characterization of the communities of microorganisms of the human gut, sinuses, and skin, for example, which are associated with human health and disease.

What is the University's Advantage and/or Anticipated Funding Opportunities?

NAU is uniquely equipped to address this challenge due to its core strength in microbial genetics, genomics and microbiome sciences, and its history of training undergraduate researchers to support the health-care and biotechnology industries. Anchored by PMI, which includes a state of the art BSL3 laboratory and vivarium, NAU will continue to maintain robust relationships with external clients at the DHS and DoD. Recent investment into PMI has enabled it to grow its portfolio to include expertise in virology and computational sciences. On average, Pathogen Genomics researchers have trained over forty undergraduate researchers annually over the previous five-year period and continue to provide exemplary training in the fundamentals of genomic research. These students go on to outstanding next steps after NAU, including medical school and top graduate programs.

Is there an Arizona Specific Benefit or Impact?

Researchers in the Pathogen Genomics program specialize in infectious disease that affect Arizona and the Southwest, such as Valley Fever, West Nile Virus, and COVID-19. The expertise of researchers in the program was instrumental to the community response to COVID-19 and they play important roles in continued environmental monitoring efforts. The program has proven to be outstandingly effective in training students for jobs in translational genetics and medicine. Program researchers are generating important intellectual property for licensing. In addition to researching pathogens with a significant presence in the state such as Valley Fever, NAU launched the COVID-19 Testing Service Center (CTSC) to grow the SARS-CoV-2 virus and test new drugs against it, giving Arizona an edge in responding to the crisis. NAU's TRIF investments in this program include basic, applied and translational research and will ensure that NAU researchers will continue to make discoveries and invent new technologies that have an immediate and long-lasting impact on the health and well-being of the diverse populations of Arizona.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$180,000	$180,000	$180,000	$540,000
Basic Research	$359,788	$385,467	$459,800	$1,205,055
Applied Research	$185,000	$185,000	$185,000	$555,000
Development	$0	$0	$0	$0
Total	$724,788	$750,467	$824,800	$2,300,055

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	4	5	6	13
Graduate Students	17	22	22	63
Undergraduate Students	50	52	55	157
Sponsored Project Funding	$6,000,300	$6,493,946	$6,890,261	$19,384,507
Publications in Academic Peer-Reviewed Journals	52	57	62	171
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	Northern Arizona University
TRIF Investment Area	Improving Health
Program Name	Pathogen Genomics

Progress Summary

NAU continues to lead impactful research into the genomics of infectious disease and microbiome sciences through the efforts of the Pathogen and Microbiome Institute (PMI), which currently supports approximately 150 faculty, staff, and students across multiple departments. Program researchers study the ecology and evolution of human pathogens using analytical instrumentation, computational resources and microbial research, some of which is conducted within a sophisticated biosafety level 3 biocontainment laboratory. The program hosts over 70 active funding awards, and researchers have published over eighty peer-reviewed scientific manuscripts and four patents. TRIF funding has been critical in expanding genetic sequencing capabilities and laboratory infrastructure, which supports both research and training opportunities for students. The Pathogen Genomics program remains a hub for multidisciplinary collaboration, with a strong focus on Valley Fever and other zoonotic diseases.

How has the problem statement been addressed in the last year by this TRIF project?

Program researchers have advanced rapid pathogen characterization methodologies by leveraging efforts in genomic surveillance, diagnostic innovation, and environmental monitoring, and have engaged in collaborative efforts to develop new treatments to combat the pathogen responsible for Valley Fever. Ongoing studies on infectious agents, whether they exist in Arizona healthcare facilities or in remote areas of the globe, have provided actionable insights for public health. Diagnostic tools developed in the program have improved detection speed and accuracy, while environmental monitoring of wastewater, household dust, and wildlife has enabled early detection of pathogens that may reside in these areas. Research into microbiome-host interactions, including cervical cancer disparities and avian malaria, have informed targeted interventions into these problems. TRIF funds have been instrumental in enabling training programs for students in bioinformatics.

What, if anything, hasn't worked as well as was hoped?

Maintaining state-of-the-art facilities for safely conducting research on restricted pathogens has been an ongoing financial challenge for the university, and the rising costs of labor and equipment have made this commitment increasingly burdensome. At the same time, the recruitment and retention of highly trained staff remains a persistent difficulty, exacerbated by the escalating cost of living across Arizona. Shifting priorities among federal funding agencies and the growing complexity of regulatory requirements together represent an active and evolving obstacle for program researchers striving to sustain and advance their work. Program researchers will lean on strategic planning and strong collaborative partners to ensure continued progress in this critical area of research.

Describe the Arizona benefit or impact of this TRIF project for the last year.

The Pathogen Genomics program has significantly enhanced Arizona's public health preparedness and the scientific reputation of the university. Genomic surveillance and diagnostic innovations have strengthened the state's ability to detect and to respond to infectious disease outbreaks. These efforts have elevated NAU's reputation, attracting federal funding and fostering international collaborations. Experiential training of students and postdocs contributes to the development of Arizona's STEM workforce. Community engagement efforts, including research on environmental and zoonotic pathogens, inform local health strategies and promote personalized healthcare. The technological innovations and industrial partnerships of researchers in the program also drive regional economic growth through commercialization, grant acquisition, and job creation in the biomedical sector.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$277,623	$451,927	$530,167	$494,684	$1,754,401
Basic Research	$478,478	$0	$137,448	$433,267	$1,049,193
Applied Research	$134,651	$0	$0	$0	$134,651
Development	$0	$0	$0	$0	$0
Total	$890,752	$451,927	$667,615	$927,951	$2,938,245

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$125,932	$325,015	$450,947
Postdocs Supported	3	4	4	7	18
Graduate Students	24	37	41	44	146
Undergraduate Students	36	69	65	78	248
Sponsored Project Funding	$6,734,981	$3,771,546	$5,875,221	$6,498,740	$22,880,488
Publications in Peer-Reviewed Journals	90	76	85	87	338
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	Northern Arizona University
TRIF Investment Area	National Security Systems
Program Name	Cybersecurity and Innovative Materials

Problem Statement

The Challenge: Preventing cybercrime through the development of hacker-resistant security measures and novel materials. As of December 2020, global economic losses from cybercrime were estimated to be over a trillion dollars, and over half of companies that experienced a cyberincident admitted to having no plan to respond to or prevent a future incident. The most pressing challenge is the need for cybersecurity that cannot be easily defeated. Novel approaches include embedded encryption in hardware, innovation in secure quantum computing, nanotechnology and robust microelectronics. The development of innovative materials to address these concerns also has practical applications spanning national security, the production of clean energy and water, and microelectronics.

Program Description

The Cybersecurity and Innovative Materials program addresses key challenges for secure computing and the development of microelectronics. Cybersecurity for information and communications systems, reconfigurable computing, remote sensing, and the internet are areas of major concern for industry operations, institutional protection of data, computer-to-computer communications, and other related applications. Every technology-oriented industry requires increasingly sophisticated approaches to computing systems operations, computing applications, and data protection. In addition to the need for cybersecure materials, the society of tomorrow will increasingly rely on bioelectronics and biosensors, quantum computing, nanotechnology, and those for novel energy storage. All of these will require fundamental research and translatable discoveries to forge these foundations for society. We see this growing need as a core national security priority in the coming decade, as is the effective training of participants in the computing systems and microelectronic industry workforce.

What is the University's Advantage and/or Anticipated Funding Opportunities?

The university will leverage expertise in the School of Informatics, Computing & Cyber Systems, Mechanical Engineering and Applied Physics & Material Science to develop technology modules that will enable new forms of protection across the landscape of cybersecurity needs. Furthermore, NAU researchers will leverage strengths in materials science across multiple academic units as well as the Center for Materials Interfaces in Research and Applications (¡MIRA!), to develop and combine several new technologies, including innovations in microelectronics and the design of computer hardware, to improve the ability of computers to fend off cyberattacks. ¡MIRA! is a materials science center with research foci on quantum materials, active matter and nanoclusters, materials for national security and maintains a mission for expanding opportunities for students from underserved groups in applied materials research.

Is there an Arizona Specific Benefit or Impact?

National security and the economic vitality of the United States depends on a stable, safe and resilient cyberspace. The cybersecurity and defense industries have long been one of the most important employers for the state, and coupled with the rapid expansion of job opportunities in semiconductors and microelectronic materials there is expected to be an immediate and pervasive need for skilled workers across these fields in the state of Arizona. Program researchers will provide important experiential opportunities for undergraduate and graduate students, thus in these disciplines to help meet the growing need for these important and rapidly growing Arizona industries.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$309,731	$125,000	$0	$434,731
Basic Research	$119,929	$128,489	$153,267	$401,685
Applied Research	$71,888	$0	$0	$71,888
Development	$71,887	$0	$0	$71,887
Total	$573,435	$253,489	$153,267	$980,191

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$309,731	$0	$0	$434,731
Postdocs Supported	6	8	8	13
Graduate Students	25	30	30	90
Undergraduate Students	30	35	40	105
Sponsored Project Funding	$1,992,141	$2,227,355	$2,389,619	$6,609,115
Publications in Academic Peer-Reviewed Journals	20	22	25	67
Startups	0	0	2	2

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	Northern Arizona University
TRIF Investment Area	National Security Systems
Program Name	Cybersecurity and Innovative Materials

Progress Summary

NAU's Cybersecurity and Innovative Materials program, supported through TRIF, aims to support areas of workforce need in cybersecurity, quantum computing and microelectronics. Program researchers in the School of Informatics, Computation and Cyber Systems (SICCS) have continued to develop innovative cybersecurity products to the DoD as part of an ongoing collaboration with the Air Force Research Laboratory. These efforts provide new approaches to identifying, authenticating, and protecting a range of electronic devices, including those in use in the military as well as for consumers. Program researchers were also awarded two significant NSF awards in quantum computing and materials science. This funding enabled the creation of the Quantum Education Laboratory (QEL), which provides students access to advanced quantum technologies and fosters innovation in secure materials. Community outreach initiatives, such as the Sparking Curiosity Suite (SparCQS), reached a wide variety of individuals inside and outside of Arizona.

How has the problem statement been addressed in the last year by this TRIF project?

TRIF support has been instrumental in advancing cybersecurity and materials research at NAU. Program researchers are continuing to deliver on projects initiated with the Department of Defense on advanced cybersecurity functions that have brought over $4M in funding to the university and has formed the basis of a successful spinoff company. A recent EXPAND-QISE grant awarded to program researchers facilitated the development of quantum education infrastructure at the university. In partnership with the Arizona Commerce Authority, program researchers have implemented workforce training efforts for the expanding semiconductor industry, and are building a dedicated facility for metrology research on the mountain campus. The Cybersecurity and Innovative Materials program brings together teacher-scholar faculty in physics, engineering, chemistry and materials science to train the next generation of the research workforce in areas of critical need in Arizona.

What, if anything, hasn't worked as well as was hoped?

TRIF funding has played a key role in helping NAU build strong programs in Cybersecurity and Innovative Materials, positioning them well for ongoing external funding. Moving forward, the program will focus on expanding student access statewide through both hands-on and academic learning experiences, and student-focused initiatives that prepare graduates for careers in Arizona's technical workforce.

Describe the Arizona benefit or impact of this TRIF project for the last year.

Arizona has seen substantial benefits from TRIF investments in the Cybersecurity and Innovative Materials program. Efforts of program researchers have strengthened STEM workforce development by creating pathways for students to enter high-impact careers inside and outside the state. Increased external funding has bolstered NAU's research infrastructure and regional innovation capacity, and outreach efforts within the program have reached thousands of individuals throughout the region.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$25,356	$0	$0	$0	$25,356
Basic Research	$439,308	$28,618	$98,137	$206,950	$773,013
Applied Research	$0	$0	$0	$0	$0
Development	$0	$0	$0	$0	$0
Total	$464,664	$28,618	$98,137	$206,950	$798,369

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$28,618	$98,137	$206,950	$333,705
Postdocs Supported	6	3	2	2	13
Graduate Students	12	38	39	41	130
Undergraduate Students	13	12	26	18	69
Sponsored Project Funding	$1,177,486	$2,673,868	$4,605,839	$9,987,384	$18,444,577
Publications in Peer-Reviewed Journals	20	38	51	27	136
Startups	0	0	1	0	1

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	Northern Arizona University
TRIF Investment Area	National Security Systems
Program Name	Supply Chain Management

Problem Statement

The Challenge: Empower communities with tools to enable adaptation to unexpected events. Communities thrive when they have ready access to food, energy and water, but when disruptions to their supply occurs (through natural disasters, wildfires, extreme weather events, or even a global pandemic) the lives and livelihood of its citizens may be jeopardized. The ability to accurately model and visualize the supply chain and commodity transit pathways in real-time can provide powerful information for decision-makers and emergency managers in the resilient management of their food, energy and water systems for disaster relief and recovery. Knowledge of potential limitations to commodity distribution can help communities and states plan for and effectuate recovery as rapidly as possible.

Program Description

The Supply Chain Management program researchers work with very large datasets in partnership with economic forecasting data and analysis of social and behavioral trends in affected communities, to enable construction of models to develop effective responses to unexpected events. Effective community responses to catastrophic events is a priority global need that serves to protect people's lives and livelihoods. Supply chain analysis will aid development of intelligently planned and sustainable smart cities, smart buildings and smart cars. Implementation of the program relies on interdisciplinary expertise from a suite of academic units, including the School of Informatics, Computing & Cyber Systems, School of Earth & Sustainability, College of Health & Human Services, College of Social & Behavioral Sciences, and the W.E. Franke College of Business. The strong focus on interdisciplinarity fosters technical innovations, economic development, and workforce training.

What is the University's Advantage and/or Anticipated Funding Opportunities?

NAU researchers are developing a nationally scalable protocol for public participation in research that leverages data science and visualization tools, and we anticipate this program will effectively complement work at our partner institutions in the state. FEWSION, which uses comprehensive data sets to map out domestic supply chains and resources, aims to develop a framework for deploying adaptation strategies for interdependent power, water, and transportation systems. The tool analyzes and extracts new information from public datasets describing the production, consumption, and flow of food, energy, and water. This program represents an attractive path for students seeking careers in data analytics or information sciences. We anticipate opportunities for student engagement to increase as the program develops, and collaboration with researchers at programs in other statewide institutions will be pursued.

Is there an Arizona Specific Benefit or Impact?

The pandemic has shown how crucial effective management of supply chains are to modern society. When disruptions to the supply of food, energy or water occurs, be it through wildfires, extreme weather events, or even a global pandemic, the lives and livelihood of many may readily become jeopardized. Investment into the Supply Chain Management program will enable NAU researchers to develop unique algorithms from publicly-available datasets to describe the production, consumption, and flow of food, energy, and water. These tools will provide invaluable information to city planners, economic planners and emergency managers inside and outside of Arizona. Further, training of undergraduate, graduate and postdoctoral scientists in advanced data analytics will provide effective workers to meet the need of industry in the state.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$119,929	$128,489	$153,267	$401,685
Applied Research	$0	$0	$0	$0
Development	$0	$0	$0	$0
Total	$119,929	$128,489	$153,267	$401,685

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	2	3	13
Graduate Students	2	6	6	17
Undergraduate Students	3	10	13	26
Sponsored Project Funding	$1,559,548	$1,456,649	$1,355,663	$4,371,860
Publications in Academic Peer-Reviewed Journals	18	20	22	60
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	Northern Arizona University
TRIF Investment Area	National Security Systems
Program Name	Supply Chain Management

Progress Summary

NAU continues to advance adaptable supply chain models that support planning and response efforts for federal, state, and regional users. These models leverage publicly accessible databases to enhance community resilience to unexpected events. The Department of Defense has sponsored an ongoing effort to develop and implement a predictive platform with Northeastern University, Mississippi State, ASU's Decision Theater, and private sector partners. Recent research has applied these models to efforts in environmental sustainability, including an examination of surface water distribution in the Great Salt Lake and an analysis of water use in the Colorado River usage. These developments underscore the program's growing relevance across national defense, homeland security, and environmental planning.

How has the problem statement been addressed in the last year by this TRIF project?

TRIF funding has supported key activities in the Supply Chain Management program, including tech transfer, program oversight, and data security. Researchers continue to work with federal and private sector partners on a program that has had multi-year support from the Department of Defense. The modeling tools developed in this program have also been applied to infrastructure and environmental systems, such as water resource management in the Colorado River Basin. Student involvement has been supported through direct funding and awards from the Seed, Equipment and Infrastructure Investment program, providing hands-on experience in high-impact research.

What, if anything, hasn't worked as well as was hoped?

TRIF funding was essential in launching the Supply Chain Management program and fostering connections between NAU researchers, statewide partners, and external collaborators. These partnerships have helped develop data analysis technology at NAU are continuing to fulfill the program's objectives. However, the program's focus on advanced research has limited its ability to expand student-centered training, and ongoing data security and DoD contracting requirements are complex and challenging to oversee. Despite these hurdles, the program has delivered strong unit-level outcomes that have enhanced NAU's sponsored research portfolio, thanks in large part to TRIF support. Looking ahead, NAU plans to scale back TRIF investment in this program to redirect resources toward emerging research opportunities.

Describe the Arizona benefit or impact of this TRIF project for the last year.

The Supply Chain Management program has delivered significant benefits to Arizona by supporting statewide collaborations focused on food, energy, and water resource planning. The application of supply chain modeling to the Colorado River has informed strategies for balancing urban and agricultural water needs. These tools are now being used by strategic planners at state, national, and international levels to improve infrastructure resilience and environmental sustainability. The program's contributions to national defense and homeland security also reinforce Arizona's role in advancing critical technologies.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$25,356	$0	$0	$0	$25,356
Basic Research	$439,308	$50,868	$0	$0	$490,176
Applied Research	$0	$0	$0	$0	$0
Development	$0	$0	$0	$0	$0
Total	$464,664	$50,868	$0	$0	$515,532

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	2	1	3
Graduate Students	7	3	4	5	19
Undergraduate Students	4	1	1	5	11
Sponsored Project Funding	$1,752,522	$5,532,617	$9,138,982	$1,691,571	$18,115,692
Publications in Peer-Reviewed Journals	13	12	11	18	54
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	Northern Arizona University
TRIF Investment Area	Space Exploration and Optical Solutions
Program Name	Solar System Science and Exoplanets

Problem Statement

The Challenge: To understand the composition of objects in our solar system, and to pursue a spacecraft mission to explore an asteroid. The origins of the Solar system and its unexplored bodies remain among the most significant questions for space scientists. Research is performed through high-powered telescopy, in which signatures are assessed through measurement and analysis of large data sets. Data obtained from instrumentation delivered to the site of observation via a planned spaceflight is also necessary. Cutting-edge equipment must be made that is limited in size and weight, is robust and resilient, and is constructed in an economical fashion. Deployed instrumentation can acquire data inaccessible through telescope images and is critical to understand the composition of these bodies.

Program Description

TRIF funding has enabled recruitment of leading-edge faculty to NAU's Department of Astronomy and Planetary Sciences with experience on collaborative spacecraft missions, and program researchers aim to lead a spacecraft mission to an asteroid through the NASA SIMPLEx program. Currently, researchers and their students direct the daily tasks of the NASA Curiosity Rover on the surface of Mars from campus and have developed deployable instruments for other missions to the red planet. Researchers specializing in exoplanets have access to powerful telescopes, as well as unique equipment capable of replicating and measuring phenomena in the environments of these distant planets. NAU researchers will engage with our partner institutions in the state, and with the aerospace industry in Arizona. In addition to yielding valuable scientific information, this project will also provide industry contacts and unique training opportunities for undergraduate and graduate researchers, strongly serving current needs of this cornerstone industry in Arizona.

What is the University's Advantage and/or Anticipated Funding Opportunities?

Northern Arizona was the site of a transformative finding in planetary science when Pluto was discovered at Lowell Observatory, and NAU is positioned to build on this rich tradition. Previous investment grew the department of Astronomy & Planetary Science, created a top-tier doctoral program, and enabled important discoveries, such as the evidence of Farfarout, which was recently confirmed as the most distant object in the Solar System by the International Astronomical Union. NAU researchers access important telescopes and have developed valuable collaborations (Lowell Observatory, USGS) to pursue new funding opportunities at NASA, the DoD, and ithe NSF. Finally, program researchers are collaborating with other areas of university strength to understand seasonal variations of biosignatures using remote sensing, both on Earth and potentially those detectable on astrobiological targets of interest.

Is there an Arizona Specific Benefit or Impact?

Arizona is host to a thriving aerospace and defense technology industry. According to the Arizona Commerce Authority, the state is home to over 1300 manufacturers and suppliers of the aerospace industry and employs over 58,000 workers. Astronomy and planetary sciences is also an important employer for the state, which houses numerous internationally recognized research facilities and observatories. A study conducted by the Arizona Arts, Sciences and Technology Academy estimates Astronomy and Planetary Sciences contribute over a quarter of a billion dollars annually to the state revenue. Investment into the Solar Systems Sciences and Exoplanets program will allow NAU researchers and students to engage with our partner institutions in the state, and with the aerospace industry in Arizona. In addition to yielding valuable scientific information, this project will also provide strong industry contacts and unique training opportunities for undergraduate and graduate researchers, strongly serving current needs of this cornerstone industry in the state. In addition to the crucial scientific information this program is poised to provide, it will also facilitate strong industry contacts and unique experiential learning opportunities for undergraduate and graduate researchers, strongly serving current needs of this industry in Arizona.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$0	$0	$0	$0
Basic Research	$1,009,288	$715,467	$789,800	$2,514,555
Applied Research	$0	$0	$0	$0
Development	$0	$0	$0	$0
Total	$1,009,288	$715,467	$789,800	$2,514,555

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	1	1	13
Graduate Students	7	8	8	25
Undergraduate Students	10	13	16	39
Sponsored Project Funding	$3,465,529	$3,919,541	$4,297,490	$11,682,560
Publications in Academic Peer-Reviewed Journals	40	44	48	132
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	Northern Arizona University
TRIF Investment Area	Space Exploration and Optical Solutions
Program Name	Solar System Science and Exoplanets

Progress Summary

The Solar System Science and Exoplanets program continues to lead in innovative research and technology development in the fields of astronomy and planetary science. The program takes advantage of Arizona's unique resources in astronomical research and leverages partnerships within the state to prepare a skilled workforce to meet the need of industries in this research domain. TRIF investment enabled NAU to establish Radiant, a new interdisciplinary center housed within the program that integrates expertise in remote sensing, planetary science, geological systems, landscape ecology, and engineering. Program researchers continued to engage and involve student researchers in astronomy and astrophysics through a transfer program from community colleges, and to foster opportunities for student researchers to be directly engaged in the development of cutting-edge analytical instrumentation and technology.

How has the problem statement been addressed in the last year by this TRIF project?

Accomplishments of researchers within the Solar Science and Exoplanets program are many. Program researchers were instrumental to NASA's DART mission, and have pursued on-site research on Antarctic weather. The program expanded its research portfolio with two major grants on active asteroids, and researchers have also secured substantial time on the James Webb Space Telescope for advanced solar system observations. Researchers in the program contributed to NASA's Lunar Trailblazer mission, with faculty and students actively participating in its launch and science team meetings. Outreach efforts included campus presentations, school visits, and a regional symposium co-hosted with Lowell Observatory. These accomplishments reflect the program's growing national and international impact and its commitment to student engagement and public science communication. TRIF funding was pivotal in launching the Radiant center, which unites faculty across multiple departments to advance remote sensing research, which is a recognized area of strength for NAU and is of emerging importance to research in ecology, agriculture, and defense.

What, if anything, hasn't worked as well as was hoped?

The Solar System Science and Exoplanets program and the remote sensing initiative are both growing at NAU and TRIF funding has enabled necessary upgrades to the research infrastructure to accommodate the needs of program researchers. The rapidly changing federal regulatory landscape, particularly around information security, has required NAU to develop and implement compliance protocols in order to facilitate research in many areas program researchers aim to explore, which has required time and resources to accomplish.

Describe the Arizona benefit or impact of this TRIF project for the last year.

TRIF-supported students gained hands-on experience in spacecraft instrumentation, hardware development, and planetary science, preparing them for careers in Arizona's growing space and technology sectors. The establishment of the Radiant center and investment in remote sensing infrastructure have positioned NAU as a leader in this emerging field, offering new research and training opportunities for students statewide. Contributions to NASA missions and international research collaborations have elevated Arizona's profile in planetary science and remote sensing, while TRIF funding continues to build the technical foundation for future innovation and workforce development.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$50,719	$0	$2,192,500	$811,605	$3,054,824
Basic Research	$774,928	$416,060	$403,896	$581,200	$2,176,084
Applied Research	$0	$0	$0	$0	$0
Development	$0	$0	$0	$0	$0
Total	$825,647	$416,060	$2,596,396	$1,392,805	$5,230,908

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$213,896	$581,200	$795,096
Postdocs Supported	4	6	6	6	22
Graduate Students	33	33	31	38	135
Undergraduate Students	5	26	20	12	63
Sponsored Project Funding	$3,231,586	$3,094,950	$3,373,799	$5,471,192	$15,171,527
Publications in Peer-Reviewed Journals	43	63	60	88	254
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	Northern Arizona University
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Adapting to a Changing Environment

Problem Statement

The Challenge: Predict the impact of a changing environment on soils, the atmosphere, ecosystems, and natural populations. Changes in our environment and climate have resulted in alteration of many aspects of the world today, including the strength and duration of weather events and changes in the average temperature and precipitation relative to historical patterns. As the environment changes, life on Earth changes with it. A deep understanding of how the flora and fauna on Earth are impacted by these changes (including wildlife ecosystems, forests, and even soils) will be required for society to effectively adapt as our environment changes around us.

Program Description

Under the Adapting to a Changing Environment program, NAU makes investments in two Research Centers: The Center for Ecosystem Science and Society (Ecoss) and the Center for Advancing Western Landscapes (CAWL). Researchers in Ecoss investigate the interactions of biological communities—from single cells to the entire globe—with the environment, with a particular eye for how they both respond to and influence environmental change. Ecoss provides opportunities for the training of future scientists and actively engages the public in the discoveries made by the center. CAWL has advanced cross-disciplinary environmental research and training at NAU with a focus on the Colorado Plateau. The center has taken the initiative to provide science-based leadership to address conservation and environmental challenges in the West. Additional complementary research in the Adapting to a Changing Environment program occurs through faculty-led initiatives from the School of Earth & Sustainability, Department of Biological Sciences, School of Forestry, School of Informatics, Computing, & Cyber Systems and the Sustainable Communities program.

What is the University's Advantage and/or Anticipated Funding Opportunities?

With recognized leaders in environmental science and ecology, and with synergy from skills in remote sensing and computational modeling, NAU is uniquely positioned to train the next generation of scientists to tackle problems in these areas. NAU has multidimensional strength in this program, including faculty who incorporate field-based, molecular genetic and bioinformatic approaches to understanding how changing climate impacts life on earth. The integration of sensor technology with informatics allows researchers to conduct longitudinal studies to assess ecosystem and forest health. Together with research in forestry and ecology, this work informs sustainable development goals and management practices. Program researchers mentor students across degree programs that take full advantage of NAU's unique place-based strength of being situated in the natural laboratory of the Colorado Plateau.

Is there an Arizona Specific Benefit or Impact?

Changing land management practices and climate variation are fundamentally altering Earth's landscapes, but scientists don't have a complete picture of their impact on global ecosystems. Program researchers use unique instruments, facilities, and field-based experiences to study the interactions of biological communities to determine how they respond to and influence environmental change. This information helps forge new solutions to environmental challenges and aids public deliberation and land-management efforts across Arizona and beyond. NAU's Adapting to a Changing Environment program provides outstanding experiential education opportunities and research engagement for undergraduate and graduate students, preparing them for careers with natural resource management agencies, federal and university research laboratories, and environmental consulting firms, among other in-demand career pathways.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$593,844	$350,000	$350,000	$1,293,844
Basic Research	$359,788	$573,967	$459,800	$1,393,555
Applied Research	$0	$0	$0	$0
Development	$0	$0	$0	$0
Total	$953,632	$923,967	$809,800	$2,687,399

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$270,000	$540,000
Postdocs Supported	8	9	10	13
Graduate Students	44	47	47	141
Undergraduate Students	35	38	40	113
Sponsored Project Funding	$4,237,633	$4,164,990	$4,073,196	$12,475,819
Publications in Academic Peer-Reviewed Journals	80	88	96	264
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	Northern Arizona University
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Adapting to a Changing Environment

Progress Summary

Researchers in the Adapting to a Changing Environment program at NAU, through research in the Center for Ecosystem Science and Society (ECOSS) and the Center for Adaptable Western Landscapes (CAWL). In the previous year, researchers have conducted influential studies into the drought resilience of native plants, soil carbon dynamics, and conservation of biodiversity across the state. Environmental sustainability and adaptive capacity in the Southwest, which are crucial for a successful future for Arizona, is a significant focus of the program. Researchers in the program are internationally recognized for their expertise and continue to be very productive in securing new funding streams and publishing high impact scientific papers. The program provides laboratory and field-based experiences to a large number of students to engage in interdisciplinary research across biology, environmental science, and informatics, effectively training the next generation of ecosystem scientists and restoration researchers.

How has the problem statement been addressed in the last year by this TRIF project?

TRIF funds invested into the program continued to support foundational research, collaborative planning, and field-based education to address large-scale environmental challenges. Program researchers have developed predictive modeling of wildfire impacts on permafrost carbon, snowpack-carbon dynamics, and microbial contributions to soil health. In one example, CrustNet, a global study on biological soil crusts and bioremediation efforts contributed to dryland restoration science. Researchers also conducted field-based research on soil moisture, plant-soil feedbacks, and invasive species dynamics, while integrating social science to understand landowner behavior and community vulnerability. The program also experienced success in securing new extramural funding including multi-million dollar awards from the NSF and Department of Defense, respectively.

What, if anything, hasn't worked as well as was hoped?

The program has made strong progress in expanding graduate and undergraduate research opportunities, with a continued focus on recruiting talented graduate students to build a skilled workforce. These advancements come as major federal funding agencies—including the National Science Foundation, EPA, and U.S. Department of Energy—undergo shifts in organizational structure and funding priorities. In response, program researchers are working collaboratively and leveraging both statewide and national partnerships to navigate these changes effectively.

Describe the Arizona benefit or impact of this TRIF project for the last year.

The Adapting to a Changing Environment program has delivered substantial benefits to Arizona through its focus on finding solutions to sustainability challenges faced by the state. Researchers continue to interface with statewide stakeholders in agriculture, ranching, natural resource management, restoration and recreation, and tribal officials. Their work informed land management policies on grazing, fire recovery, and ecological restoration, while promoting scientific literacy through public outreach events. Climate resilience research, community engagement, and workforce development are all important drivers of the program and student training and employment opportunities in the program supported regional economies and strengthened Arizona's STEM workforce.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$199,897	$279,011	$612,654	$260,406	$1,351,968
Basic Research	$644,142	$83,672	$1,382	$239,925	$969,121
Applied Research	$0	$0	$0	$0	$0
Development	$0	$0	$0	$0	$0
Total	$844,039	$362,683	$614,036	$500,331	$2,321,089

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$2,817	$1,382	$239,925	$244,124
Postdocs Supported	11	8	12	16	47
Graduate Students	62	41	63	92	258
Undergraduate Students	27	18	58	28	131
Sponsored Project Funding	$6,705,932	$14,973,654	$3,013,885	$10,566,881	$35,260,352
Publications in Peer-Reviewed Journals	117	106	85	120	428
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	Northern Arizona University
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Forest Health and Land Management

Problem Statement

The Challenge: Development of a sustainable management strategy to improve forest health and lessen the risk of catastrophic wildfire. Forests in the western U.S. provide invaluable resources and services to the nation. In addition to the financial benefit they provide, healthy forests also contribute to people's quality of life. Forests provide clean air and water, contribute to biodiversity, recreational opportunities, and scenic landscapes. Unmanaged forests, on the other hand, are at risk of catastrophic wildfires and post-fire flooding that damage landscapes and livelihoods. An interdisciplinary and coordinated approach to develop and promote the best science to inform management is required to accomplish forest restoration and watershed protection is needed inside and outside of Arizona.

Program Description

Under the Forest Health and Land Management initiative, NAU invests in researchers in the Ecological Restoration Institute (ERI), along with faculty in the School of Forestry, School of Earth & Sustainability, and School of Informatics, Computing & Cyber Systems. ERI seeks solutions to the costly environmental problems of degraded forest health and unnatural wildfire. Losses of city and county revenue from decreased tourism, short-term job losses, damage to water supplies, and the devastation experienced by those who live through catastrophic wildfire are just some of the economic impacts that ERI's work seeks to alleviate. Additionally, investments in the program support the development and use of remote sensing technology to monitor forest health, wildfire recovery, and the effect of environmental change on wildlife populations. Past TRIF investments in these units have enabled NAU to provide training in restoration science, including fieldwork experiences, to hundreds of graduate and undergraduate students.

What is the University's Advantage and/or Anticipated Funding Opportunities?

Centered in the largest ponderosa pine forest in North America, and with the only School of Forestry in the state, NAU is uniquely positioned to pursue this challenge. NAU's ERI plays a primary role in forest restoration initiatives across the west and is the lead member of the multi-university Southwest Ecological Restoration Institute (SWERI). Ongoing research and restoration work performed in NAU's highly regarded School of Forestry supports active management and conservation of our natural resources in concurrence with the revival of the forest products industry in Arizona. In the 1950's, the Arizona State Land Department dedicated 4000 acres of forest in Northern Arizona as an "outdoor laboratory" for NAU. Building on this history, the 50,000 acre Centennial Forest was established in 2000, offering a premier location for research and workforce training for students in Forestry undergraduate and graduate programs.

Is there an Arizona Specific Benefit or Impact?

Arizona has over 18 million acres of forested land within its boundaries. Unmaintained and unhealthy forests are at significant risk of catastrophic wildfire which disrupts the lives and livelihood of communities who live in proximity to these natural resources. The development of thinning and land restoration practices minimizes the risk of wildfires, and in turn lessens the economic impact of these natural disasters. In addition to the introduction of responsible land management and resource conservation practices that protect residents throughout the American west, program researchers are developing industry partnerships to revive the forest products industry in Arizona, thus improving the economic outlook for rural communities within the forests of the state. The long-term partnerships NAU has developed with federal government entities such as the USGS, National Park Service, U.S. Forest Service and the Bureau of Land Management will continue to generate environmental, economic, and social wellbeing improvements for stakeholders across the rural portions of Arizona. Finally, the research underway in this critical area has been, and will continue to be, essential for experiential training in restoration science, including fieldwork experiences, to many graduate and undergraduate students.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$1,205,000	$625,000	$500,000	$2,330,000
Basic Research	$359,788	$385,467	$459,800	$1,205,055
Applied Research	$0	$0	$0	$0
Development	$0	$0	$0	$0
Total	$1,564,788	$1,010,467	$959,800	$3,535,055

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$100,000	$0	$0	$100,000
Postdocs Supported	2	2	2	13
Graduate Students	8	10	10	30
Undergraduate Students	15	18	22	55
Sponsored Project Funding	$3,626,718	$3,817,599	$3,962,319	$11,406,636
Publications in Academic Peer-Reviewed Journals	40	44	48	132
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	Northern Arizona University
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Forest Health and Land Management

Progress Summary

Researchers in the Forest Health and Land Management program at NAU, through the School of Forestry and the Ecological Restoration Institute (ERI), continued to lead in the fields of forest restoration, wildfire management, and post-fire recovery. NAU researchers collaborate extensively with federal agencies and local stakeholders, and have continued to contribute to areas vital for Arizona, including global change impacts on forests, resilience to disturbances, ecosystem restoration, tribal engagement, and workforce development. Program researchers are internationally recognized for their expertise in forestry and wildfire science, and continue to pursue studies into forest recovery after fire, aspen response to climate stressors, and long-term effects of restoration treatments, to name a few. TRIF funds supported the continued development of a nationwide wildfire treatment map, informational resources about wildfires for decision-makers and field-based research opportunities for students, reinforcing NAU's leadership in forest health science.

How has the problem statement been addressed in the last year by this TRIF project?

TRIF funding enabled operational support for the Ecological Research Institute (ERI), the School of Forestry, and the School of Earth and Sustainability, facilitating recruitment of staff and graduate students. Program researchers have investigated the impacts of climate on wildfire risk and developed forest management strategies, which have resulted in millions of dollars of external funding for the university. NAU researchers spearheaded a landmark study on post-fire tree replanting across the Interior West which provided critical insights into recovery strategies. Economic analyses showed that forest restoration in high-risk watersheds yields over seven dollars in benefits for every dollar invested. Program researchers also collaborated on managed fire policy analysis and supported the Four Forest Restoration Initiative (4FRI). Innovative technologies like mobile biochar production were tested in partnership with the Forest Service.

What, if anything, hasn't worked as well as was hoped?

Recruiting talented students into the program's research efforts remains a challenge, particularly given the specialized nature of the work. However, the program has made encouraging progress over the past year in growing mentored research opportunities. Close collaboration with federal partners—especially the U.S. Forest Service—continues to be a vital component of the program's success. Although recent workforce restructuring within this and many other federal agencies has introduced new complexities to joint initiatives, the program is actively navigating these changes through strong partnerships and adaptive strategies.

Describe the Arizona benefit or impact of this TRIF project for the last year.

The work of researchers in the Forest Health and Land Management program has delivered substantial benefits to Arizona, improving forest health and reducing wildfire risks. Forest health is crucial for water security, the sustainability of rural and forest-based economies, and the safety and well-being of the residents of Arizona. Collaborations of program researchers with tribal communities, including the Wood for Life program, strengthened community engagement and resource sharing. Science-based insights resulting from ongoing program research have informed state and federal policy, in turn facilitating planning and response strategies for severe wildfire events or challenges to forest health from bark beetle infestations. This program is a central part of NAU's research enterprise and represents a historical strength for the university, with TRIF funding supporting ongoing research that benefits Arizona's residents.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$745,532	$977,569	$718,934	$705,080	$3,147,115
Basic Research	$538,700	$198,677	$167,184	$49,388	$953,949
Applied Research	$0	$0	$0	$0	$0
Development	$0	$0	$0	$0	$0
Total	$1,284,232	$1,176,246	$886,118	$754,468	$4,101,064

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$198,677	$137,571	$49,388	$385,636
Postdocs Supported	2	7	5	5	19
Graduate Students	25	39	39	28	131
Undergraduate Students	20	63	26	29	138
Sponsored Project Funding	$3,398,402	$10,706,802	$8,335,936	$6,780,607	$29,221,747
Publications in Peer-Reviewed Journals	67	75	51	97	290
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	Northern Arizona University
TRIF Investment Area	Workforce Development
Program Name	Continuing Support for Existing Access and Workforce Development Programs

Problem Statement

NAU offers a legacy of strong programs that align with the workforce demand across the State of Arizona. The programs serve transfer students, including adult learners, through statewide and online delivery modes. Additionally, the support for the development of real-time labor demand and workforce analysis is aligned with the programming offered. The continuation of these program investments is critical to continue the delivery and support of flexible high-quality programming that meets the needs of the Arizona workforce.

Program Description

The existing academic programs supported through A/WD TRIF funding cross many disciplines. They are intentionally designed in flexible manners, including but not limited to 90/30-degree completion programs, certificates, and graduate degrees. For the 90/30-degree completion programs, NAU faculty collaborate with our community college partners to design and design programs in Arizona that include well-articulated progression plans for students to follow from entry point through graduation. The following academic discipline areas deliver more than sixty certificate, undergraduate and graduate programs online and at statewide sites through the TRIF A/WD initiative. These programs will continue to be supported with this important funding: Communication Sciences & Disorders Programs, Educational Leadership Programs, Educational Psychology Programs, Educational Specialties Programs, Teaching & Learning Programs, Health Sciences Programs, Nursing Programs

What is the University's Advantage and/or Anticipated Funding Opportunities?

NAU has a significant advantage for serving Arizona transfer students and adult learners through the delivery of workforce-driven programs at our statewide sites. These locations provide place-bound students the much-needed access to high-quality educational pathways, while empower them to maintain their life commitments, particularly jobs, family, and community responsibilities.

Is there an Arizona Specific Benefit or Impact?

High-growth labor trends are commonly described as above-average student and labor market demand growth and volume. According to Hanover Research, Arizona student degree completion trends and employment projections indicate there are 11 high-growth fields projected at the bachelor's level. Additionally, there are 14 high-growth fields projected at the master's level. All projected high-growth fields are captured within the existing academic programs supported through A/WD TRIF funding. The continued delivery of these programs is essential for the sustainability and growth of programs that align with current and projected workforce trends.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$2,758,788	$2,539,588	$2,539,588	$7,837,964
Basic Research	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0
Development	$0	$0	$0	$0
Total	$2,758,788	$2,539,588	$2,539,588	$7,837,964

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	13
Graduate Students	1235	1321	1321	4010
Undergraduate Students	2749	2941	3235	8925
Sponsored Project Funding	$0	$0	$0	$0
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	Northern Arizona University
TRIF Investment Area	Workforce Development
Program Name	Continuing Support for Existing Access and Workforce Development Programs

Progress Summary

This project supports online and in-person, statewide programs designed to meet the needs of adult learners, serving students where they work, live, and learn. Undergraduate programs primarily serve adults with some college and no degree, while graduate programs are geared toward those who are looking to advance in their careers by earning master's or terminal degrees. To address critical need for behavioral health professionals, statewide offerings were expanded in FY23, including master's programs in School Psychology, School Counseling, and Clinical Mental Health Counseling. Enrollments in those programs increased by 13% in FY24 and 18% in FY25. In FY24, two additional statewide programs were launched including a new partnership with Maricopa Community Colleges: Educational Leadership–Community College and Higher Education MED and an Emphasis in Health Sciences–Allied Health BS, Occupational Therapy Assistant in Yuma. A robust leadership review of the portfolio of statewide and online programs informed disestablishment of 35 academic programs at various statewide locations or discontinued altogether; three were created to meet workforce needs in Arizona during FY25. Investment Detail This project funded 30 full-time and over 200 part-time faculty across 50 education and health science programs. Additionally, operational funding was used for vendor supported program market research and analysis. Future Outlook NAU will continue to: 1) enhance its academic program portfolio as workforce needs evolve throughout the State; 2) implement high impact practices related to regional workforce development, and improved student and career service experiences aimed at retention; and 3) study and implement targeted recruitment strategies in regions with high job demand and lower educational attainment levels.

How has the problem statement been addressed in the last year by this TRIF project?

There are currently three new College of Education and College of Health and Human Services online programs launching in fall 2025 in direct response to the needs of Arizona's residents. NAU invested in statewide and online operations. Enrollment Management, Student Affairs, University Advising, Workforce Development, and Statewide Initiatives and Alliances (overseeing our regional hubs) all have staff working in-person around the state to recruit and retain students and engage with the business community. In furtherance of this effort, the Arizona Attainment Alliance (A++) advances NAU's strong relationship with Arizona community colleges to boost Arizona's post-secondary attainment rate. NAU Online added a retention focused coaching team, restructured the instructional design team, and refined program operations to enhance service to students.

What, if anything, hasn't worked as well as was hoped?

NAU's competitors are private and public institutions, in and outside of Arizona, all of whom, at some level, are recruiting students who seek high return on educational investments. The cost of marketing is expensive and must therefore be done with small investments yielding the greatest impact. Online and statewide students have distinctive needs for support. Students from lower socioeconomic backgrounds experience greater disruptions to their education, as costs are more difficult to manage and competing demands of employment and family responsibilities.

Describe the Arizona benefit or impact of this TRIF project for the last year.

NAU is committed to ensuring post-graduation success. In FY25, NAU awarded 585 degrees and 84 certificates in education and health science disciplines, resulting in 669 candidates for jobs in hospitals, clinics, and schools. 47% of these graduates completed master's or terminal degrees, preparing them for leadership and other high-wage careers.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$2,798,571	$4,776,040	$3,795,063	$3,780,099	$15,149,773
Basic Research	$0	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0	$0
Development	$0	$0	$0	$0	$0
Total	$2,798,571	$4,776,040	$3,795,063	$3,780,099	$15,149,773

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	0	0	0
Graduate Students	1362	1287	1251	1239	5139
Undergraduate Students	776	769	744	741	3030
Sponsored Project Funding	$0	$0	$0	$0	$0
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	Northern Arizona University
TRIF Investment Area	Workforce Development
Program Name	Instructional and Graphic Design Support for High-quality Programming

Problem Statement

Providing well-developed faculty professional development programs increases overall organizational satisfaction. Professional instructional design drives engaging learning experiences within faculty coursework. A focus on instructional design is necessary to develop and deliver high-quality, accessbile programs for all learners. Course enrichments for adult learners will provide classroom design that create effective learning experiences. Busy working professionals will be more engaged and retained through professional design practices. Ongoing TRIF funding will support innovative development of new and existing programs, including alternative credentials, learning modules, stackable programming, as well as prior learning assessments and portfolios.

Program Description

The following instructional and graphic design strategies will be supported through the TRIF A/WD initiative. • Coordination of a university-wide instructional and graphic design team to develop transformative and equitable educational opportunities for all learners, including the growing diverse population of adult learners and working professionals • Intentional universal design practices for the creation of instructional materials and utilization of educational technology that enables student success • Ensuring that workforce training, lifelong learning, and professional development programs are developed with competency-based focus design that articulate to learning outcomes

What is the University's Advantage and/or Anticipated Funding Opportunities?

Designing classroom instruction that utilizes emerging educational technologies to engage and satisfy adult learners will lead to high-quality learning experiences. The ongoing support of the coordinated team of instructional and graphic designers aligns with NAU's vision to create access to high-quality programming by delivering the highest course quality through the professional development of NAU faculty.

Is there an Arizona Specific Benefit or Impact?

NAU serves a diverse population of students through the statewide and online programs. The instructional and graphic designers provide expert learning design, educational graphics and creative design, educational technology services, and training support for all NAU faculty, including online and statewide faculty members. Instructional design principles will support the faculty to deliver engaging content that will lead to effective connections between students, faculty, as well as more involvement from students in their learning.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$1,313,554	$1,123,553	$1,123,553	$3,560,660
Basic Research	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0
Development	$0	$0	$0	$0
Total	$1,313,554	$1,123,553	$1,123,553	$3,560,660

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	13
Graduate Students	50	100	100	350
Undergraduate Students	100	200	300	600
Sponsored Project Funding	$0	$0	$0	$0
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	Northern Arizona University
TRIF Investment Area	Workforce Development
Program Name	Instructional and Graphic Design Support for High-quality Programming

Progress Summary

Last year the Advanced Instructional and Creative Design (AICD) group invested in Canvas LMS integrations (CidiLabs) that significantly increased our Instructional Designers ability to rapidly prototype and standardize course templates without the need for laborious hand coding. The AICD team built 40 courses in support of NAU Online, Personalized Learning, and Continuing Education programs. The Creative Design team generated more than one thousand custom graphic and digital media assets. Investment Details This project supports 11 FTE and includes funding for staff professional development. There were staffing changes through retirements, promotions, and other departures (none with cause) that resulted in salary-savings redirected to fill needs in other AWD projects. Future Outlook The AICD team supports the course development for each new program launching within NAU Online. They will also be supporting the re-development of a curated set of 11 online General Studies courses, including OER (Open Educational Resources) materials. Finally, AICD is developing a summer faculty workshop series focused on refreshing online courses.

How has the problem statement been addressed in the last year by this TRIF project?

The AICD team built 19 Applied Wildland Fire Science courses; 5 Continuing Education Fire Management Certification courses; 8 Physical Education Certification courses; 1 Communication Sciences and Disorders Certification course; and 7 BS-IT courses. They also lead the evaluation and implementation of NAU's remote proctoring service change.

What, if anything, hasn't worked as well as was hoped?

The AICD team onboarded 5 new instructional designers and 4 student workers in Fall 2024. The team was able to hire positions remotely within Arizona, thus expanding recruitment beyond the Flagstaff area. There were delays with procurement approvals which delayed timelines on several projects. Nonetheless, the team eventually procured the CidiLabs course prototyping tool, YujaVerity remote proctoring, and project partnership with LearningMate to support the hybrid DPT program.

Describe the Arizona benefit or impact of this TRIF project for the last year.

NAU's Statewide and Online programs contributed to the Arizona economy by awarding college credentials to 1358 Arizona residents in FY25, all of whom benefited from highly produced online and hybrid course content delivered with support from AICD.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$797,747	$778,564	$231,942	$754,476	$2,562,729
Basic Research	$0	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0	$0
Development	$0	$0	$0	$0	$0
Total	$797,747	$778,564	$231,942	$754,476	$2,562,729

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	0	0	0
Graduate Students	148	0	0	0	148
Undergraduate Students	609	0	0	0	609
Sponsored Project Funding	$0	$0	$0	$0	$0
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	Northern Arizona University
TRIF Investment Area	Workforce Development
Program Name	New and Expanded Programming

Problem Statement

The Covid-19 pandemic has disrupted the labor market in unprecedented manners across the State of Arizona, including the closings of nonessential businesses, significant demands in healthcare, and sudden shifts to remote work. These disruptions have resulted in displacements of much of the workforce, including but not limited to, service workers, education providers, sales, and social service fields. A significant number of affected workers represent socioeconomically vulnerable diverse populations. Workers are urgently seeking flexible and stackable pathways of education that provide new career and advancement opportunities through upskilling and furthering their educations.

Program Description

We have organized an action team to provide an inclusive and collaborative review of our current portfolio of academic programs, delivery models, and student services for each of the statewide sites. This action team is further charged to identify the unique labor demand needs of the individual communities surrounding each statewide site and provide recommendations for new and expanded programming in collaboration with the community college partners. Programming recommendations will include workforce development strategies and student services to best serve our current and future students across the State of Arizona. NAU's implementation of related actions will be data-driven and well-informed through the collective voices and work of the action team. The commitment of A/WD funding is critical for the success of this effort. Examples of potential programming: Grow Your Own Program – Teacher Education: The Grow Your Own program will prepare future teachers to make a difference in their communities. CS4ALL Teaching Certificate – Teacher Education: NAU's strong expertise in computer science pedagogy and teacher training make it a natural partner in the state's Computer Science vision.

What is the University's Advantage and/or Anticipated Funding Opportunities?

We are well-positioned to reach urban and rural communities through our established statewide sites. The delivery of new and expanded programs will represent high workforce demand and will also provide much needed access to local communities. Proposed expansion of programs will offer a wider range of credentials and new ways of operating in collaboration with community colleges, including opportunities to partner across staff and faculty, building stackable program pathways, and employing universal design practices across programs in 90/30 programs.

Is there an Arizona Specific Benefit or Impact?

As reported in the 2020 College Completion Report, most of the state public universities' graduates stay in Arizona, find jobs, and contribute to the state's workforce. Providing access to degree attainment in high demand fields for place-bound adult learners will continue to support who would otherwise face undue challenges in pursuing a baccalaureate or graduate degree. Additionally, we will provide upskilling of the workforce communities surrounding our individual statewide sites that will provide pathways for securing a job near their homes and result in the retention of our working residents of Arizona.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$219,112	$945,624	$1,062,348	$2,227,084
Basic Research	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0
Development	$0	$0	$0	$0
Total	$219,112	$945,624	$1,062,348	$2,227,084

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	13
Graduate Students	20	60	60	200
Undergraduate Students	30	60	120	210
Sponsored Project Funding	$0	$0	$0	$0
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	Northern Arizona University
TRIF Investment Area	Workforce Development
Program Name	New and Expanded Programming

Progress Summary

An NAU task force recommended several workforce-aligned programs. Five colleges and NAU-Yuma launched a total of 22 such new academic programs in fall 2023, nine of which are also offered in-person across the state. By fall 2025, an additional 14 online and eight statewide programs began in response to regional workforce needs, including programs in Speech Language Pathology, Engineering Technology, and IT. Investment Details This project supports five full-time faculty teaching in online programs and stipends for faculty to develop the courses needed for the new programs. Other new online and statewide programs received funding support outside of AWD. Future Outlook This year NAU Online will build 11 new General Studies courses (one from each category) from a recommended list developed in Spring 2025. Faculty are incentivized to adopt OER (Open Education Resources) materials to help minimize textbook costs for students. Additionally, Colleges have demonstrated robust interest to bring online and in-person, high-demand programming across the state based on market analyses, labor trends, and regional needs. We expect this interest to grow as we encourage career-ready academic programs and curriculum design.

How has the problem statement been addressed in the last year by this TRIF project?

Total employment in the US is projected to grow by four percent between 2023 and 2033, while occupations requiring bachelor's degrees including in healthcare, technology, and management are expected to grow faster according to the Bureau of Labor Statistics. Additionally, as indicated by the Arizona Office of Economic Opportunity, the adjusted unemployment rate remains unchanged from 2024 to 2025, indicating job creation is keeping pace with Arizona's labor force growth. As the nation moves through its current economic cycle, NAU is positioned to bring equitable post-secondary value to our students through career-aligned academic programming, career services, alternative pathways for adult learners, and hands-on work experiences through internships, apprenticeships, and other fieldwork experiences. For example, our Career Readiness initiative is an effort in which all our academic units collaborate with the Provost Office and Career Development to align their program learning outcomes to career readiness. In addition, our newest academic offerings show a commitment by our academic leaders to align their efforts to the needs of Arizona.

What, if anything, hasn't worked as well as was hoped?

Though we had many successful faculty hires last year, some positions were left vacant due to the competitiveness of the market and challenges recruiting to rural areas and Flagstaff. Additionally, new and expanded programming in alignment with state and regional needs entails various processes, which could benefit from increased efficiency.

Describe the Arizona benefit or impact of this TRIF project for the last year.

NAU continues to have robust enrollments in programs aligned to Arizona workforce needs that are offered online or at locations around the state. As we strengthen existing relationships with employers and partner with new, emerging industries, we are confident we can continue to provide critical degree attainment access, at an affordable price, to citizens seeking career entry, advancement or change.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$367,144	$456,497	$454,418	$1,278,059
Basic Research	$0	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0	$0
Development	$0	$0	$0	$0	$0
Total	$0	$367,144	$456,497	$454,418	$1,278,059

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	0	0	0
Graduate Students	0	0	0	0	0
Undergraduate Students	0	0	0	0	0
Sponsored Project Funding	$0	$0	$0	$0	$0
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	Northern Arizona University
TRIF Investment Area	Workforce Development
Program Name	Seed Equipment and Infrastructure Investment

Problem Statement

The Challenge: Provide resources to departments/centers, faculty and students to ensure the University remains responsive to current needs of the state. The ability of an institution to succeed in research, student training and workforce development requires support in a variety of ways. Students benefit from the mentorship of expert researchers through paid fellowships or project grants. Early/Mid-career faculty require support to host students and seed funding to help acquire key data to help find external funding. Departments can develop through strategic planning funds to support faculty working in areas that benefit the university's mission. Investment into research infrastructure ensures the university pursues cutting edge-work and effectively trains students to meet the evolving needs of employers.

Program Description

The Seed, Equipment and Infrastructure Investments (SEII) program provides a competitive mechanism for NAU researchers, students and/or interdisciplinary teams to request internal support for equipment, infrastructure, seed funding, or strategic planning for new programs to train students in emerging areas of workforce need. Requests will be solicited from eligible investigators doing research in a TRIF-supported initiative, and will be evaluated by internal and external referees on their scientific excellence, impact on student training and workforce development, and alignment with broader strategic goals of the university. We anticipate that researchers participating in programs recognized as Areas of Distinctive Excellence for NAU will be very competitive for support through the SEII program, as will researchers who, in collaboration with others, aim to explore how their own research can integrate with and benefit from these recognized areas of expertise. Improving student outcomes and expanding access to research traineeships or research workforce development are a major focus of the request.

What is the University's Advantage and/or Anticipated Funding Opportunities?

NAU prides itself as an institution that is dedicated to student access and success, and empowers our students to succeed both in the classroom and the research laboratory. Through this novel program, the university will be able to foster new research opportunities in a manner that is inclusive of the diverse research strengths of research on campus, as well as to help ensure the robustness of our research enterprise and its ability to remain responsive to the evolving workforce needs in our community. Providing exceptional student training and experiential learning opportunities has always been a core mission of NAU and this program will allow us to significantly expand the number of students we serve, and broaden the demographic of students who participate in research.

Is there an Arizona Specific Benefit or Impact?

The Seed, Equipment and Infrastructure Investments program serves to help the research enterprise at NAU operate optimally, which in turn continues to aid the state's economic growth through providing rigorously trained individuals to support workforce needs in high-demand areas throughout Arizona in all TRIF supported initiatives.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$4,240,500	$5,535,000	$6,100,000	$15,875,500
Basic Research	$519,167	$474,167	$487,500	$1,480,834
Applied Research	$354,166	$514,166	$527,500	$1,395,832
Development	$276,667	$436,667	$450,000	$1,163,334
Total	$5,390,500	$6,960,000	$7,565,000	$19,915,500

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$525,000	$650,000
Postdocs Supported	0	2	3	13
Graduate Students	8	10	10	30
Undergraduate Students	50	60	70	180
Sponsored Project Funding	$0	$0	$0	$0
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	Northern Arizona University
TRIF Investment Area	Workforce Development
Program Name	Seed Equipment and Infrastructure Investment

Progress Summary

The Seed, Equipment and Infrastructure Investment (SEII) program at NAU continues to be a strategic driver of innovation and student success across all TRIF research initiatives. The program supports NAU's efforts in research and workforce development by seeding support to develop new externally funded programs, purchasing specialized equipment, upgrading laboratory spaces, and supporting undergraduate and graduate research. In 2025, a new pilot program was launched to create student-focused opportunities at the intersection of research and academic programming with the goal of enhancing student research skills, fostering engagement, and developing technologies to support instructional innovation and course-based research. The SEII program remains centrally administered and competitively distributes funding to individuals and teams across the university.

How has the problem statement been addressed in the last year by this TRIF project?

The SEII program has made significant strides in increasing student success through expanded mentored research, experiential learning, and workforce development opportunities. In three years, the program has fostered over 700 additional mentored research experiences for students, jointly through the Office of Undergraduate Research and Creative Activities and the Office of the Vice President for Research. In partnership with NAU's Veterans and Military Service office, the program hosts an initiative to provide mentored research experiences for military-affiliated students, helping them transition into research careers. Graduate students received focused support to position them for prestigious external fellowships such as the NSF Graduate Research Fellowship Program and NASA FINESST awards. TRIF funds were also allocated to small pilot projects, instrumentation upgrades, and direct support for graduate researchers, all contributing to the university's goal of creating environments where students thrive academically and professionally.

What, if anything, hasn't worked as well as was hoped?

The Seed, Equipment and Infrastructure Investment program is designed to be flexible in order to efficiently deploy resources in response to the evolving needs of the university's research enterprise. Predicting the expenditures required to meet the needs of the program over the course of a given year can be challenging. Some of the investments made by the program are designed to be multi-year efforts which has thus necessitated carry-over of funds across fiscal years.

Describe the Arizona benefit or impact of this TRIF project for the last year.

The SEII program has had a measurable impact on Arizona by strengthening the state's research capacity and economic development. In addition to creating a substantial number of individual mentored research experiences for students, the program supported research infrastructure that was also utilized in academic programming, impacting over 1000 additional students enrolled in these courses. Together, these experiences equipped students with hands-on skills in high-demand fields, preparing them for careers in the state's growing research and technology sectors inside and outside of Arizona.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$413,053	$4,199,125	$3,882,343	$3,745,172	$12,239,693
Basic Research	$97,447	$495,416	$1,551,035	$462,292	$2,606,190
Applied Research	$29,844	$30,091	$0	$0	$29,844
Development	$29,844	$0	$0	$0	$29,844
Total	$570,188	$4,724,632	$5,433,378	$4,207,464	$14,935,662

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$371,289	$1,012,856	$112,941	$1,497,086
Postdocs Supported	0	0	0	0	0
Graduate Students	52	38	49	78	217
Undergraduate Students	88	221	198	206	713
Sponsored Project Funding	$0	$0	$0	$0	$0
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	Northern Arizona University
TRIF Investment Area	Workforce Development
Program Name	Student Service and Support

Problem Statement

As US society has increasingly created a narrative of questioning the value of higher education, students and their families have had greater interest in assurances that the university experience and achieving a college degree will lead to social mobility through expanded employment opportunities. This specific population will benefit from a prescriptive degree completion plan that increases access through barrier-free support. Now more than ever, it is critical that all students, including adult learners, receive holistic services and support throughout the student lifecycle, particularly in the areas of purposeful academic and career alignment, participation in internship and externships, transferable career skill development, and strong job seeking skills.

Program Description

Example of proposed programming: • University Advising Access Connected Care Team: The creation of the University Advising Access Connected Care Team (ACCT) will build new institutional services devoted to increasing access and student success, with a particular emphasis on non-traditional transfer students and academic programs supporting workforce development. We will directly address the distinct needs of non-traditional and adult learners through a case-management approach, which guides students through institutional policies and processes, serves students outside traditional business hours, and integrates an infrastructure that utilizes data and technology for data-driven decision-making and efficient operations.

What is the University's Advantage and/or Anticipated Funding Opportunities?

ACCT will substantially improve our ability to open access pathways and build capacity in workforce development programs. The North Valley site provides an ideal location convenient for place-bound students within Phoenix, Statewide Sites, and surrounding communities. We will provide on-site services at the North Valley site with a focus on degree attainment in a timely and cost-effective manner. The student support will collaborate across university and community college partners to attract and serve students with barrier-free educational pathways, including the development of a comprehensive structure for accessing prior learning for credit.

Is there an Arizona Specific Benefit or Impact?

In July 2021, Arizona ranked 39th amongst US states in unemployment rates at 6.6% (national average is 5.4%, U.S. Bureau of Labor Statistics) and 33rd in college attainment rates (30% compared to the national average of 33%). College degrees can result in greater access to higher paying jobs and provide protection against unemployment during economic downturns. But college degrees alone do not provide access to higher paying job opportunities; students also need experiences that build transferable job skills and access to social networks that provide access to such jobs. By investing in to embed career development in academic programs, as well as provide direct support to students to build a strong professional portfolio of transferrable career skills enhanced with internship experiences, NAU will advance its commitment to equitable postsecondary value.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$1,477,146	$1,219,979	$1,082,361	$3,779,486
Basic Research	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0
Development	$0	$0	$0	$0
Total	$1,477,146	$1,219,979	$1,082,361	$3,779,486

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	13
Graduate Students	481	713	713	2171
Undergraduate Students	1070	1587	2174	4831
Sponsored Project Funding	$0	$0	$0	$0
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	Northern Arizona University
TRIF Investment Area	Workforce Development
Program Name	Student Service and Support

Progress Summary

A cross-divisional task force-identified priorities to enhance online and statewide student support services within our organizational structure. These priorities included the enhancement of wrap-around support services including advising, retention, financial aid, tutoring, wellness, retention coaching, and other services. The Transfer Admissions Team has streamlined admission decisions to 1-2 days. The University Advising Access Connected Care Team offers coaching, mentoring, and connects students to essential university resources, and responds to faculty and staff alerts about students who may need additional support. Statewide Initiatives and Alliances and Workforce Development units are responsible for the development and cultivation of educational and business partnerships for the university. These partnerships include government, public agencies, businesses, and community colleges that enhance access to NAU programs, foster work skill development, and overall job readiness. The Academic Affairs Business Intelligence (AABI) team was created to enhance data-informed decision-making, support strategic student outreach, and improve retention through the use of proactive and strategic data. They support University Advising, Success Coaching, and other student-facing teams across Academic Affairs. Online Success Coaching offers retention support for NAU Online learners. The team developed 'Jacks Journey,' a virtual orientation & resource hub which introduces students to essential academic and wellness resources. They lead outreach campaigns targeting unenrolled students, students impacted by natural disasters, and proactive check-ins at critical points in the semester. Investment Details This budget was used to fund 12 full-time staff positions to support the regional hubs, Success Coach positions to support proactive outreach, business analysts who provide actionable data for the student-facing teams across Academic Affairs, and University Admissions staff who support improved admission processing. Future Outlook NAU has organized Statewide operations into four regional hubs. Each of the regions includes: (a) a Campus Executive Officer/Dean or a Regional Director to oversee academic pathways; and (b) specialized recruitment and student services teams. The teams work closely with Enrollment Management, Student Affairs, and Academic Operations for outreach and recruitment, to ensure coordination of services, and promote student success.

How has the problem statement been addressed in the last year by this TRIF project?

We have built holistic services focused on the unique needs of adult learners, including academic and career advising, library services, disability resources, tutoring, financial support, counseling, health promotion, peer mentoring, and veteran and military services. NAU has maximized transfer opportunities by updating policies, which will now allow up to 90 credits of transfer and expand opportunities for credit for prior learning. We have pending HLC approval for two 90-credit Bachelor of Professional Studies programs, approved by ABOR during FY25. We actively manage our program portfolio to optimize operations and alignment with regional workforce demand.

What, if anything, hasn't worked as well as was hoped?

Recruitment of personnel is always a challenge due to the availability of qualified candidates in Flagstaff and other rural areas of the state.

Describe the Arizona benefit or impact of this TRIF project for the last year.

With over 7,000 (or roughly 25% of NAU) students enrolled in online and statewide programs in fall 2024, our regional service hubs and proactive success coaching provides distributed students with an opportunity to experience care and engagement that will support their persistence.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$81,590	$1,168,994	$1,731,586	$1,190,885	$4,173,055
Basic Research	$0	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0	$0
Development	$0	$0	$0	$0	$0
Total	$81,590	$1,168,994	$1,731,586	$1,190,885	$4,173,055

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	0	0	0
Graduate Students	0	518	0	0	518
Undergraduate Students	315	4935	0	0	5250
Sponsored Project Funding	$0	$0	$0	$0	$0
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	Northern Arizona University
TRIF Investment Area	Workforce Development
Program Name	Workforce Training, Lifelong Learning, and Professional Development

Problem Statement

Arizona is facing a worker shortage across several sectors, including the service industry, high-skilled technical talent, and manufacturing environments. Arizona sectors with high job losses due to the pandemic include education, sales, and social services, with the current job market privileging bachelor's and master's degree recipients. Arizona's Hispanic or LatinX populations are reported at 31.7%, a significantly higher percentage than the rest of the country. Hispanic, first-generation, non-traditional, and low-income students often seek formal education and/or workforce training to enhance their opportunities. The demand for workforce training, lifelong learning, professional development will remain strong as community members seek alternative educational pathways toward sustainable employment.

Program Description

Mesa Workforce Development Center: The NAU School of Hotel and Restaurant Management (SHRM) is working with Intermestics Partners and Kind Hospitality to develop a facility that will serve as an education and training hub located at Skybridge Arizona in Mesa, AZ. The leaders of SkyBridge estimate 10,000-12,000 new jobs will be created within the next decade on site, based on the mixed use of the 3.5 million square feet slated for development, and that is just within Phoenix-Mesa Gateway Airport. The Center will prepare students and workers for jobs by providing the necessary skills and credentials through apprenticeships and employer required occupational training in addition to their regular academic instruction. Other proposed workforce training, lifelong learning, and professional development programs include a Microelectronics Workforce Training Program, Industry 4.0 Workforce Training Lab, Financial Planning Certificate, Risk Management and Insurance Certificate, Hospitality Innovative Technology (HIT) Certificate, Organizational Leadership Series, Customer Service Institute, and K-12 Center.

What is the University's Advantage and/or Anticipated Funding Opportunities?

The Mesa Workforce Development Center Skybridge partner, Swift, is already a corporate partner for the W.A. Franke College of Business (FCB) Risk Management and Insurance (RMI) program. The corporation has made a significant donation to the RMI program. The state of Arizona has been home to many semiconductor and electronics manufacturing companies since 1950's. Recently, TSMC and Intel both announced their investment to build additional semiconductor fabs in Chandler, AZ. The Microelectronics Workforce Training Program will provide the industry with a talented and intelligent university-educated workforce that will innovate, build new products, and adapt to new technologies. Short, non-credit programming that allows workforce training, lifelong learning, and professional development opportunities will enable adult learners and working professionals to quickly upskill or change careers completely. These non-traditional educational and training pathways are essential to building a strong and adaptable workforce in Arizona.

Is there an Arizona Specific Benefit or Impact?

The Mesa Workforce Development Center, with state-of-the-art facilities, will be able to provide affordable and accessible education and training where people work and live. Swift, a Phoenix, Arizona-based American truckload motor shipping carrier with over 23,000 trucks, is the largest common carrier in the United States. Mesa, Arizona was recently ranked by Bloomberg CityLab as one of the top 10 cities with the fastest-growing job markets and fastest-growing populations. NAU will help develop the talent that hospitality employers need to accommodate present and future demand for their products and services. This workforce development center will increase HRM's visibility in the greater Phoenix area, assisting with student recruitment and the building and maintaining of a stronger enrollment pipeline.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$800,600	$740,456	$761,350	$2,302,406
Basic Research	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0
Development	$0	$0	$0	$0
Total	$800,600	$740,456	$761,350	$2,302,406

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	13
Graduate Students	100	200	200	600
Undergraduate Students	165	300	475	940
Sponsored Project Funding	$0	$0	$0	$0
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	Northern Arizona University
TRIF Investment Area	Workforce Development
Program Name	Workforce Training, Lifelong Learning, and Professional Development

Progress Summary

Workforce Development (WFD) at NAU includes Educational Partnerships and Continuing Education. It establishes and enhances business partnerships across the state, with the goals of providing workforce training, lifelong learning, and professional development opportunities. It develops alternative and continuing education classes for Arizona communities and completes real-time workforce and market demand analyses for Academic Affairs. In close collaboration with college faculty and leadership, 10 academic programs with over 250 students were supported by this team and 31 non-credit, continuing education programs were offered, both in-person and online, serving a total of 392 participants. Workforce development and lifelong learning programs are underway or being developed for Process Technician, Robotics, Culinary Training, Risk Management, and Dental Hygiene Laser Certification. Additionally, NAU expanded tuition reduction partnerships in FY24 to include all Arizona government and non-profit educational institutions. Investment Details Funds supported the hiring of faculty and staff to support the new programming and initiatives, travel for coordination meetings with workforce development boards and businesses throughout the state. Additionally, funding from the Arizona Office of the Governor supported development of wildfire science and forest management programs to address the shortage of skilled workforce in this area. We created online programs accessible to students throughout the southwest region, where the workforce need is most substantial. Funds were used to sustain personnel for the Master's degree program and partnerships with SRP and APS that are underway. Future Outlook With our college partners engaged in workforce education and training programs, we will launch new educational pathways throughout the next reporting period and grow the programs underway. The Mesa Workforce Development Center will likely require investment in faculty as its programming is expanded into academic degree and certification programs.

How has the problem statement been addressed in the last year by this TRIF project?

Engagement with Arizona industries allowed us to identify gaps in professional development programming and opportunities for ad hoc workforce training programs that align with NAU's core strengths. In one instance, we engaged with Taiwan Semiconductor Manufacturing Company (TSMC) to better understand their labor needs. In collaboration with Rio Salado Community College, NAU launched a Process Technician Apprenticeship Program that prepares TSMC employees to positions where they will eventually improve engineering processes at the TSMC plant in Phoenix.

What, if anything, hasn't worked as well as was hoped?

Collaborating across a large geographic area and ensuring we can meet multiple community workforce needs in multiple ways may be limited by institutional human capital. Additionally, although much effort has been geared toward the establishment of the Mesa Workforce Development Center, NAU has been unable to secure a permanent facility in the east valley to house its Hotel and Restaurant Management for-credit programs. New, potential sites are being explored as of the writing of this report. Nonetheless, a culinary training for high school teachers continuing education program in the east valley is launching in the spring 2026 semester.

Describe the Arizona benefit or impact of this TRIF project for the last year.

Ensuring Arizonans possess the skills and education necessary to be competitive in the Arizona job market is central to this project. To do so, we collaborate with workforce development offices, engage with chambers, other business associations, and employers. We also participate in consortia for emerging industries and monitor national, regional, and state labor trends and identify labor gaps.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$123,907	$592,471	$909,648	$324,445	$1,950,471
Basic Research	$0	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0	$0
Development	$0	$0	$0	$0	$0
Total	$123,907	$592,471	$909,648	$324,445	$1,950,471

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	0	0	0
Graduate Students	0	0	0	0	0
Undergraduate Students	163	326	392	418	1299
Sponsored Project Funding	$0	$0	$0	$0	$0
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	Improving Health
Program Name	Aging and Resilience

Problem Statement

With more and more individuals living longer, an aging Arizona population will bring unique challenges and opportunities in health care. Critical research and development still needs to be done to understand the processes of normal and healthy aging; determine the causes of age-related diseases; develop and test drugs, devices, and behavioral interventions to minimize handicap and disease; and maximize functionality and independence for a higher quality of life.

Program Description

We expect to gain a better understanding of common initiating mechanisms across four age-associated neurodegenerative diseases (Alzheimer's, Parkinson's, multiple sclerosis, and ALS). We also will continue trials into potential therapeutics and interventions to reverse cognitive decline. Technology developments will be leveraged into advances in home health, mobile health (mHealth), and telemedicine applications that bring safety, security, and medical care to all corners of the state and beyond. Working with the resources of the University of Arizona's NCI-designated Comprehensive Cancer Center, we will embark on programs to prevent cancer through precision lifestyle modifications and early detection, and cure cancer with greater understanding of its biological underpinnings and new treatments, such as immunotherapy.

What is the University's Advantage and/or Anticipated Funding Opportunities?

We are uniquely poised to conduct both basic and clinical research into the biology of aging and age-related brain diseases such as Alzheimer's, Parkinson's, and other neurological conditions. We have expertise in many areas related to aging and age-related disease, particularly in psychosocial, cognitive, immune, inflammation, neurodegenerative, metabolic, and geriatric care. Our studies range from brain imaging to looking at molecular and genomic changes during aging to dietary and exercise interventions. Together with our health and community partners, we have the expertise and support to translate basic studies into effective treatments and life-enhancing strategies for humankind, which ultimately will reduce health care costs and increase the chance for a long, healthy, productive, disease-free life.

Is there an Arizona Specific Benefit or Impact?

Investment Detail

	2022	2023	2024	Total
Infrastructure	$644,488	$644,488	$644,488	$1,933,464
Basic Research	$220,048	$220,048	$220,048	$660,144
Applied Research	$385,084	$385,084	$385,084	$1,155,252
Development	$55,012	$55,012	$55,012	$165,036
Total	$1,304,632	$1,304,632	$1,304,632	$3,913,896

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$275,060	$3	$495,108	$1,155,252
Postdocs Supported	25	25	25	75
Graduate Students	65	65	65	195
Undergraduate Students	70	70	70	210
Sponsored Project Funding	$20,000,000	$20,000,000	$20,000,000	$60,000,000
Publications in Academic Peer-Reviewed Journals	92	92	92	276
Startups	0	1	0	1

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	University of Arizona
TRIF Investment Area	Improving Health
Program Name	Aging and Resilience

Progress Summary

TRIF support continues to enable researchers to explore how biology, environment and behavior influence healthy aging and neurological decline. Aging-related efforts span cognitive science, biomedical imaging, gene-environment interactions and immune system resilience. A key discovery found that exposing roundworms to high levels of cholesterol extended lifespan significantly. Researchers are investigating the underlying mechanisms to develop new therapeutics related to cholesterol and health. Researchers also discovered that copper exposure can impart resistance to forms of cellular stress. If researchers can determine the mechanisms, they hope to develop strategies to improve multiple stress resistance. Researchers developed lab-grown cell models that offer insights into Parkinson's disease progression and biomarker detection. Studies led to the identification of a promising drug candidate that could slow cognitive decline and dementia in patients with Parkinson's. Meanwhile, TRIF support continues to bolster the NIH-funded Precision Aging Network, which aims to create personalized interventions for brain aging and cognitive resilience.

How has the problem statement been addressed in the last year by this TRIF project?

TRIF-supported investigators are working to understand aging at the cellular and systemic levels and generate knowledge that may help prevent disease and preserve independence later in life. Researchers continued to build a pipeline of drug discovery and early intervention efforts aimed at minimizing age-related cognitive decline. One group identified a compound that may delay or prevent dementia symptoms in Parkinson's patients, offering hope for more effective treatment strategies. Behavioral research found that vocal patterns in birds may reveal neural deterioration, suggesting that human vocal biomarkers could enable non-invasive, earlier detection of Alzheimer's disease and similar disorders. At the molecular level, scientists are examining how stress pathways and environmental factors like copper exposure influence resilience and longevity. Their robotic imaging tool allows for real-time measurement of aging indicators in live organisms, opening the door to therapeutic screening. Researchers are investigating mitochondrial dysfunction and how shifts in energy regulation contribute to chronic inflammation, frailty, and cognitive decline. These efforts support both early detection and targeted intervention, helping Arizonans maintain function and independence as they age.

What, if anything, hasn't worked as well as was hoped?

N/A

Describe the Arizona benefit or impact of this TRIF project for the last year.

With multidisciplinary collaborations and strong external partnerships, investments are accelerating discoveries that directly benefit Arizona's growing older adult population through earlier diagnoses, better treatment strategies, and new technologies that enhance the quality and longevity of life. Collaborations within the BIO5 Institute, the Arizona Center for Drug Discovery, and other departments will further expand opportunities to commercialize life-enhancing medications and therapies. Translational work on mitochondrial decline and resilience testing has laid the groundwork for a future startup focused on cellular screening tools. With support from Tech Launch Arizona, researchers are moving toward pilot manufacturing of biotech scaffolds to test aging-related therapies. Additional research is examining how mitochondrial responses can predict the effectiveness of hormone therapy during menopause. This work seeks to personalize care for women navigating midlife transitions.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$658,551	$797,634	$856,929	$994,405	$3,307,519
Basic Research	$2,471	$19,108	$88,308	$23,100	$132,987
Applied Research	$117,916	$205,353	$122,499	$146,148	$591,916
Development	$136,918	$205,072	$72,816	$0	$414,806
Total	$915,856	$1,227,167	$1,140,552	$1,163,653	$4,447,228

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$197,155	$422,362	$304,890	$493,046	$1,417,453
Postdocs Supported	6	4	6	7	23
Graduate Students	35	33	54	46	168
Undergraduate Students	54	63	193	34	344
Sponsored Project Funding	$29,020,922	$38,324,919	$28,492,639	$25,493,648	$121,332,128
Publications in Peer-Reviewed Journals	54	16	25	27	122
Startups	1	0	0	0	1

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	Improving Health
Program Name	Infectious Disease and Microbiome Sciences

Problem Statement

Infectious disease is the major cause of death in low-income countries, and emerging infectious diseases threaten countries worldwide, as the COVID-19 pandemic has shown. Researchers learn more every day about the role the human microbiome (both bacteria and viruses) plays in health and behavior. An example includes respiratory diseases that are considered to result from a combination of genes, environment, and lifestyle. The role of microbes in health and disease through interconnected human-animal-plant-earth reservoirs presents a complexity which is of vast importance and not yet completely understood.

Program Description

We will leverage the considerable infrastructure we have developed for testing and serology of COVID-19 into a broader infrastructure for understanding, preventing, and treating infectious disease and possible future pandemics, as well as understanding the long-term effects of these diseases. We will also develop models of vector-born infections such as Zika. Understanding the variables affecting mosquito spread in Arizona may inform strategies to stop the transmission of Zika and keep Arizona free of this disease. Finally, we will look inside the human body to understand the healthy microbiome in niches throughout the body, as well as dysbiosis and its effect on diseases such as gastrointestinal cancers and infertility.

What is the University's Advantage and/or Anticipated Funding Opportunities?

UArizona's interdisciplinary researchers are pushing the boundaries of knowledge. Our outstanding investigators across immunobiology, public health, medicine, animal and comparative biomedical sciences, and others work together with complemented expertise to solve complex problems. TRIF-supported facilities such as the genetically engineered mouse models and biosafety level 3 and omics capabilities support cutting-edge research to enable new discoveries related to the role of microbes in human health and disease.

Is there an Arizona Specific Benefit or Impact?

•Development of more accurate, rapid, and inexpensive tests for COVID-19 and future infectious diseases •Better understanding of demographic and health history effects on immunoprotection gained with vaccination against COVID-19 and other diseases •New clinical trials to show effect of potential therapies for respiratory illnesses •Better understanding of the healthy biome in various human organs, and development of therapies for dysbiosis

Investment Detail

	2022	2023	2024	Total
Infrastructure	$644,488	$644,488	$644,488	$1,933,464
Basic Research	$220,048	$220,048	$220,048	$660,144
Applied Research	$385,084	$385,084	$385,084	$1,155,252
Development	$55,012	$55,012	$55,012	$165,036
Total	$1,304,632	$1,304,632	$1,304,632	$3,913,896

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$275,060	$3	$495,108	$1,155,252
Postdocs Supported	25	25	25	75
Graduate Students	65	65	65	195
Undergraduate Students	70	70	70	210
Sponsored Project Funding	$20,000,000	$20,000,000	$20,000,000	$60,000,000
Publications in Academic Peer-Reviewed Journals	92	92	92	276
Startups	0	1	0	1

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	Improving Health
Program Name	Infectious Disease and Microbiome Sciences

Progress Summary

TRIF funding enables leading-edge research that advances Arizona's role in combating infectious diseases and understanding microbiome-related health outcomes. This year, researchers contributed to an NIH human virome initiative aiming to map the “viral dark matter” and understand its role in human disease. In collaboration with NAU and tribal partners, investigators examined vaginal microbiome differences linked to increased cervical cancer rates in Native American women, offering new insights into cancer health disparities. Across multiple labs, TRIF support enabled chemical biology research on cytomegalovirus replication, antimicrobial resistance in C. difficile, and precision-targeted therapies for sexually transmitted infections (STIs), all of which are disproportionately impactful to Arizona’s public health.

How has the problem statement been addressed in the last year by this TRIF project?

This year’s projects reflect Arizona’s proactive stance in addressing infectious disease threats. One TRIF-supported study, recently highlighted by STAT News and Nature Immunology, evaluated how the immune system responds to different SARS-CoV-2 variants. The findings provide key insights for future pandemic responses and vaccine design. Another multiomics study uncovered disease-specific glycosylation changes in heart tissue from COVID-19 patients and offered new insight into viral cardiac injury mechanisms. These findings provide a basis for diagnostic biomarkers and therapeutic targets for long COVID cardiac complications. A long-standing U of A effort has now formally joined the NIH Human Virome Program to explore understudied viruses and their links to chronic disease, thanks in part to TRIF-enabled core facilities and cross-disciplinary collaborations. Another major initiative is tackling Valley fever by investigating how pesticide exposure and other environmental factors may influence infection severity, particularly among Arizona's agricultural workers. Researchers identified metabolite markers tied to endometriosis and explored host-microbiome dynamics that regulate immune responses. These findings lay the foundation for future non-invasive diagnostics and microbial therapies. Meanwhile, labs investigating STIs are leveraging TRIF-supported molecular tools to study microbial interactions and develop next-generation therapies.

What, if anything, hasn't worked as well as was hoped?

Increased costs associated with supporting graduate students. Difficulty reaching the right patient populations due to IRB restrictions and limited contact options. Access to large clinical data sets from the region.

Describe the Arizona benefit or impact of this TRIF project for the last year.

Arizona communities, especially rural and agricultural populations, directly benefit from TRIF-enabled research. For example, Valley fever investigations have uncovered underrecognized disease patterns and risk factors, paving the way for improved regional diagnostics and community education. One U of A Southwest Environmental Health Sciences Center pilot grant, stemming from TRIF-supported research, now explores links between pesticide exposure and fungal disease progression. In the borderlands, projects have spotlighted structural inequalities tied to infectious disease outcomes, while arts- and health-integrated programming brings public awareness to issues such as HIV/AIDS disparities in underrepresented communities. Another study examining STIs prevalent in Arizona has trained doctoral students who recently presented their work at international microbiology conferences, elevating the state’s visibility in global health forums. Across the state, TRIF support continues to amplify research with tangible health, equity, and economic benefits.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$353,607	$508,045	$967,880	$349,359	$2,178,891
Basic Research	$0	$108,833	$1,166	$122,287	$232,286
Applied Research	$285,179	$273,449	$226,661	$283,910	$896,941
Development	$0	$0	$0	$0	$0
Total	$638,786	$890,327	$1,195,707	$755,556	$3,480,376

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$54,023	$387,926	$8,031	$449,980
Postdocs Supported	13	15	34	35	97
Graduate Students	61	58	100	58	277
Undergraduate Students	48	76	94	41	259
Sponsored Project Funding	$78,657,229	$45,673,250	$34,148,621	$32,514,211	$190,993,311
Publications in Peer-Reviewed Journals	80	114	92	59	345
Startups	0	0	0	1	1

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	Improving Health
Program Name	KEYS and Engaged Training

Problem Statement

As one of the core tenets of our mission, we are committed to training and inspiring our next generation of scientists. Many students interested in the biosciences are never able to practice and contribute to hands-on research in actual laboratories. Through BIO5's KEYS Research Internship Program, we provide real-world application of classroom learning to spark intellectual and creative curiosity and connect Arizona's excelling students with UArizona while still in high school. These real-world laboratory experiences with BIO5 build a pipeline of talent into our state universities, prepare students for success in college and career, and help strengthen our state's future knowledge-based workforce.

Program Description

BIO5 engages and trains our future generations of scientists through innovative internship programs and an interactive learning environment that promotes experiential learning and STEM proficiency in Arizona. Undergraduates, graduates, postdocs, and even high school interns experience practical application of what they learn in the classroom by working side by side with world-class researchers in BIO5 labs. Forty percent of those working in BIO5 are students. We will continue to engage the pipeline of trainees from the high school through postdoc levels through programs like KEYS and active learning research opportunities for UArizona students. We will also demonstrate how student success and experiential research are integrally linked. Our KEYS Research Internship Program binds talented high school students to UArizona early, which often provides the foundation to keep them in Arizona for, and after, college.

What is the University's Advantage and/or Anticipated Funding Opportunities?

The seven-week KEYS Research Internship Program offers a unique opportunity to talented high school students who have a strong interest in science, health, or the environment. The internship provides students with laboratory experience and the ability to work with world-class scientists on real research projects. Since 2007, 526 students have completed the KEYS internship. Of those, 71 percent have chosen to stay in Arizona for college, with the majority of those attending UArizona. KEYS alumni are automatically accepted into UArizona's Honors College, and most pursue STEM-related degrees and careers. BIO5 also engages students at post-secondary levels through initiatives including the Student-Industry Networking Event, Post-Doctoral Fellowship program, and the BIO5 Ambassadors program.

Is there an Arizona Specific Benefit or Impact?

We expect the benefits to Arizona to include: •Increased student participation in KEYS statewide through both a computational, remote version and an in-person laboratory-based version, boosting the interest in STEM careers among Arizona high school students •Increased number of companies and external entities who participate in activities such as the student-industry networking event leading to connections and internships •Increased number of well-trained personnel from bachelors to doctoral levels available to work with and/or be hired by our Arizona biosciences industry

Investment Detail

	2022	2023	2024	Total
Infrastructure	$731,986	$731,986	$731,986	$2,195,958
Basic Research	$74,255	$74,255	$74,255	$222,765
Applied Research	$74,255	$74,255	$74,255	$222,765
Development	$0	$0	$0	$0
Total	$880,496	$880,496	$880,496	$2,641,488

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	75
Graduate Students	0	0	0	0
Undergraduate Students	50	50	50	150
Sponsored Project Funding	$0	$0	$0	$0
Publications in Academic Peer-Reviewed Journals	12	12	12	36
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	University of Arizona
TRIF Investment Area	Improving Health
Program Name	KEYS and Engaged Training

Progress Summary

More than 1,000 high school interns, undergraduates, graduate students, and postdoctoral scholars participated in hands-on training experiences through the BIO5 Institute. BIO5 remains committed to developing the next generation of scientific leaders through the KEYS Research Internship, BIO5 Ambassadors Internship, and the BIO5 Postdoctoral Fellowship. Public engagement efforts broaden access to science communication and reinforce the university's role in improving lives across Arizona. The 2025 KEYS cohort was its largest ever, with 65 interns: 50 in Tucson, 6 in Phoenix for its inaugural cohort, and 9 virtual interns from 34 Arizona high schools. KEYS alum were two of 20 Arizona students selected for the Flinn Foundation's scholarship. The KEYS social media had over 450,000 impressions, 23,000 engagements, and 77,000 video views, driven by storytelling and sharing of intern stories to demonstrate the impact of the program. The audience has doubled over the past year, with well over 2,000 engaged followers. The KEYS newsletter reaches over 5,000 people, including interns, parents, donors, and community members, with a 40% open rate and 2% click rate on stories and events.

How has the problem statement been addressed in the last year by this TRIF project?

BIO5 continues to train and inspire Arizona's future scientists by offering hands-on, real-world research experiences. The KEYS Research Internship expanded its reach with the launch of a Phoenix-based cohort, providing high school students in Maricopa County the opportunity to conduct research alongside U of A faculty at the College of Medicine–Phoenix. BIO5 creates meaningful training environments that prepare students for academic and professional success while building Arizona's STEM workforce. To support early research talent, BIO5 partners with the Flinn Scholars Program to provide paid spring-semester research experiences for first-year scholars, offering individualized mentorship and lab placement aligned with their interests. BIO5 Ambassadorships Internship is a unique two-semester opportunity open to all majors that pairs students with a BIO5 staff member. Since 2017, 21 students have participated in the program. In parallel, the BIO5 Postdoctoral Fellowship remains a vital part of our training infrastructure. Since 2019, 54 postdoctoral fellows have received $5,000 awards to support their research and professional development.

What, if anything, hasn't worked as well as was hoped?

Growing program costs present a challenge to maintaining momentum and expanding access. To continue KEYS Research Internship growth, especially efforts to provide on-campus housing in Tucson for students with financial need, additional resources are required beyond what current TRIF allocations can support. This challenge has been further compounded by the loss of federal grant funding that previously supported student engagement and training opportunities for students under U of A faculty.

Describe the Arizona benefit or impact of this TRIF project for the last year.

Thanks to the continued success of the KEYS Research Internship, BIO5 Postdoctoral Fellowship, and other hands-on training programs, Arizona's bioscience sector benefits from an increasing number of highly skilled professionals, ranging from high school interns to postdoctoral researchers. The launch of the KEYS Phoenix cohort has extended BIO5's reach into Maricopa County, while hybrid and virtual learning opportunities continue to engage students from rural and underrepresented communities across the state. Dynamic engagement activities coupled with our strong relationships with local and national industry and academic partners enhance student access to networking, mentorship, and professional development. These efforts are strengthening Arizona's future STEM workforce and advancing statewide innovation.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$800,315	$896,867	$1,082,413	$914,916	$3,694,511
Basic Research	$0	$3,535	$17,455	$74,615	$95,605
Applied Research	$0	$0	$0	$0	$327,852
Development	$0	$0	$0	$0	$0
Total	$800,315	$900,402	$1,099,868	$989,531	$3,790,116

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	0	51	51
Graduate Students	1	2	0	321	324
Undergraduate Students	58	85	62	473	678
Sponsored Project Funding	$3,717,460	$3,223,481	$5,379,122	$5,633,815	$17,953,878
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	Improving Health
Program Name	Precision Medicine and Omics

Problem Statement

Omics refers to collective technologies that explore the role of different molecules and how they interact with various bodily systems. Proteins, lipids/fats, and their metabolic products are all important and accessible indicators of human health. The study of omics is critical to developing personalized, targeted therapies to boost efficacy, improve health, lessen adverse exposures, and reduce health care costs. To analyze the vast amounts of omics data and turn it into actionable precision medicine, the science of bioinformatics needs not only to be used, but be further developed, using the combination of computer science, statistics, mathematics, and engineering.

Program Description

We expect to make major strides in four general areas. First, we will create a comprehensive approach in the nascent field of pharmacogenomics. Rather than a one-size-fits-all approach to therapy or dosage based on gross factors such as body surface area, drug prescriptions—and in particular polypharmacy—we need to take into account an individual's genomic factors. Second, with gene interactions, we are beginning to understand not just the impact of single genes on health but also the interplay of many, or even hundreds, of genes on complex conditions such as diabetes and heart disease. Extracting this information using conventional naive biostatistical models may require numbers of participants exceeding the world's population. We will develop new models to enable extraction of complex data. Third, we will develop models of the transcriptome, which is the initial product of gene expression.We will determine the difference between "nature and nurture," or the effect of the environment (internal and external) on gene expression. Finally, to address the unsustainable cost of drug development, we will advance an adaptable clinical trials model to improve outcomes and reduce costs.

What is the University's Advantage and/or Anticipated Funding Opportunities?

UArizona has a strong infrastructure in both expertise and instrumentation to develop omics and precision medicine. Investments in sequencing and mass spectroscopy facilities have occurred with past TRIF investments, with a particular emphasis on metabolomics and precision nutrition. The National Science Foundation-sponsored CyVerse and the UArizona Center for Biomedical Informatics and Biostatistics bring strengths in extracting actionable knowledge from large data sets. In addition, UArizona's partnership with Banner Health, including the All of Us program, means that enormous amounts of health data are available for researchers to analyze and drive subsequent experiments and therapy development.

Is there an Arizona Specific Benefit or Impact?

The benefit to Arizona will include: ▪UArizona is successful in obtaining a Clinical and Translational Science Award with partners across Arizona to move promising science to translation, ▪An increase in Banner Health and other clinical partner collaborative grants and contracts, bringing research dollars to Arizona and increasing research and clinical staff jobs, ▪More clinical trials in Arizona because of the expertise in adaptive clinical trial design, which will provide cutting-edge treatment options for Arizonans and more rapid development of cures.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$644,488	$644,488	$644,488	$1,933,464
Basic Research	$220,048	$220,048	$220,048	$660,144
Applied Research	$385,084	$385,084	$385,084	$1,155,252
Development	$55,012	$55,012	$55,012	$165,036
Total	$1,304,632	$1,304,632	$1,304,632	$3,913,896

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$275,060	$0	$495,108	$1,155,252
Postdocs Supported	25	25	25	75
Graduate Students	65	65	65	195
Undergraduate Students	70	70	70	210
Sponsored Project Funding	$20,000,000	$20,000,000	$20,000,000	$60,000,000
Publications in Academic Peer-Reviewed Journals	92	92	92	276
Startups	1	0	1	2

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	University of Arizona
TRIF Investment Area	Improving Health
Program Name	Precision Medicine and Omics

Progress Summary

TRIF investments continue to drive discovery in omics, data science, and translational research. From genomics and proteomics to imaging and artificial intelligence, precision medicine at the U of A is tackling disease at the molecular level. Researchers are developing tools to predict, prevent, and personalize treatment across conditions such as infectious diseases, chronic illness, and cancer. A TRIF-supported platform uses advanced machine learning and sequencing tools to identify antibiotic resistance genes in wastewater, an early warning system that supports community health and response efforts. Meanwhile, researchers are improving diagnostic accuracy in cardiovascular and pulmonary diseases through advanced imaging technologies and modeling.

How has the problem statement been addressed in the last year by this TRIF project?

To make omics data actionable, researchers are merging molecular insights with scalable analytics platforms.TRIF-supported studies are using artificial intelligence to model lung inflammation associated with circadian rhythm disruption and to identify protein regulation pathways for heart disease treatments. Another effort explored the virome's role in chronic disease as part of the Human Virome Program, enabled by TRIF investments in core facilities and cross-campus collaborations. Researchers supported by TRIF identified metabolite markers linked to endometriosis and uncovered host-microbiome mechanisms that regulate immune responses, laying the groundwork for non-invasive diagnostics and microbial therapies. Meanwhile, a $5M NIH award is advancing nature-inspired CAR-T therapies to reimagine autoimmune disease treatment. On the imaging front, TRIF-supported faculty are refining diagnostics for heart and lung disease through MRI-based tissue mapping and modeling, while others are enabling earlier detection of chemotherapy-induced neuropathy using novel optical technologies. Bioinformatics is also being advanced through the Statistics Consulting Laboratory, which supported 29 omics-intensive projects, providing specialized expertise in experimental design, data analysis, and publication support. These projects helped secure more than $36M in external research awards.

What, if anything, hasn't worked as well as was hoped?

Standardizing omics data across platforms remains a barrier to broader clinical integration, limiting the speed at which discoveries can be translated into treatment.

Describe the Arizona benefit or impact of this TRIF project for the last year.

Researchers are advancing personalized medicine by integrating bioinformatics and biomedical engineering. For example, researchers explored how protein homeostasis affects cardiovascular disease, revealing a potential mechanism to prevent progression through targeted therapy. Arizona benefits from TRIF-supported omics data infrastructure through enhanced clinical collaborations, translational research pipelines, and commercialization outcomes. For instance, researchers launched a startup to develop a novel asthma and COPD treatment platform based on transcriptomic signatures. Other translational benefits include the development of a precision robotics system for tissue engineering and the growth of clinical trial opportunities through increased research-industry partnerships. As Arizona's health needs become more diverse, precision medicine offers pathways to tailored, cost-effective care for its communities.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$503,138	$1,361,483	$828,751	$1,096,047	$3,789,419
Basic Research	$0	$78,133	$22,558	$295,381	$396,072
Applied Research	$291,221	$274,784	$95,926	$56,356	$675,429
Development	$306,092	$192,477	$373,916	$248,125	$1,120,610
Total	$1,100,451	$1,906,877	$1,321,151	$1,695,909	$6,024,388

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$86,084	$499,428	$218,679	$50,000	$854,191
Postdocs Supported	28	16	25	26	95
Graduate Students	106	69	143	154	472
Undergraduate Students	125	133	150	87	495
Sponsored Project Funding	$48,929,390	$50,819,044	$57,527,837	$43,055,276	$200,331,547
Publications in Peer-Reviewed Journals	95	50	97	89	331
Startups	1	2	0	3	6

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	Improving Health
Program Name	Technology for Health

Problem Statement

Advances in technology always have been quickly adopted to aid human health and well-being. For example, the rise of computer technology in the 1950's enabled computational tomography (CT) scans that allowed clear visualization of the human brain for the first time. More recently, strong, flexible, and inert materials have made long-term implantable vascular shunts possible. Improving Health depends upon continual adoption of technology and innovation to solve problems identified by scientists and physicians.

Program Description

The Fourth Industrial Revolution envisions a convergence of biological, physical, and data sciences. This collaborative approach has long been a hallmark of BIO5. Specifically, we will do the following: Point-of-care imaging: We will create new, noninvasive imaging tools for earlier diagnosis and treatment of disease -enabling point-of-care imaging that can even be done by an individual with a smartphone; Closed-Loop Sensors Lab: Sensors/detectors/cameras and closed-loop "sensors/data -> analysis -> intervention -> measure impact" experiments will measure the effect of environmental perturbations on workplace performance, analyze reaction to social interactions, negotiation, team building exercises, etc., and develop/monitor the effects of "electroceuticals" or wearable therapeutics; Wearable technology: Develop new materials and electronic technologies further enabling battery-less, wireless, conformable wearables; Shared resources: Modern biology requires ever more complex instrumentation, to expedite large-scale, team science grants. These grants in turn will boost federal research funding, serve as a resource for local industry, and create new services and companies in Arizona.

What is the University's Advantage and/or Anticipated Funding Opportunities?

With co-located engineering, optical sciences, and medical disciplines, UArizona is poised to make technology advances and rapidly apply them to human health. The culture of interdisciplinary research and strong translational sciences, together with a supportive intellectual property environment with Tech Launch Arizona and the Eller College of Management's McGuire Entrepreneurship Program, mean that innovations are rapidly turned into products to improve the health and wellness of Arizonans and beyond.

Is there an Arizona Specific Benefit or Impact?

•Increased industry engagement with faculty and students through facilities and services, including analytical chemistry, imaging, bioinformatics, and sensors, leading to synergies in research and development, and accelerating Arizona bioindustry •An increase in technology transfer activities related to sensors and imaging technology with more patents and licenses •Additional external funding in wearable technology, home health, and telemedicine related to expertise in cutting-edge technology and resources such as the Sensors Lab

Investment Detail

	2022	2023	2024	Total
Infrastructure	$1,742,576	$1,742,576	$1,742,576	$5,227,728
Basic Research	$381,158	$381,158	$381,158	$1,143,474
Applied Research	$762,315	$762,315	$762,315	$2,286,945
Development	$127,052	$127,052	$127,052	$381,156
Total	$3,013,101	$3,013,101	$3,013,101	$9,039,303

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$635,263	$0	$635,263	$1,905,789
Postdocs Supported	25	25	25	75
Graduate Students	65	65	65	195
Undergraduate Students	70	70	70	210
Sponsored Project Funding	$20,000,000	$20,000,000	$20,000,000	$60,000,000
Publications in Academic Peer-Reviewed Journals	92	92	92	276
Startups	1	0	1	2

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	University of Arizona
TRIF Investment Area	Improving Health
Program Name	Technology for Health

Progress Summary

The advancement of technology has long served as a catalyst for health innovation, from early breakthroughs like CT scans to today's transformative biomedical devices and data-driven tools. TRIF continues to support faculty and cross-disciplinary teams in applying emerging technologies to address today's most pressing health challenges. Through investments in imaging, wearables, AI and drug development platforms, researchers are translating technological breakthroughs into accessible, patient-centered care solutions. The continued partnership with Tech Launch Arizona has allowed more researchers to think about their discoveries as commercializable technologies that help people from bench side to bedside.

How has the problem statement been addressed in the last year by this TRIF project?

Wearable devices using sensors to monitor biological signals can play an important role in health care. These devices provide information that allows providers to predict, diagnose, and treat a variety of conditions while improving access to care and reducing costs. U of A engineers and health researchers leveraged TRIF support to develop wearable biosensors that continuously monitor infection risk, stress and inflammation and use AI to interpret real-time data, helping identify issues before symptoms appear, particularly in aging and rural populations. In imaging and surgical innovation, a new fallopian tube endoscope design both images abnormalities and collects cells for analysis. The endoscopes have been delivered to an east coast hospital, with the necessary population size, where they are being used to evaluate the prophylactically removed fallopian tubes of women at high risk of ovarian cancer. Researchers discovered that optical imaging can be used to quantify cilia function in the fallopian tubes. This has led to the first cross-sectional imaging of human fallopian tube cilia movement accepted for publication. U of A startup, Branch Therapeutics, secured $4 million in seed funding to develop novel orally bioavailable drugs targeting colorectal, and potentially breast and liver cancers. This innovation leverages advanced chemistry and engineering to create next-generation therapeutics capable of rapidly moving from lab to clinical testing.

What, if anything, hasn't worked as well as was hoped?

Despite strong progress, several researchers cited persistent challenges accessing patients and clinical data through hospital partnerships, which can delay technology validation and real-world implementation. Additionally, global supply chain issues continue to hinder the acquisition of critical components and specialized equipment.

Describe the Arizona benefit or impact of this TRIF project for the last year.

Our vibrant research and innovation ecosystem, along with the supportive environment fostered by Tech Launch Arizona, frequently turns discoveries into health-improving products and technologies. TRIF's backing of our state-of-the-art equipment and facilities has attracted world-renowned scientists to join the U of A to further their research. TRIF enabled researchers to acquire a state-of-the-art Horiba Soleil Raman microscope for use in designing highly sensitive sensors for cancer diagnostics. This research integrates spatial transcriptomics with high-resolution molecular imaging, aiming to enable earlier and more precise cancer detection, which will lead to more effective and personalized treatment strategies for Arizonans. This advancement directly improves human well-being by enhancing health outcomes and reducing healthcare burdens. TRIF supported the purchase and siting of a state-of-the-art high-performance low-field MRI scanner. This scanner is designed for high-quality medical imaging in remote areas, benefiting communities in Arizona that lack current services. Researchers are utilizing it to enhance lung cancer diagnosis in areas where Valley Fever poses diagnostic challenges.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$1,850,634	$2,417,371	$2,831,349	$2,089,122	$9,188,476
Basic Research	$0	$80,679	$2,095	$24,126	$106,900
Applied Research	$185,882	$437,212	$411,591	$181,653	$695,387
Development	$0	$66,113	$31,492	$196,700	$294,305
Total	$2,036,516	$3,001,375	$3,276,527	$2,491,601	$10,806,019

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$242,603	$262,098	$397,523	$455,171	$1,357,395
Postdocs Supported	12	15	41	22	90
Graduate Students	121	56	254	162	593
Undergraduate Students	95	124	317	68	604
Sponsored Project Funding	$15,004,103	$23,164,095	$30,792,932	$21,624,261	$90,585,391
Publications in Peer-Reviewed Journals	56	47	173	81	357
Startups	0	0	0	1	1

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Advanced Manufacturing

Problem Statement

Advanced manufacturing (AM) includes concepts in rapid prototyping and parts-on-demand, additive manufacturing (e.g., 3D printing), sustainable and environmentally sound processes, and advanced robotics and other forms of automation. Enabling technologies can include materials, equipment, processes, software, and computation. AM has the potential to shorten product development timelines, improve worker safety, increase production, reduce waste, and preserve the natural environment. Significant challenges remain for widespread implementation of many AM technologies and include materials research, robotics, in-process quality control, and product inspection.

Program Description

Presently there are several elements of AM that are coalescing around areas such as aerospace research. These elements include advanced materials and additive manufacturing. TRIF funding will help accelerate and expand these efforts, fostering maturation toward larger extramural funding mechanisms. Opportunities exist for novel application of AM to new domains, and TRIF resources will be devoted to supporting projects that will target these opportunities with unique ideas. Over the next five years, we expect continued aggregation of related areas of research (e.g. AR/VR, advanced materials, robotics) around AM, facilitated by TRIF support.

What is the University's Advantage and/or Anticipated Funding Opportunities?

UArizona has many research programs and experienced investigators active in new materials development, additive manufacturing equipment and processes, artificial intelligence for process improvement, environmental engineering, and advanced robotics. In one particular area of AM, additive manufacturing, faculty across several units have collaborated to form the Additive Manufacturing Initiative. This group seeks to leverage faculty expertise and resources to further research and training in the application of 3D printing to challenges in manufacturing in extreme conditions, next-generation manufacturing, and adaptive process control. The team also has initiatives in workforce development, including using virtual and augmented reality technology to teach advanced manufacturing practices.

Is there an Arizona Specific Benefit or Impact?

• Maturation of at least one program area into a research center focused on AM • Increased coordination of related research and technologies around AM • Development of new application areas for AM and the number of potential sponsors of extramurally funded research • Cultivatation of a larger number of partnerships with a growing AM industry base, particularly those in Arizona

Investment Detail

	2022	2023	2024	Total
Infrastructure	$624,640	$624,640	$624,640	$1,873,920
Basic Research	$178,238	$178,238	$178,238	$534,714
Applied Research	$262,115	$262,115	$262,115	$786,345
Development	$178,238	$178,238	$178,238	$534,714
Total	$1,243,231	$1,243,231	$1,243,231	$3,729,693

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$209,692	$1	$209,692	$629,076
Postdocs Supported	1	1	1	75
Graduate Students	3	3	3	9
Undergraduate Students	2	2	2	6
Sponsored Project Funding	$2,083,333	$2,083,333	$2,083,333	$6,249,999
Publications in Academic Peer-Reviewed Journals	17	17	17	51
Startups	0	1	2	3

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Advanced Manufacturing

Progress Summary

Cybersecurity - Developed new models to assess cyberattack risk in manufacturing, including a taxonomy and digital twin-based detection method. Nanofabrication Infrastructure - Upgraded air and power systems at the NanoFabrication Center to ensure safe operations for the next 15 years. Workforce & Collaboration - Co-hosted a national workshop with ASU on careers in advanced materials, manufacturing and ML, now supported annually by NSF and DoD. Students gained hands-on experience, including work on an autonomous driving platform that led to an internship at Nikola. Materials Science - Advanced ultrablack material research for defense, semiconductors and energy, with findings shared at the 2024 Materials Research Society meeting.

How has the problem statement been addressed in the last year by this TRIF project?

The project advanced Arizona's leadership in advanced manufacturing through innovation in materials, automation, intelligent systems and workforce development. Next-Gen Materials & Processes: Researchers developed ultrablack materials for defense, semiconductors and energy. Sustainable 3D printing using mining by-products resulted in four publications. Work on graphene nanoribbons advanced high-performance logic applications. Automation & Robotics: Student-led projects included a small-scale autonomous vehicle and Army-funded research on autonomous water treatment. A new Digital Engineering platform, combining MBSE and a Software Factory, modernized training in automated design and manufacturing. Intelligent Systems & Quality: Cybersecurity research produced the first risk model for cyberattacks in manufacturing, a new threat taxonomy and digital twin detection tools. In partnership with Sion Power, researchers developed an AI model to predict battery thermal runaway, enhancing safety.

What, if anything, hasn't worked as well as was hoped?

Advanced manufacturing efforts faced hurdles in system integration, equipment delays and scaling prototypes into manufacturable solutions. Developing autonomous driving and mmWave platforms proved slow and resource-intensive. Physical testbeds required high-cost setups and specialized facility support. Surgical training systems faced hardware/software integration issues, including latency, portability and motion discomfort—key barriers in advanced training tech. Graphene and bioengineered material projects encountered synthesis and alignment issues. Delays in custom part delivery—up to a year—slowed testing and development. Acquisition of key tools like drones, optics and GPUs was impacted by regulation and supply chain constraints, limiting progress in high-end manufacturing research.

Describe the Arizona benefit or impact of this TRIF project for the last year.

The project strengthened Arizona's advanced manufacturing sector by advancing material science, intelligent automation and hands-on workforce training. Materials & Sustainability: Developed ultrablack materials for Arizona's defense, energy and semiconductor sectors. Published research on using mining waste for 3D printing and advanced graphene nanoribbons for logic applications. Automation & Workforce: A student-built autonomous vehicle platform provided robotics experience, leading to an internship at Nikola Motor in Arizona. A Digital Engineering platform modernized training for automated design and manufacturing. Quality & Safety: Researchers delivered Arizona's first cyber risk model for manufacturing, plus digital twin detection tools. In partnership with Tucson's Sion Power, AI was used to predict thermal runaway in batteries—improving safety in energy tech.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$1,588,081	$2,118,747	$2,053,359	$797,584	$6,557,771
Basic Research	$306,546	$9,660	$931,340	$111,572	$1,359,118
Applied Research	$144,812	$302,281	$137,203	$498,506	$971,170
Development	$0	$0	$0	$14,102	$14,102
Total	$2,039,439	$2,430,688	$3,121,902	$1,421,764	$9,013,793

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$122,427	$1,543,602	$1,834,083	$468,356	$3,968,468
Postdocs Supported	1	9	12	12	34
Graduate Students	14	31	60	88	193
Undergraduate Students	20	28	67	91	206
Sponsored Project Funding	$5,228,930	$6,565,724	$5,085,958	$11,794,848	$28,675,460
Publications in Peer-Reviewed Journals	0	0	16	42	58
Startups	0	1	0	2	3

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Data Sciences

Problem Statement

Many areas of the Fourth Industrial Revolution (4IR) produce and/or can benefit from large pools of data. However, data in and of itself is not useful unless properly interpreted. Analytics provides for the systematic computational analysis of data using techniques such as text-to-data (e.g., natural language processing), machine learning, data visualization, and image informatics. Current challenges such as analysis of unstructured data, computation time, predictive accuracy, and complex event processing provide opportunities for additional academic research.

Program Description

Data sciences is at the core of many research activities at UArizona, and establishment of the Data Science Institute (DSI) has been instrumental in creating an array of capabilities available to many investigators and teams. Over the next five years, this initiative will use TRIF funds to expand the application of data science techniques, in particular the use of DSI, among a broader base of users. We will take concepts, practices, and capabilities from tools like CyVerse and support their expansion beyond life science research so that they can be utilized more broadly. We will support projects that apply data science to more application domains and demonstrate utility in a wider array of problems solving endeavors. TRIF support will also be directed toward the application of data sciences at different size scales. This initiative will support projects that seek to implement the use of data science techniques, especially those that enable data analysis and interpretation in new and novel ways.

What is the University's Advantage and/or Anticipated Funding Opportunities?

Through DSI, numerous faculty across the university have access to core capabilities in many facets of data processing and analysis, visualization, and interpretation. DSI fills the gap between research software and domain science by working with research teams at the cutting edge of data-driven discovery. Currently, DSI offers support in four applied focus areas, including natural language processing, machine learning, large-scale data visualization, and image informatics. Individual investigators working in various 4IR fields can leverage the DSI for their own investigations that require data analytics, as well as collaborate on research that aims to answer important questions and broaden the application of data analytics itself.

Is there an Arizona Specific Benefit or Impact?

• Increased awareness and utilization of data sciences as a research tool, particularly DSI and CyVerse, across all 4IR- related initiatives • Growth of CyVerse beyond life sciences • Implementation of data science techniques at a range of dataset size scales

Investment Detail

	2022	2023	2024	Total
Infrastructure	$373,011	$373,011	$373,011	$1,119,033
Basic Research	$178,238	$178,238	$178,238	$534,714
Applied Research	$429,868	$429,868	$429,868	$1,289,604
Development	$262,114	$262,114	$262,114	$786,342
Total	$1,243,231	$1,243,231	$1,243,231	$3,729,693

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$209,692	$1	$209,692	$629,076
Postdocs Supported	2	2	2	75
Graduate Students	5	5	5	15
Undergraduate Students	3	3	3	9
Sponsored Project Funding	$2,083,333	$2,083,333	$2,083,333	$6,249,999
Publications in Academic Peer-Reviewed Journals	17	17	17	51
Startups	0	1	2	3

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Data Sciences

Progress Summary

The program advanced data science applications through partnerships, research and social data analysis. Environmental Monitoring - Partnered with Pima Department of Environmental Quality, nonprofits and school districts like Sunnyside USD to deploy air quality sensors in Pima County. Publications - Published a study using Google Earth Engine to build an urban greenspace identification tool. Social Data Analysis - Conducted 200+ interviews with AI scientists worldwide; transcripts are being analyzed for academic and policy research.

How has the problem statement been addressed in the last year by this TRIF project?

The project is advancing data sciences by turning large, unstructured datasets into actionable intelligence, while improving speed, accuracy and real-time analysis. Unstructured Data - Applied transformer models to classify oral cancer images, advancing medical diagnostics from unstructured visuals. Used NLP to analyze 200+ interviews with AI scientists, generating structured insights for research and policy. Built a misinformation detection tool with 95% accuracy, showing the ability to classify unstructured web content. Digitized community flood narratives to improve historic flood maps and enhance ML-based environmental modeling. Speed & Accuracy - Developed a stochastic optimization algorithm that accelerates discovery by 2–3x, directly addressing computational bottlenecks. Partnered with Tucson-based Sion Power to build an AI model predicting battery thermal runaway, highlighting advances in predictive accuracy for safety-critical applications. Complex Events - Created a digital twin-driven approach to detect cyberattacks on manufacturing systems, demonstrating mastery of real-time, multi-source event processing in dynamic cyber-physical environments.

What, if anything, hasn't worked as well as was hoped?

Projects in data sciences faced hurdles tied to data quality, model performance and project strategy. Data Issues - Obtaining and preparing reliable datasets was difficult. Projects struggled with massive volumes (e.g., vehicle classification), ambiguous labels (e.g., water detection in satellite images) and disambiguating institutional data. Errors in labeling often propagated into models. Securing external datasets through partnerships also proved challenging. Model & Algorithm Limits - Ensemble methods, imitation learning and recommendation system models often failed to outperform baselines. Fine-tuning LLMs was highly sensitive to small details, while many new tools underperformed in practice. Optimization under uncertainty and stochastic models proved more complex than anticipated, slowing progress. Process & Strategy - Researchers noted the need for phased approaches, incremental milestones and stronger literature reviews to catch problems earlier. Rapid AI advances forced some projects to shift strategies, including tailoring workflows for distinct domains rather than seeking generic solutions.

Describe the Arizona benefit or impact of this TRIF project for the last year.

The project is turning complex data into practical tools that strengthen Arizona's economy, improve public health and safety, and build workforce expertise. Economic Growth - Partnered with Tucson-based Sion Power to develop an AI model predicting battery thermal runaway, improving safety and competitiveness. New algorithms that accelerate discovery 2–3x promise to boost Arizona's advanced manufacturing and tech sectors. Health & Safety - Applied AI image models for mobile-based oral cancer detection, enabling earlier, more accessible diagnostics. City of Phoenix–funded analytics projects are improving traffic safety for residents. Environmental Resilience - Created historic flood maps by combining satellite data with resident narratives, enhancing prediction and mitigation strategies for Arizona communities.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$419,260	$610,942	$1,207,660	$535,174	$2,773,036
Basic Research	$871,429	$0	$8,089	$62,254	$941,772
Applied Research	$0	$0	$243,494	$555,131	$882,983
Development	$0	$0	$0	$269,352	$269,352
Total	$1,290,689	$610,942	$1,459,243	$1,421,911	$4,782,785

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$195,914	$294,153	$257,982	$80,687	$828,736
Postdocs Supported	6	5	5	14	30
Graduate Students	23	15	46	80	164
Undergraduate Students	49	23	54	145	271
Sponsored Project Funding	$19,349,775	$2,147,532	$6,463,537	$14,058,195	$42,019,039
Publications in Peer-Reviewed Journals	17	12	15	77	121
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	4th Industrial Revolution Workforce Development

Problem Statement

The Fourth Industrial Revolution is characterized by a period of an unprecedented rapid change. Concepts are advancing so quickly to implementation, led mostly by large companies, that the existing workforce struggles to keep pace. Moreover, academic programs that would train the pool of new workers are falling behind the demand for skills in new employees. Particularly in STEM fields, the imperative for a focus on fundamentals and connection of theory to practice leaves little room for additional training in areas required for the 4IR. Development of new programs that can address the training of both existing workers and current students is necessary to feed the needs of the 4IR workforce.

Program Description

TRIF funding will support the expansion of STEM education programs at UArizona, especially in those that target growth in enrollment from groups underrepresented in fields of study related to 4IR. We will seek out and fund initiatives that bring faculty and staff together to address an urgent need for the 4IR workforce of the future. Several funding agencies, particularly those in the Department of Defense, are launching new programs related to STEM education and workforce development to fill a current pipeline that has been diminishing over time in the US. We will employ TRIF funding strategically to strengthen programs so that they are competitive on a national level.

What is the University's Advantage and/or Anticipated Funding Opportunities?

UArizona already has institutional strengths in STEM fundaments education, as well as ongoing emphasis in connecting theory to practice with curricula, such as our four-year Craig M. Berge Engineering Design Program. Faculty with expertise in pedagogical, social, and behavioral research can complement ongoing program development to help implement new teaching modalities (e.g., online learning), and we can expand industry partnerships not only to serve workers interested in continuing education, but also to provide internship and co-op opportunities to traditional students. Current programs such as the Catapult Engineering Program seek to support and mentor underrepresented groups to help students persist in their degrees and graduate.

Is there an Arizona Specific Benefit or Impact?

• Development of innovative STEM-based workforce development programs, particularly those that address known pipeline shortages for government and industry • Success in competing for at least one major STEM training grant • Growth in partnerships with stakeholders such as government labs and industry to better align workforce development programs with their needs and expand experiential learning for students • Launch of at least one workforce development program that partners with K-12 and community colleges, across a spectrum of institutions but especially in areas with disadvantaged and/or underserved populations

Investment Detail

	2022	2023	2024	Total
Infrastructure	$399,446	$399,446	$399,446	$1,198,338
Basic Research	$145,619	$145,619	$145,619	$436,857
Applied Research	$116,495	$116,495	$116,495	$349,485
Development	$29,124	$29,124	$29,124	$87,372
Total	$690,684	$690,684	$690,684	$2,072,052

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$116,495	$1	$116,945	$349,935
Postdocs Supported	0	0	0	75
Graduate Students	1	1	1	3
Undergraduate Students	3	4	5	12
Sponsored Project Funding	$2,083,333	$2,083,334	$2,083,335	$6,250,002
Publications in Academic Peer-Reviewed Journals	10	11	12	33
Startups	0	1	1	2

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	4th Industrial Revolution Workforce Development

Progress Summary

The project advanced workforce development by immersing students in hands-on research, technical training and interdisciplinary problem solving across high-impact fields—AI, clean energy, biomedicine, environmental sensing and semiconductor manufacturing. Students gained practical skills in coding, data analysis, remote sensing and lab techniques. Training covered cloud tools, AI/ML software, high-performance computing and communication. Projects used real-world systems for sensing, modeling and decision-making. Many participants secured internships and worked in interdisciplinary teams alongside faculty and external partners. Graduate students deepened expertise in secure hardware, biomedical design and quantum systems, often mentoring peers. Together, these efforts strengthened the talent pipeline and reinforced U of A's commitment to experiential learning and technical excellence.

How has the problem statement been addressed in the last year by this TRIF project?

The project advanced 4IR workforce readiness through hands-on training, AI and data skills and workforce-focused curricula in semiconductors, biomedicine and sustainability—positioning Arizona as a national leader in future-ready talent. Students trained in coding, HPC, AI/ML, biomedical design and clean energy, using real-world data and hardware to apply classroom learning. Over 1,000 undergrads used the Engineering Design Center for prototyping. Cleanroom and fabrication sessions met semiconductor industry needs. AI projects built skills in LLMs, neural networks and misinformation tools. New courses in ML, social computing, quantum info and semiconductors aligned with 4IR fields. Nearly 370 trainings covered data, GIS and modeling. Student work addressed state priorities in wildfire, water, energy, biomedicine and transportation, often in partnership with agencies like USFWS and NPS.

What, if anything, hasn't worked as well as was hoped?

Key challenges remain in scaling engagement, tracking impact and staying ahead of fast-moving industry needs. Future efforts must strengthen integration and outcome measurement to fully deliver on the promise of 4IR workforce development. While over 1,000 students engaged with design tools and 369 training sessions were offered, many experiences were brief. Fewer students received sustained mentorship or advanced research roles. Despite new offerings in ML, semiconductors and quantum systems, industry adoption continues to outpace curriculum updates, leaving gaps in deep, career-ready mastery. Training often stayed siloed within departments. While some multidisciplinary work occurred, consistent convergence across STEM, social science and industry is still developing.

Describe the Arizona benefit or impact of this TRIF project for the last year.

This project strengthened Arizona's innovation economy by equipping students with advanced skills in high-demand fields and supporting strategic sectors like semiconductors, AI, healthcare, sustainability and aerospace. It expanded the STEM workforce pipeline, boosted research capacity and delivered community benefits through applied, real-world projects. Hundreds of students gained skills in coding, AI/ML, HPC, quantum systems, semiconductors, biomedicine and environmental science. Training also built communication and project management capabilities aligned with industry needs. Students trained in semiconductor fabrication, biomedical design and clean energy systems. Projects supported state needs in wildfire mitigation, water, traffic safety and infrastructure resilience. Students advanced AI/ML research in LLMs, misinformation and neural networks, with results embedded in courses across engineering, atmospheric sciences and more while collaborating with USFWS, USFS and NPS on conservation and sustainability. Over 1,000 accessed labs and prototyping tools, with 369 trainings reinforcing Arizona's research and workforce infrastructure.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$693,462	$0	$147,599	$0	$841,061
Basic Research	$36,321	$0	$1,315,608	$53,413	$1,405,342
Applied Research	$0	$0	$969,121	$225,269	$553,121
Development	$200,085	$116,705	$559,913	$38,732	$915,435
Total	$929,868	$116,705	$2,992,241	$317,414	$4,356,228

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	3	9	17	29
Graduate Students	10	6	264	65	345
Undergraduate Students	5	8	222	47	282
Sponsored Project Funding	$47,463	$242,520	$2,527,618	$3,377,816	$6,195,417
Publications in Peer-Reviewed Journals	8	0	17	15	40
Startups	0	0	1	0	1

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Advanced Communications Systems

Problem Statement

The requirement for assured, secure, and ad hoc communications with independent, remote, and other systems operating under attack requires creative, innovative, and breakthrough approaches to consistently establish connections and deliver that data in a timely way. Quantum communications, optical communications, new approaches to encryption, and other approaches to sound and radio-frequency devices are desperately needed by the military and may add value to the methods of the Fourth Industrial Revolution.

Program Description

We anticipate the development of fundamental science and prototype systems that, with additional federal or industrial engagement, can lead to effective commercial and military solutions. We would expect to see even greater collaboration among the colleges and such sites as Ft. Huachuca, providing students with multidisciplinary research experiences ready to compete for top jobs in these industries and fields.

What is the University's Advantage and/or Anticipated Funding Opportunities?

The UArizona Colleges of Science, Optical Sciences, and Engineering are perfect sources of these types of solutions. From the $26M NSF-funded Center for Quantum Networks, an engineering research center, to our efforts in the Frontiers of Sound, acoustic waves research for next-generation information processing, we have the skill and the scientific and technical collaborations in place to answer these challenges.

Is there an Arizona Specific Benefit or Impact?

● Increased industrial-sponsored research in advanced communications systems ● Increased federal, defense, and intelligence agency sponsored projects ● Increased recruiting of top faculty and students ● Increased licensing and tech transfer impacts

Investment Detail

	2022	2023	2024	Total
Infrastructure	$887,657	$887,657	$887,657	$2,662,971
Basic Research	$323,598	$323,598	$323,598	$970,794
Applied Research	$258,879	$258,879	$258,879	$776,637
Development	$64,720	$64,720	$64,720	$194,160
Total	$1,534,854	$1,534,854	$1,534,854	$4,604,562

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$258,879	$1	$258,879	$776,637
Postdocs Supported	2	2	2	75
Graduate Students	3	3	3	9
Undergraduate Students	3	3	3	9
Sponsored Project Funding	$1,666,667	$1,666,667	$1,666,667	$5,000,001
Publications in Academic Peer-Reviewed Journals	22	22	22	66
Startups	0	1	2	3

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Advanced Communications Systems

Progress Summary

The U of A's Advanced Communications Systems initiative advanced secure tech, expanded partnerships and supported student research. Highlights include: Advanced super-resolution imaging—from microscopic to astronomical scales. Won NASA contracts to push exoplanet and coronagraph technologies. Partnered on projects like Breakthrough Watch and K2 Space, fusing RF and optical sensing. Extended support for science policy efforts and the Arizona Science and Technology Policy Fellowship. TRIF funding backed graduate training and early-stage research proposals.

How has the problem statement been addressed in the last year by this TRIF project?

The project tackled the challenge of secure, high-fidelity communication and data transmission under threat by advancing next-generation technologies like Quantum and Optical Communications. Research into quantum-inspired super-resolution imaging directly supports the need for resilient, high-speed communication and detection in contested environments.

What, if anything, hasn't worked as well as was hoped?

The team faced and addressed several technical and organizational challenges. Nanomaterials Handling - Electron beam sensitivity and transfer difficulties from substrate to TEM grid hindered imaging. NASA Funding Expectations - Lower-than-anticipated federal investment in exoplanet technologies led to a strategic pivot toward philanthropic sources. Infrastructure Delays - Initial lab space shortages slowed progress, but relocation to ARB facilities resolved the issue. Investigations into grounding materials are underway to stabilize imaging procedures.

Describe the Arizona benefit or impact of this TRIF project for the last year.

The TRIF project yielded measurable benefits for the state of Arizona in education, policy, and industry. Workforce Development: Local students gained technical skills in nanomaterials and space systems—areas aligned with Arizona's semiconductor and aerospace sectors. Aerospace Ecosystem Growth: Training in space instrumentation supports Arizona's NewSpace economy by preparing students for defense and commercial aerospace roles.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$798,438	$1,594,543	$598,511	$28,155	$3,019,647
Basic Research	$480,864	$119,178	$4,893	$0	$604,935
Applied Research	$0	$0	$0	$0	$327,852
Development	$0	$149	$91,085	$10,671	$101,905
Total	$1,279,302	$1,713,870	$694,489	$38,826	$3,726,487

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$798,438	$433,611	$103,787	$28,155	$1,363,991
Postdocs Supported	3	4	0	1	8
Graduate Students	25	29	13	12	79
Undergraduate Students	17	16	5	8	46
Sponsored Project Funding	$2,037,482	$2,891,130	$8,313,058	$4,779,624	$18,021,294
Publications in Peer-Reviewed Journals	0	22	2	5	29
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Advanced Energy Systems

Problem Statement

Energy systems are required everywhere from deep sea to space, and from miniature applications to electrical grid storage devices. Meeting these demands requires a broad range of energy systems with discrete size, weight, power density, capacity, and cost targets. New approaches to providing these solutions are slow to emerge in the commercial market and must rely on fundamental and applied research that can rapidly scale and transition to commercial production.

Program Description

We anticipate making advances in fundamental science, prototype systems, and teaching and learning that ensure Arizona serves the needs of commerce and the military, and that the state is an attractive destination for these industries.

What is the University's Advantage and/or Anticipated Funding Opportunities?

These solutions require the combined creativity of electrical, mechanical, and systems engineers, materials scientists, and application space expertise. The close-knit activities between the UArizona Colleges of Engineering and Science faculty are ideal for attacking these problems.

Is there an Arizona Specific Benefit or Impact?

• Increased industrial-sponsored research in energy systems • Increased federal, defense, and intelligence agency sponsored projects • Increased recruiting of top faculty and students • Increased licensing and tech transfer impacts

Investment Detail

	2022	2023	2024	Total
Infrastructure	$462,697	$462,697	$462,697	$1,388,091
Basic Research	$132,028	$132,028	$132,028	$396,084
Applied Research	$194,159	$194,159	$194,159	$582,477
Development	$132,028	$132,028	$132,028	$396,084
Total	$920,912	$920,912	$920,912	$2,762,736

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$155,327	$1	$155,327	$465,981
Postdocs Supported	1	1	1	75
Graduate Students	3	3	3	9
Undergraduate Students	2	2	2	6
Sponsored Project Funding	$1,666,667	$1,666,667	$1,666,667	$5,000,001
Publications in Academic Peer-Reviewed Journals	13	13	13	39
Startups	0	1	2	3

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Advanced Energy Systems

Progress Summary

The project assisted the development of novel acoustic based non-destructive testing techniques for additively manufactured structures and awarded MACH-XPhase 2 at the level of $3.15million that will support additive manufacturing technology for hypersonics.

How has the problem statement been addressed in the last year by this TRIF project?

One of the most pressing needs is accelerating development and near-term deployment of high-speed missiles. Retaining technological leadership in this essential battlefield capability is needed to deter threats to national security and provide the U.S. military with cutting edge weapon systems. Affordable precision munitions that utilize high temperature materials are urgently needed by the Army. The continued development of novel, design enabling advanced materials and manufacturing technologies is needed to accelerate deployment and bestow transformational improvements in performance and reliability of these high-speed missile systems.

What, if anything, hasn't worked as well as was hoped?

N/A

Describe the Arizona benefit or impact of this TRIF project for the last year.

TRIF funding has supporting research programs aimed at developing materials and manufacturing technologies that align directly with the needs of over 1,250 aerospace and defense companies in the State of Arizona, including Raytheon, Honeywell, Northrop Grumman and their respective supply chain. There is also nationwide impact as the U.S. needs to maintain technological leadership in this field as it directly impacts national security. The aerospace and defense industry in Arizona significantly impacts the state's economy by contributing over $21.5 billion in total gross state product and$5.6 billion in total annual wages. This program will build a future-proof, equitable talent pipeline to support strategic materials development and advanced manufacturing in Arizona.

Investment Detail	2022	2023	2024	2025	Total
Infrastructure	$376,331	$106,729	$92,380	$0	$575,440
Basic Research	$0	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0	$327,852
Development	$0	$0	$0	$0	$0
Total	$376,331	$106,729	$92,380	$0	$575,440

Performance Measures	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$276,795	$92,380	$0	$369,175
Postdocs Supported	0	0	2	0	2
Graduate Students	0	0	2	0	2
Undergraduate Students	0	0	3	0	3
Sponsored Project Funding	$0	$0	$0	$134,188	$134,188
Publications in Peer-Reviewed Journals	0	0	3	0	3
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Artificial Intelligence

Problem Statement

The field of artificial intelligence (AI) can encompass research in machine learning, computer visioning, and natural language processing. Application of such research can create computational approaches to human-like reasoning that can augment decision making. A laudable goal of AI is to replace human decision making, particularly where the task is extremely complex and/or large amounts of data are involved. The quality of any AI system is dependent on the data used to develop and support it. Major challenges are data quality, bias, structure, labeling, and methods to curate large datasets.

Program Description

An important objective for TRIF support in the AI initiative is to bring existing research and application capabilities together in new ways to create synergies and increase opportunities for both funding and impact. We expect there are step-function gains that can be realized by connecting investigators and seeding new projects that will expand the development and application of AI. At present, there is fervent excitement around AI that is making it challenging to understand what represents true opportunity for UArizona. TRIF funding will be employed to bring together AI investigators from across campus to sort through potential strategies for expansion of AI research and technologies and determine the best path. We expect at least one outcome to be a cogent roadmap that will help UArizona establish itself as a leader in AI in one or more research and/or application domains.

What is the University's Advantage and/or Anticipated Funding Opportunities?

UArizona currently deploys AI approaches across several research domains, including AI research itself. Recent and current programs include applications of AI in cybersecurity, space exploration, health care, education, sustainability, transportation, and border security. UArizona investigators are developing new approaches to AI itself, such as machine learning algorithms that adapt over time. Current efforts span multiple departments and colleges and provide the potential to pull teams of AI specialists together to address even larger challenges.

Is there an Arizona Specific Benefit or Impact?

• Development of an AI roadmap that details a strategy for UArizona to follow toward a position of national prominence • Determination of AI-related areas where UArizona can be competitive and establish world-class programs • Demonstration of UArizona leadership in one or more research or application domains related to AI (e.g., major grant award, center of excellence)

Investment Detail

	2022	2023	2024	Total
Infrastructure	$719,002	$719,002	$719,002	$2,157,006
Basic Research	$262,115	$262,115	$262,115	$786,345
Applied Research	$209,692	$209,692	$209,692	$629,076
Development	$52,422	$52,422	$52,422	$157,266
Total	$1,243,231	$1,243,231	$1,243,231	$3,729,693

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$209,692	$1	$209,692	$629,076
Postdocs Supported	0	0	0	75
Graduate Students	1	1	1	3
Undergraduate Students	3	3	3	9
Sponsored Project Funding	$2,083,333	$2,083,333	$2,083,333	$6,249,999
Publications in Academic Peer-Reviewed Journals	17	17	17	51
Startups	0	1	2	3

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Artificial Intelligence

Progress Summary

Progress included: Global AI Research - Conducted over 200 interviews with AI scientists worldwide. Transcripts will inform future academic and policy research. Student Engagement - Expanded lab team to 12–15 members, engaging student researchers and interns across multiple U of A colleges. Applied AI Research - Published a study using Google Earth Engine to create a tool for identifying urban greenspaces.

How has the problem statement been addressed in the last year by this TRIF project?

The project is advancing AI by strengthening model performance while tackling foundational data challenges—improving reliability, equity and real-world impact for Arizona. Smarter Decision-Making: Developed cutting-edge models in ML, NLP and computer vision to support or replace human decisions in complex domains. Faster Discovery: Created a new optimization algorithm that accelerates discovery in fields like materials science by 2–3x. Better Diagnostics: Applied transformer models to classify oral cancer images via mobile devices, expanding early diagnostic reach. Automated Analysis: Used LLMs to aid lens design and detect science misinformation with 95% accuracy, reducing time-intensive human tasks. Data Quality & Curation: Generated flood maps from satellite data by combining machine learning with digitized resident experiences—enhancing training accuracy. Bias & Trust: Conducted 200+ interviews with global AI researchers and studied how bias enters AI systems, aligning with national guidance on ethical AI. Making Data Useful: Leveraged LLMs to structure public NSF award data for proposal development—turning vast, unstructured datasets into usable insight.

What, if anything, hasn't worked as well as was hoped?

Challenges: AI work under IT4IR faced hurdles in model performance, data quality, infrastructure and adapting to a fast-moving field. Model Development: Building vehicle classification models from large datasets proved difficult. Early imitation learning and LLM fine-tuning yielded weak results, requiring revised approaches. Bias mitigation was constrained by time and funding. Data Limitations: Creating high-quality labeled datasets was more labor-intensive than expected, with labeling errors affecting outcomes. Difficulty securing real-world data from partners limited broader AI application. Infrastructure Gaps: GPU shortages restricted model training and data handling. Regulatory limits on hardware like drones shifted focus away from physical testbeds. Strategic Shifts: Naïve baselines and simple prompts underperformed. Progress improved with agent-based AI methods, but constant tool updates made it hard to maintain stable research direction.

Describe the Arizona benefit or impact of this TRIF project for the last year.

Arizona Benefit: The IT4IR TRIF program is advancing AI innovation that supports Arizona's economy, public well-being and workforce development. Driving Economic Growth: Partnered with Tucson-based Sion Power to develop AI that improves battery safety—boosting local industry competitiveness. New optimization algorithms accelerate materials discovery, with direct applications in Arizona's manufacturing sector. Sponsored capstone projects with local startups foster innovation and entrepreneurship. Enhancing Health & Safety: Developed AI models for mobile-based oral cancer detection, expanding early diagnosis access. City of Phoenix–funded research uses AI to improve traffic safety, including red light running analysis. Tools to detect science misinformation and examine bias in AI promote ethical, informed public use of technology.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$176,218	$0	$521,734	$697,952
Basic Research	$61,860	$0	$46,641	$0	$108,501
Applied Research	$0	$165,187	$0	$481,960	$809,812
Development	$0	$0	$213,397	$0	$213,397
Total	$61,860	$341,405	$260,038	$1,003,694	$1,666,997

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$521,734	$521,734
Postdocs Supported	0	1	2	7	10
Graduate Students	5	11	21	53	90
Undergraduate Students	2	2	13	33	50
Sponsored Project Funding	$0	$0	$385,192	$2,744,044	$3,129,236
Publications in Peer-Reviewed Journals	17	0	6	25	48
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Cyber Defense

Problem Statement

Our hyper-digital world, where anything that can be referred to as a "device" is probably connected or connectable to the internet, creates a vast attack surface for bad behavior, whether from script-kiddies, criminals, or nation states. This is true for commercial, government, consumer systems, and a wide swath of America's defense systems. Preventing attacks that deny or degrade the confidentiality, integrity, or availability of the data or systems is critical to a well-functioning military, economy, and society.

Program Description

TRIF investments in cyber defense activities are intended to develop countermeasures and solutions to phishing, ransomware, advanced persistent threat, and more subtle attack mechanisms.

What is the University's Advantage and/or Anticipated Funding Opportunities?

The university is home to talented and innovative electrical and computer engineers and scientists and draws globally competitive students to Arizona. They are backed by top physicists and mathematicians, and they have access to some of the most advanced modeling and research platforms in the world. Our College of Applied Science and Technology (CAST) in Sierra Vista offers degree and certificate programs to train personnel in machine learning, artificial intelligence, and cybersecurity. We have achieved the highest level of recognition from defense agencies for our ability to contribute to solutions in this area.

Is there an Arizona Specific Benefit or Impact?

● Open-source solutions ● Increased industrial-sponsored research in cyber defense ● Increased federal, defense, and intelligence agency sponsored projects ● Increased recruiting of top faculty and students ● Increased licensing and tech transfer impacts

Investment Detail

	2022	2023	2024	Total
Infrastructure	$623,103	$623,103	$623,103	$1,869,309
Basic Research	$176,037	$220,047	$220,047	$616,131
Applied Research	$258,879	$323,598	$323,598	$906,075
Development	$258,879	$323,598	$323,598	$906,075
Total	$1,316,898	$1,490,346	$1,490,346	$4,297,590

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$207,103	$1	$258,879	$724,861
Postdocs Supported	1	1	1	75
Graduate Students	3	3	3	9
Undergraduate Students	2	2	2	6
Sponsored Project Funding	$1,666,667	$1,666,667	$1,666,667	$5,000,001
Publications in Academic Peer-Reviewed Journals	17	22	22	61
Startups	0	1	2	3

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Cyber Defense

Progress Summary

The project made significant strides in supporting research, student training and defense-related applications. TRIF funds supported four undergraduate and two graduate students in research activities, contributing to workforce development in cybersecurity and AI. Proposed the NSF-funded Center for Aerial Intelligent Crisis Management (CAICM), leveraging AI and UAS to support emergency responders during disasters. Created the MASQRAD tool using multi-agent actor-critic generative AI, enhancing query resolution with imprecise user inputs—published in IEEE Transactions on Artificial Intelligence. Developed and published a novel framework for identifying cyber-physical security vulnerabilities in smart manufacturing. Researchers gave oral presentations at the Air Force Research Lab's VOLTRON conference. Published studies on technology acquisition practices in HEIs, contributing to NSF proposal submissions.

How has the problem statement been addressed in the last year by this TRIF project?

The project directly tackled the pressing challenges posed by the expanding digital threat landscape. Enhanced Cybersecurity Research - Novel tools such as MASQRAD and advanced clustering algorithms were developed to interpret and secure complex data environments—central to national defense and commercial cybersecurity. AI in Crisis Management - The proposed CAICM aims to apply AI and UAS in real-time emergency support, directly addressing the need for resilient communications and data systems.

What, if anything, hasn't worked as well as was hoped?

Technical Expertise and Tooling - Early challenges in reverse-engineering app protocols were overcome as the student team-built expertise in formal verification and reverse engineering. Despite its successes, the project faced several difficulties - Hardware and Infrastructure Gaps - Many sensors were too small to detect adversarial payloads targeting the Moon.

Describe the Arizona benefit or impact of this TRIF project for the last year.

TRIF investments have had far-reaching impact on Arizona's technological, academic, and economic ecosystems. Support to Local Industry and Defense - Partnerships with small Tucson-area businesses and collaborations with AMARG at Davis–Monthan AFB provided crucial defense-oriented innovation support. Policy and Social Science Contributions - TRIF-funded research also informed broader security issues via political science insights into criminal governance in Latin America, enriching Arizona's role in global security research.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$324,401	$448,258	$34,757	$0	$807,416
Basic Research	$829,415	$11,858	$3,099	$0	$844,372
Applied Research	$0	$0	$0	$0	$327,852
Development	$0	$0	$1,162,455	$2,717,058	$3,879,513
Total	$1,153,816	$460,116	$1,200,311	$2,717,058	$5,531,301

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$324,401	$448,258	$34,757	$0	$807,416
Postdocs Supported	0	0	7	9	16
Graduate Students	6	8	14	34	62
Undergraduate Students	6	5	84	28	123
Sponsored Project Funding	$169,777	$1,082,773	$26,470	$8,023,877	$9,302,897
Publications in Peer-Reviewed Journals	0	4	24	28	56
Startups	1	0	0	0	1

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Cyber Exploitation

Problem Statement

Understanding how our digital systems can be adversely impacted by bad actors starts with the initiative on cyber defense, outlined above. The cyber exploitation initiative focuses on the second and third order effects when a breach occurs: How we delay, deny, and defeat attempts to cause our digital systems to mislead us, perform in unintended and dangerous ways, or slow down or confuse the integrated or cyber-physical systems with which they are associated.

Program Description

TRIF investments in cyber exploitation technologies will deliver techniques, software, and improved instruction in methods to ensure the safe and continuous operation of systems that have been challenged or threatened.

What is the University's Advantage and/or Anticipated Funding Opportunities?

We are fortunate to have faculty and staff with real-world experience dealing with these threats for the Department of Defense and in industrial settings. Again, in this area, we have achieved the highest level of recognition from defense agencies for the quality of our faculty, infrastructure, and instruction.

Is there an Arizona Specific Benefit or Impact?

● Open-source solutions ● Increased industrial-sponsored research in cyber exploitation ● Increased federal, defense, and intelligence agency sponsored projects ● Increased recruiting of top faculty and students ● Increased Licensing and tech transfer impacts

Investment Detail

	2022	2023	2024	Total
Infrastructure	$307,005	$307,005	$307,005	$921,015
Basic Research	$176,037	$132,028	$132,028	$440,093
Applied Research	$424,561	$318,421	$318,421	$1,061,403
Development	$258,879	$194,159	$194,159	$647,197
Total	$1,166,482	$951,613	$951,613	$3,069,708

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$207,103	$1	$155,327	$517,757
Postdocs Supported	1	1	1	75
Graduate Students	4	4	4	12
Undergraduate Students	3	3	3	9
Sponsored Project Funding	$1,666,667	$1,666,667	$1,666,667	$5,000,001
Publications in Academic Peer-Reviewed Journals	17	13	13	43
Startups	0	1	2	3

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Cyber Exploitation

Progress Summary

The project significantly advanced the integration of AI with cyber-physical systems, highlighted by a multifunctional drone platform. Innovative Drone System Development - Developed a prototype drone integrating Computer Vision, OCR, and LLMs (e.g., ChatGPT) that autonomously collects sensor and image data, interprets environmental text, generates AI prompts and acts on AI responses, making it suitable for discreet intelligence gathering in both military and civilian applications. Academic-Industry Interface - explored the dual-use implications of military-grade drone technology, including privacy concerns and commercialization potential. Recognition and Publication - The PI received the MSI Scholars Award and the Eller Dean's Research Award for Associate Professors. Student Engagement - One undergraduate student contributed Python modules for AI integration and completed an honors thesis.

How has the problem statement been addressed in the last year by this TRIF project?

This project directly addresses the second- and third-order effects of cyber breaches—how to delay, deny or defeat adversarial manipulation of digital systems. The intelligent drone exemplifies proactive surveillance and data interpretation tools that detect deceptive inputs or environmental manipulation and respond dynamically.

What, if anything, hasn't worked as well as was hoped?

Underestimated build time and faulty hardware delayed integration, compounded by limited open-source documentation.

Describe the Arizona benefit or impact of this TRIF project for the last year.

Educational Impact and STEM Outreach - The drone serves as an engaging K–12 demonstration tool to encourage student interest in AI and robotics. Equity and Representation in AI Systems - The new classifier reduces AI detection bias, supporting fairness for Arizona's diverse populations.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$1,064,625	$2,139,650	$1,021,666	$248,418	$4,474,359
Basic Research	$9,441	$36,008	$125,276	$12,966	$183,691
Applied Research	$0	$0	$0	$0	$327,852
Development	$0	$0	$0	$0	$0
Total	$1,074,066	$2,175,658	$1,146,942	$261,384	$4,658,050

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$1,064,625	$2,139,650	$1,021,666	$0	$4,225,941
Postdocs Supported	0	0	0	0	0
Graduate Students	0	0	19	86	105
Undergraduate Students	6	1200	556	34	1796
Sponsored Project Funding	$921,080	$1,392,997	$5,038,105	$697,681	$8,049,863
Publications in Peer-Reviewed Journals	0	0	1	4	5
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Cyber-Physical Systems

Problem Statement

Industry has traditionally relied on highly linear data and communications for decision making. Cyber-physical systems (CPS) enables real-time access to data and intelligence from a myriad of sources and locations simultaneously, with the potential to fundamentally change the way businesses operate. Challenges in CPS include many fundamental questions regarding system integration, safety, accuracy, data processing, and reliability.

Program Description

At present there are several active programs that focus on CPS problems and technologies. TRIF funding would support further growth and expansion. Over the next five years, we expect that the number of competitive grants submissions from these programs will grow and the number of research sponsors will increase beyond past experience, which recently has been limited mostly to NSF. In particular, current opportunities exist with the Department of Defense, NASA, and industry that we can and should pursue. TRIF funding will also make investments to increase UArizona's activities in this domain by bringing current groups together for larger projects, as well as introducing new investigators to the field through seed grants. One area that may be particularly fruitful is CPS application to health care. With the growth of telemedicine, which is largely focused on video-enabled patient interactions (especially during the SARS-CoV-2 pandemic), innovators are turning to the next frontier. This will undoubtably involve CPS-enabled platforms such as remote surgery.

What is the University's Advantage and/or Anticipated Funding Opportunities?

UArizona has a history of involvement in CPS research since at least 2014. We held a workshop for faculty interested in CPS funded by the NSF and most recently were awarded another NSF grant in "Computationally Aware Cyber-Physical Systems." UArizona has many units and individual investigators across the university conducting research and student training in the broad field of CPS. The Compositional Systems Labs, housed within Systems and Industrial Engineering and aligned with the UArizona Transportation Research Institute, works in the fields of transportation and autonomous vehicles. The College of Science (Applied Math), Electrical and Computer Engineering, and the Center for Applied Genetics and Genomic Medicine also are engaged in CPS activities.

Is there an Arizona Specific Benefit or Impact?

• Growth of existing CPS activities and an increase in the number of submitted proposals, particularly beyond NSF • Increased participation of faculty in CPS-related research, especially from related areas (e.g., mechanical engineers that work on the physical systems side) • Expanded application space for CPS-related technologies in all relevant areas, but importantly in health care

Investment Detail

	2022	2023	2024	Total
Infrastructure	$373,011	$373,011	$373,011	$1,119,033
Basic Research	$262,114	$262,114	$262,114	$786,342
Applied Research	$429,868	$429,868	$429,868	$1,289,604
Development	$178,238	$178,238	$178,238	$534,714
Total	$1,243,231	$1,243,231	$1,243,231	$3,729,693

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$209,692	$1	$209,692	$629,076
Postdocs Supported	2	2	2	75
Graduate Students	5	5	5	15
Undergraduate Students	3	3	3	9
Sponsored Project Funding	$2,083,333	$2,083,333	$2,083,333	$6,249,999
Publications in Academic Peer-Reviewed Journals	17	17	17	51
Startups	0	1	2	3

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Cyber-Physical Systems

Progress Summary

Cyber-Physical Systems - The IT4IR TRIF program advanced research on secure integrated sensing and communications (ICAS) for next-generation cyber-physical systems. Security Research - Identified vulnerabilities in joint communication and sensing waveforms, showing how adversaries can spoof or suppress targets. Countermeasure development is underway. Funding & Proposals - Findings support a new Army Research Office proposal on cyber-physical trust binding and a \$1.2M NSF proposal on ICAS security. Testbed & Collaboration - Arizona's College of Engineering provides a connected autonomous vehicle testbed to study ICAS attack impacts and mitigation on real-world systems like vehicles and industrial robots.

How has the problem statement been addressed in the last year by this TRIF project?

The project is tackling core challenges in Cyber-Physical Systems (CPS) by developing secure, intelligent and integrated platforms that move beyond traditional linear models. Integration & Real-Time Data - Created a digital twin-driven detection system for CPS manufacturing, enabling proactive response to cyberattacks. Developed a Digital Engineering platform with Model-Based Systems Engineering and a Software Factory to modernize education in complex system integration. Army-funded work on autonomous water treatment systems integrates sensors, data and controls for real-time performance. Safety & Reliability - Published the first risk assessment and taxonomy of cyberattacks on manufacturing systems, establishing a foundation for secure CPS. Partnered with Tucson's Sion Power to create an AI model predicting thermal runaway in batteries, improving safety across vehicles and electronics. A student-led autonomous driving platform provided practical training on CPS safety and reliability, preparing students for real-world applications.

What, if anything, hasn't worked as well as was hoped?

CPS work faced hurdles in integrating theory with real-world testbeds, managing hardware/software co-design and navigating infrastructure limits. Autonomous Systems - Building and validating mmWave and vehicle testbeds was slow and resource-heavy. Students encountered gaps between theoretical models and real-world deployment in small-scale autonomous platforms. Hardware/Software Integration - VR and surgical training simulators struggled with latency, realism and portability. Custom designs for haptics required complex hardware/software coordination. Resource Limits - Progress was slowed by supply chain delays, high costs and regulatory restrictions on drones and other specialized equipment. Lab space and facilities support also lacked needed CPS expertise. Operational Barriers - Motion sickness in VR training systems demanded UI redesign. Scaling prototypes like surgical trainers and autonomous vehicles remained difficult due to hardware and portability constraints.

Describe the Arizona benefit or impact of this TRIF project for the last year.

The project is strengthening Arizona's industries by improving CPS security and competitiveness while building a future-ready workforce. Industrial Security & Competitiveness - Developed the first risk assessment and taxonomy of cyberattacks on manufacturing systems, along with a digital twin-driven detection tool that gives Arizona companies real-time defenses against costly disruptions. Local Industry Impact - Partnered with Tucson-based Sion Power to create an AI model that predicts battery thermal runaway, addressing a critical safety issue and boosting the market value of Arizona-made technologies.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$75,191	$111,245	$61,541	$663,590	$911,567
Basic Research	$78,562	$0	$20,875	$0	$99,437
Applied Research	$0	$0	$398,107	$136,221	$464,073
Development	$0	$0	$190,153	$0	$190,153
Total	$153,753	$111,245	$670,676	$799,811	$1,735,485

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$75,191	$62,418	$59,449	$298,027	$495,085
Postdocs Supported	1	0	1	1	3
Graduate Students	2	8	6	29	45
Undergraduate Students	6	3	1053	1608	2670
Sponsored Project Funding	$8,000	$43,929	$1,029,248	$1,934,198	$3,015,375
Publications in Peer-Reviewed Journals	17	0	7	14	38
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Human-Computer Interactions

Problem Statement

Computer systems used to be designed to respond to human input efficiently and consistently. With wearables, digital assistants, ubiquitous data, and artificial intelligence-infused and connected objects, we now require approachable, accessible, efficient interactions for compute-capable platforms to interact with humans. In many critical applications and systems, we also have moved from a time of a human operator in the control loop, to a human supervisor on the control loop. Safety, ergonomics, multi-sensory interactions, and intuitive interfaces are critical.

Program Description

Research in the area of human-computer interaction should reduce errors in the use of our defense systems, reduce the training burden as users transition to new systems, and reduce human stress in the use of these systems.

What is the University's Advantage and/or Anticipated Funding Opportunities?

UArizona has strong electrical and computer engineering faculty as well as depth in artificial intelligence and mathematics. We have strong language centers; psychology, physiology, and social sciences faculty; and design themes around strengthening the built environment. These multidisciplinary talents will help us shape the interface between the real world and digital terrain, building efficiency and removing impediments to national security system interfaces and practices.

Is there an Arizona Specific Benefit or Impact?

● Increased industrial-sponsored research in human-computer interactions ● Increased federal, defense, and intelligence agency sponsored projects ● Increased recruiting of top faculty and students ● Increased licensing and tech transfer impacts

Investment Detail

	2022	2023	2024	Total
Infrastructure	$184,203	$184,203	$184,203	$552,609
Basic Research	$129,439	$129,439	$129,439	$388,317
Applied Research	$212,280	$212,280	$212,280	$636,840
Development	$88,019	$88,019	$88,019	$264,057
Total	$613,941	$613,941	$613,941	$1,841,823

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$103,551	$1	$103,551	$310,653
Postdocs Supported	0	0	0	75
Graduate Students	3	3	3	9
Undergraduate Students	3	3	3	9
Sponsored Project Funding	$1,666,667	$1,666,667	$1,666,667	$5,000,001
Publications in Academic Peer-Reviewed Journals	9	9	9	27
Startups	0	1	2	3

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Human-Computer Interactions

Progress Summary

The project advanced key systems supporting university compliance, research collaboration, education and scientific exploration. Agiloft for Export Control Compliance - Successfully deployed the Agiloft platform to centralize and manage Technology Control Plans (TCPs), ensuring compliance with U.S. These efforts laid the groundwork for the JEDI Aquanautics platform for networked blue economy research and education, including hybrid virtual/physical field trips through VIP Holodeck courses. Facilitated discovery of research expertise, enabled cross-disciplinary grant teams, and supported funding proposals through co-authorship and funding visualizations. Ocean Science and Robotics Innovation - Supported scientific diving operations and tested the Ocean Space HabitatSM at Biosphere.

How has the problem statement been addressed in the last year by this TRIF project?

The project addressed the evolving human-computer interaction landscape through practical and institutional innovations. System Accessibility and Supervision Support - Agiloft transitioned compliance oversight from a manual process to a centralized digital platform, enhancing safety, accessibility and administrative supervision.

What, if anything, hasn't worked as well as was hoped?

Template Development Limitations - Microsoft Word formatting incompatibilities in Agiloft necessitated the creation of three distinct TCP templates to ensure document integrity. Agiloft Data Migration - Integrating data from multiple legacy systems caused unanticipated delays. KMap Accessibility and Structuring - Initial researcher clustering was confusing; shifting to department-based visualization improved usability.

Describe the Arizona benefit or impact of this TRIF project for the last year.

This project delivered impactful outcomes across academia, government and the broader Arizona community. Support for Export-Controlled Research - Agiloft enabled PIs and college staff to easily manage TCPs, supporting research subject to federal regulation and increasing research compliance statewide. Tech Transfer and Innovation - Work with Tech Launch Arizona yielded intellectual property disclosures and a pending patent, underscoring the translational potential of TRIF-supported innovations.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$1,403,749	$2,018,670	$3,422,419
Basic Research	$172,604	$9,433	$0	$0	$182,037
Applied Research	$0	$0	$0	$0	$327,852
Development	$0	$1,138	$115,406	$0	$116,544
Total	$172,604	$10,571	$1,519,155	$2,018,670	$3,721,000

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	1	4	2	2	9
Graduate Students	3	6	1	8	18
Undergraduate Students	8	4	0	7	19
Sponsored Project Funding	$0	$115,125	$0	$0	$115,125
Publications in Peer-Reviewed Journals	0	0	0	2	2
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Internet of Things (IoT)

Problem Statement

The Internet of Things (IoT) is represented by devices with a multitude of capabilities, including self-identification, localization, diagnostic status, data acquisition, processing, and device-to-device and device-to-network communication. Devices function under the umbrella of the internet, which serves as a means of data transfer and communication. Application areas can be broadly categorized in terms of consumer, organizational, industrial, infrastructure, and military sectors. Technologies that support the IoT include wireless, low-power consumption electronics, energy storage, miniaturization, cloud computing, and data analytics. Barriers such as compatibility and lack of a clear value-proposition have hampered adoption. Security and privacy concerns with respect to data usage also have tempered enthusiasm.

Program Description

We anticipate this initiative will focus resources around current areas of demonstrable leadership in IoT technologies (e.g., transportation, agriculture, mining), as well as emerging areas (e.g., health monitoring), to deepen expertise and solidify critical mass. Over the next five years, one or more of these programs will be capable of maturation to national research center status, with commensurate federal funding support (e.g., ERC, MURI, NIH P01 or P50). TRIF funding also would support smaller programs in a “seed and feed” approach. The nature of IoT research involves a wide application space, and new discoveries can potentially be directed toward a myriad of applications and/or combined with related technologies to address ever-larger challenges. TRIF seed grants in the IoT initiative will be used to ensure that a pipeline of discoveries emerges over the five-year timeframe, and that this culture persists in the future.

What is the University's Advantage and/or Anticipated Funding Opportunities?

As a large land-grant university, UArizona is positioned to address complex system problems in a variety of application domains. Current research in wireless communications, low-energy consumption sensors, agricultural automation, data analytics, machine learning, wearables, advanced manufacturing, robotics, and transportation provide broad capabilities and expertise that can be directed toward important research questions that currently limit the effective application of IoT technologies. The university’s ability to form strong academic-industry partnerships can help focus research and accelerate translation through proof-of-concept, technology transfer, and commercialization.

Is there an Arizona Specific Benefit or Impact?

• Development of a community around IoT technologies that includes multiple investigators, a convergence research approach, education and training programs directed toward workforce development, and increased technology transfer activity • Increased synergy between currently diffuse areas of IoT research and improved competitiveness for large, center-type funding awards • Development of a robust pipeline of seed projects that address emerging challenges and new application spaces

Investment Detail

	2022	2023	2024	Total
Infrastructure	$540,763	$540,763	$540,763	$1,622,289
Basic Research	$178,238	$178,238	$178,238	$534,714
Applied Research	$262,115	$262,115	$262,115	$786,345
Development	$262,115	$262,115	$262,115	$786,345
Total	$1,243,231	$1,243,231	$1,243,231	$3,729,693

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$209,692	$1	$209,692	$629,076
Postdocs Supported	2	2	2	75
Graduate Students	5	5	5	15
Undergraduate Students	3	3	3	9
Sponsored Project Funding	$2,083,333	$2,083,333	$2,083,333	$6,249,999
Publications in Academic Peer-Reviewed Journals	17	17	17	51
Startups	0	1	2	3

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Internet of Things (IoT)

Progress Summary

The program advanced IoT applications in healthcare, environmental monitoring and water systems. Healthcare Innovation - Supported NSF CAREER and US Army–funded research, securing $2.3M for osseosurface electronics that enable wireless communication between embedded devices and external systems. Environmental Monitoring - Partnered with local agencies and nonprofits to deploy air quality sensors across Pima County. Autonomous Water Systems - Launched an Army-funded project to develop IoT-enabled technologies for autonomous water treatment and reuse.

How has the problem statement been addressed in the last year by this TRIF project?

The project is advancing IoT by building real-world applications, developing enabling technologies and tackling barriers of security and trust. Real-World Applications - Deployed air quality sensors in Pima County through partnerships with local agencies and schools, showcasing community-scale IoT benefits. Launched an Army-funded project on autonomous water treatment systems that integrates sensors, processors and communication networks for real-time operation. Enabling Technologies - Advanced research on energy-efficient AI for low-power electronics, critical for wireless IoT devices. Partnered with Tucson’s Sion Power to build an AI model predicting battery thermal runaway, improving safety and reliability in IoT energy storage. Security & Trust - Developed the first risk assessment and taxonomy of cyberattacks on manufacturing systems. Created a digital twin-driven detection approach to identify and neutralize cyber threats in real time, strengthening security for industrial IoT environments.

What, if anything, hasn't worked as well as was hoped?

IoT projects faced hurdles in hardware performance, systems integration and real-world deployment. Hardware Limits - VR training systems struggled with latency, portability and graphical demands. Graphene nanoribbon devices were hampered by quality and alignment issues. Supply chain delays, including year-long waits for parts, slowed progress. Implementation Barriers - Bridging theory to practice proved difficult, particularly in autonomous systems where testbed integration was time-consuming. Some teams relied on simulations to accelerate early testing. Emerging research into security for integrated communications and sensing (ICAS) revealed new challenges but also potential competitive advantage.

Describe the Arizona benefit or impact of this TRIF project for the last year.

The project is advancing IoT for Arizona by improving community infrastructure, addressing water needs and securing the technologies that power connected industries. Public Infrastructure & Environment - Partnered with Pima Department of Environmental Quality and Sunnyside USD to deploy air quality sensors in Pima County, giving communities real-time data to protect public health. An Army-funded project on autonomous water treatment demonstrates how industrial IoT can help meet Arizona’s critical water challenges. Industrial Security & Core Tech - Developed the first risk assessment and taxonomy of cyberattacks on manufacturing systems, along with a digital twin-driven detection tool to safeguard critical infrastructure. Partnered with Tucson’s Sion Power to create an AI model predicting battery thermal runaway, improving reliability of IoT devices. These advances build trust in connected systems and strengthen Arizona’s industrial competitiveness.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$3,234	$133,105	$506,474	$1,091,058	$1,733,871
Basic Research	$137,844	$0	$0	$0	$137,844
Applied Research	$339,237	$0	$0	$398,816	$1,065,905
Development	$0	$0	$106	$0	$106
Total	$480,315	$133,105	$506,580	$1,489,874	$2,609,874

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$125,860	$504,382	$979,519	$1,609,761
Postdocs Supported	3	0	1	10	14
Graduate Students	7	0	19	49	75
Undergraduate Students	19	0	47	72	138
Sponsored Project Funding	$401,797	$1,003,255	$3,318,237	$4,669,694	$9,392,983
Publications in Peer-Reviewed Journals	17	0	5	29	51
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Novel Materials

Problem Statement

Military systems operate in extreme environments that pose challenges to structural and packaging materials. Their energy systems require lightweight and high-electrical discharge capabilities. The structures require materials systems with unique fastening and joining methods. Increasingly, those materials must accommodate additional functionality and embedded systems than previous systems.

Program Description

We expect substantial progress in fundamental materials development, testing, and evaluation of coupon (small materials samples) and larger scale-up materials models, technical artifacts, and prototypes.

What is the University's Advantage and/or Anticipated Funding Opportunities?

Through growing collaborations with Arizona's resident military and intelligence components, our scientists are increasingly familiar with the operational and design issues that these systems must accommodate.

Is there an Arizona Specific Benefit or Impact?

● Increased industrial-sponsored research in novel materials ● Increased federal, defense, and intelligence agency sponsored projects ● Increased recruiting of top faculty and students ● Increased licensing and tech transfer impacts

Investment Detail

	2022	2023	2024	Total
Infrastructure	$355,063	$355,063	$355,063	$1,065,189
Basic Research	$129,439	$129,439	$129,439	$388,317
Applied Research	$103,551	$103,551	$103,551	$310,653
Development	$25,888	$25,888	$25,888	$77,664
Total	$613,941	$613,941	$613,941	$1,841,823

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$258,879	$1	$258,879	$776,637
Postdocs Supported	0	0	0	75
Graduate Students	3	3	3	9
Undergraduate Students	3	3	3	9
Sponsored Project Funding	$1,666,667	$1,666,667	$1,666,667	$5,000,001
Publications in Academic Peer-Reviewed Journals	9	9	9	27
Startups	0	1	2	3

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	University of Arizona
TRIF Investment Area	National Security Systems
Program Name	Novel Materials

Progress Summary

The Novel Materials TRIF initiative significantly advanced research infrastructure, proposal development, collaborations and innovation across disciplines. Infrastructure and Facility Development - TRIF support enabled critical instrumentation purchases, lab refurbishments, and access to high-performance computing (including CUI/ITAR-compliant resources). Cross-Disciplinary and National Security Research - Support through the National Security Program and the Applied Research Corporation allowed for sensitive research in hypersonics and quantum materials, strengthening controlled research capabilities and industry partnerships. Proposal and Research Support - Faculty received proposal development assistance for major opportunities, including a $1B space mission concept.

How has the problem statement been addressed in the last year by this TRIF project?

The project addressed military materials challenges by advancing technologies aligned with the performance demands of extreme environments. Lightweight and Functional Materials - Investments in advanced spectroscopic and fabrication labs enabled the study of 2D materials, quantum systems, and high-strength polymers—materials suited for energy systems and multifunctional applications.

What, if anything, hasn't worked as well as was hoped?

External Funding Volatility - A DURIP proposal for spectroscopic expansion was declined due to federal budget cuts, prompting a pivot to industry and non-traditional funding channels. While the project experienced robust progress, several challenges emerged. Staffing Constraints - Progress was delayed where dedicated personnel could not be allocated. The team responded with phased implementation strategies. Speed improved once externally funded researchers joined.

Describe the Arizona benefit or impact of this TRIF project for the last year.

The project delivered wide-reaching impacts on Arizona's educational, industrial, and research landscapes. Workforce Training and Education - Over 15 undergraduates, many from diverse backgrounds, were engaged in research. Innovation Ecosystem - Through TRIF, Arizona solidified its reputation in quantum sciences, polymer materials, mining technology and defense R&D—reinforced by $1.5M in philanthropic gifts and federal recognition. Industry Engagement - TRIF-supported labs attracted attention and partnerships from Intel, ASML, Raytheon, Northrop Grumman and Arizona’s mining industry.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$976,178	$634,649	$438,249	$557,015	$2,606,091
Basic Research	$18,795	$92,467	$225,734	$0	$336,996
Applied Research	$0	$0	$0	$0	$327,852
Development	$0	$69,100	$588,327	$0	$657,427
Total	$994,973	$796,216	$1,252,310	$557,015	$3,600,514

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$859,695	$306,355	$254,048	$323,694	$1,743,792
Postdocs Supported	1	5	7	17	30
Graduate Students	7	21	57	40	125
Undergraduate Students	10	16	78	122	226
Sponsored Project Funding	$6,015,937	$2,398,019	$1,911,718	$15,287,220	$25,612,894
Publications in Peer-Reviewed Journals	0	10	15	31	56
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	University of Arizona
TRIF Investment Area	Space Exploration and Optical Solutions
Program Name	Frontiers in Space Exploration and Optical Sciences

Problem Statement

To achieve any of our objectives in Space Exploration and Optical Sciences, we need to be able to recruit the talent and establish the new programs necessary to respond to the latest developments in—and actively create the future of—those fields. This means hiring the scientists and engineers who are developing those fields and providing them with the resources necessary to succeed. These resources can include students, technical support, and equipment. This investment in the future is crucial to sustaining our current successes and building the new success stories.

Program Description

UArizona has world leaders in many fields and subfields within the Space Exploration and Optical Sciences focus area. However, to remain a leader as an institution, we need to continue to add future leaders in burgeoning fields and replace the expertise we inevitably lose as the current leaders age and retire. In particular, UArizona has a history of developing sensors and instruments that leverage emerging technologies to make revolutionary measurements, but we need to continue to hire the scientists who are able to make this happen.

What is the University's Advantage and/or Anticipated Funding Opportunities?

UArizona is home to internationally recognized faculty, staff, and students in Steward Observatory, the Lunar and Planetary Laboratory, and the College of Optical Sciences. This reputation makes the university a destination of choice for the very best talent in space exploration and optical sciences. Securing resources to recruit that talent, however, remains a major challenge.

Is there an Arizona Specific Benefit or Impact?

The primary measure of success is adding faculty who: • generate new streams of funding • attract high-quality new students • build programs that integrate with the existing strengths of the University's Space Exploration and Optical Sciences areas

Investment Detail

	2022	2023	2024	Total
Infrastructure	$710,125	$710,125	$710,125	$2,130,375
Basic Research	$258,879	$258,879	$258,879	$776,637
Applied Research	$207,103	$207,103	$207,103	$621,309
Development	$51,776	$51,776	$51,776	$155,328
Total	$1,227,883	$1,227,883	$1,227,883	$3,683,649

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$415,000	$0	$415,000	$1,245,000
Postdocs Supported	1	1	1	75
Graduate Students	2	2	2	6
Undergraduate Students	0	0	0	0
Sponsored Project Funding	$500,000	$500,000	$500,000	$1,500,000
Publications in Academic Peer-Reviewed Journals	15	15	15	45
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	Space Exploration and Optical Solutions
Program Name	Frontiers in Space Exploration and Optical Sciences

Progress Summary

As a global leader in space and optical sciences, the U of A is widely recognized for cutting-edge science that pushes boundaries in the theoretical, technical and observational spheres. TRIF has funded a variety of projects for individual researchers pursuing new approaches to studying everything from the origin of life to the oldest galaxies observed. Funding that brings in new, diverse faculty who are developing new technologies to use on telescopes and optical systems and make scientific discoveries that motivate future projects and bring more funding and support to the university.

How has the problem statement been addressed in the last year by this TRIF project?

TRIF funding supports faculty who leverage TRIF dollars to generate new support, train dozens of new students and develop new techniques for analysis and technology. Including topics as diverse as finishing the build of a UV telescope, studying photonics, observing atmospheres of distant planets, studying human biology and psychology in space flight, developing high speed cameras for use in military helicopters, modeling water on a national scale and understanding gravitational waves and the nature of spacetime.

What, if anything, hasn't worked as well as was hoped?

Challenges are primarily related to continuous changes at the federal level. In particular, the uncertainty, possibility of large cuts, and general chaos of the NASA and NSF budgets have stifled a primary source of external grants that allow TRIF PIs to continue their work beyond TRIF funding.

Describe the Arizona benefit or impact of this TRIF project for the last year.

Revealed a new role of magnetic fields in the interstellar medium which is crucial to the birth of stellar systems like our solar system. Developed and published the first methodologies for multiphoton microscopy analysis of geological materials, providing a new, powerful tool for nondestructively studying rocks, minerals, gemstones and Astro materials in 3D using nonlinear optics. This establishes a new interdisciplinary field of study, which we are calling Nonlinear Optical Mineralogy. Developed a novel method for fast and high-resolution eye tracking Multiple examples of leveraging TRIF funding in several million dollars' worth of new awards.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$2,544,695	$2,221,866	$2,466,703	$2,109,433	$9,342,697
Basic Research	$0	$0	$0	$0	$0
Applied Research	$0	$0	$40,746	$30,031	$357,883
Development	$0	$0	$0	$47,161	$47,161
Total	$2,544,695	$2,221,866	$2,507,449	$2,186,625	$9,460,635

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$1,886,985	$1,667,771	$1,705,396	$1,450,873	$6,711,025
Postdocs Supported	12	9	27	33	81
Graduate Students	68	37	114	118	337
Undergraduate Students	75	38	110	156	379
Sponsored Project Funding	$10,771,885	$22,257,995	$31,811,707	$35,079,925	$99,921,512
Publications in Peer-Reviewed Journals	148	42	147	128	465
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	Space Exploration and Optical Solutions
Program Name	Optical Sensing and Display for Human-Centered Intelligent and Autonomous Systems

Problem Statement

Since the dawn of computing, the interface between computers and humans has become progressively more personal, from computer room to desktop to mobile phone. The next revolution, wherein people will live and work in ubiquitous digital spaces, is just starting, and it will spawn entirely new economies and improvements in quality of life. Optical sensing is a critical enabling technology in this revolution, and we already are witnessing the increasing proliferation of sophisticated 3D optical sensing and imaging in consumer mobile platforms, autonomous vehicles, entertainment, smart spaces for enterprise business, remote medicine, and remote sensing for scientific discovery, defense, environment, and agriculture. Rapid progress in these applications is enabled by breakthrough advances in underlying optical and laser technologies using chip-scale structured illumination, LIDAR, stereoscopic and novel focal plane array concepts for 3D imaging, and human-computer interface technologies such as gesture-recognition systems and augmented and virtual reality (AR/VR) displays. Integrating these technologies with emerging computing and communication platforms, especially neural and quantum processing, will be key in the new digital age. The future economic potential of optically enabled intelligent systems is enormous, and the moment is now for Arizona to lead through regional economic development that leverages faculty strength with investments supporting more integrative, applications-driven programs.

Program Description

This initiative will advance UArizona's scientific/engineering leadership in a very high-impact area. We will establish applications-driven collaborative research teams to accelerate the development of underlying optical technologies, ranging from breakthrough chip-scale 3D imagers with integrated neural processors, to smart displays and interfaces that enable ubiquitous information access, to new free-form optics that enable 100x reductions in size, weight, power, and cost (SWaP-C). In addition to the discovery engendered by cutting-edge applications research, this applications-driven approach lays the groundwork for increased private-sector partnerships, commercial transitions, and economic development.

What is the University's Advantage and/or Anticipated Funding Opportunities?

UArizona is exceptionally well positioned to take on this challenge. The College of Optical Sciences has eight faculty members strongly engaged in this area of optical sensing and display, including a new Endowed Chair and three additional new hires, spanning the core technologies and application domains mentioned above. These faculty are pursuing innovations that offer exciting promise in providing game-changing technical capabilities and cost reduction. They are also leaders in their field and have exceptionally strong industry engagement, with more than $10M in private-sector research support and IP revenue over the past four years. By linking with engineering, medicine, and data science, this effort will leverage synergies from university-wide investments.

Is there an Arizona Specific Benefit or Impact?

This TRIF initiative will produce compelling ROI, including: • Growth in optical sensor research grants/contracts, including a major center proposal • Workforce development, producing BS, MS, PhD, and postdoc/research scientist talent with application team experience to support regional economic development • Intellectual property generation with an excellent record of licensing potential • New start-up companies and strengthened relationships with local tech companies

Investment Detail

	2022	2023	2024	Total
Infrastructure	$625,701	$625,701	$625,701	$1,877,103
Basic Research	$0	$0	$0	$0
Applied Research	$375,514	$575,514	$575,514	$1,526,542
Development	$0	$140,000	$140,000	$280,000
Total	$1,001,215	$1,341,215	$1,341,215	$3,683,645

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$500,000	$0	$200,000	$900,000
Postdocs Supported	6	10	14	75
Graduate Students	8	15	15	43
Undergraduate Students	0	0	0	0
Sponsored Project Funding	$800,000	$2,000,000	$3,500,000	$6,300,000
Publications in Academic Peer-Reviewed Journals	8	12	20	40
Startups	0	0	1	1

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	Space Exploration and Optical Solutions
Program Name	Optical Sensing and Display for Human-Centered Intelligent and Autonomous Systems

Progress Summary

The Optics for Autonomous Services and Interactive Systems (OASIS) effort led by the Wyant College of Optical Sciences expanded in scope and funding this year. U of A provides one-of-a-kind testbed infrastructure that enables cross-campus collaboration between engineering, medicine, computer science and optical sciences. This allows OASIS researchers to rapidly prototype and validate systems in real-world environments—something few institutions can match at scale. The newly installed Meta CAVE is positioned to be a campus and regional asset for mixed reality applications and a possible major partnership with a consortium of tech sector firms: Meta, Google, Amazon and Anduril.

How has the problem statement been addressed in the last year by this TRIF project?

Three peer-reviewed conference proceeding papers were published and presented at the SPIE Medical Imaging 2025, including innovations in task-specific image denoising, AI-based image synthesis and feature extraction for signal detection. These methods support faster, more accurate clinical interpretation—directly benefiting radiology workflows and patient care. Presented research on AI applications in medical imaging during the “AI in the Optics Ecosystem” Panel at the Wyant College of Optical Sciences’ Industrial Affiliates Workshop & Meeting. This event brings industry and the university together to advance the educational training of students and fill a pipeline of new talent ready to meet industry opportunities and growth. Over 50 leading corporations and business groups actively participate in the Industrial Affiliates program.

What, if anything, hasn't worked as well as was hoped?

One of the most persistent scientific and operational challenges is systems integration across disciplines. U of A’s cross-campus collaboration structure is a strength, but the technical and logistical hurdles of aligning software, hardware and human interface components from different research domains initially slowed progress on certain testbed implementations—particularly in mixed-reality applications and hybrid AI-optics systems. The infrastructure challenge we confronted in FY24-25 was an operational challenge associated with the space renovation required to install the Meta CAVE in the GCRB Building. It took a delicate dance of schedule and program management between Meta Reality Labs, the CAVE vendor, and the U of A general contractor, but in the end, we completed the installation of the CAVE on schedule, and it is now operational. University operations have also become challenging. Given the flux to a centralized model of institutional support, and the pervasive work from home challenges and most exchanges being done via email exclusively, operating complex research programs on milestone-based schedules is challenging.

Describe the Arizona benefit or impact of this TRIF project for the last year.

OASIS research teams attracted approximately $15M in extramural funding over the last three years, with an additional $10M pending for the fall of FY 26 across federal and private sources proposed—fueling cutting-edge R&D in Arizona across defense and the high-tech sector. These funds have directly supported local research talent and infrastructure at the U of A, with a strong emphasis on economic growth through high-impact innovation. The program supports 42 graduate students, 6 postdoctoral researchers, and 5 faculty members across optics/engineering/machine learning/imaging, training them in advanced sensing, imaging, AI integration, and human-system interaction. OASIS teams deployed super camera technology and AI integration for defense technologies —advances that enhance safety, situational awareness, and performance in high-risk environments. These technologies are being adapted for applications in autonomous ground vehicles and mining operations, with direct relevance to Arizona’s defense and natural resources sectors. Major Platform Demo is scheduled for FY 26/27.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$83,429	$1,204,331	$1,122,965	$2,410,725
Basic Research	$0	$0	$0	$0	$0
Applied Research	$0	$24,677	$0	$54,083	$381,935
Development	$0	$0	$0	$0	$0
Total	$0	$108,106	$1,204,331	$1,177,048	$2,489,485

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$42,871	$42,871
Postdocs Supported	0	0	1	9	10
Graduate Students	0	1	28	74	103
Undergraduate Students	0	0	31	5	36
Sponsored Project Funding	$2,989,822	$487,228	$0	$176,817	$3,653,867
Publications in Peer-Reviewed Journals	0	0	21	29	50
Startups	0	1	0	0	1

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	University of Arizona
TRIF Investment Area	Space Exploration and Optical Solutions
Program Name	Quantum Technology & Systems Engineering

Problem Statement

UArizona has successfully launched a vital program in quantum information science and engineering (QISE), including its recent leadership role in the NSF Center for Quantum Networks. Quantum technologies also are positioned to benefit a host of additional applications and markets that harness advanced sensor systems in physical sciences, life sciences, and defense. To lead the emerging quantum economy, UArizona must galvanize a high-impact, integrative, university-wide QISE effort.

Program Description

This TRIF initiative will focus resources on developing explicit systems-scale solutions and demonstrators with unambiguous quantum performance advantage, ideally in sensor spaces that will strongly complement other UArizona investment areas, such as those in space sciences, National Security Systems, and Improving Health. To support CQN and other emerging systems QISE applications, and to bring experience in deployable quantum systems, the College of Optical Sciences has committed an Endowed Chair faculty position to lead in quantum systems engineering. It will also support committed Research, Innovation and Impact matching funds for CQN and additional infrastructure required for the QISE effort, such as advanced e-beam lithography tools.

What is the University's Advantage and/or Anticipated Funding Opportunities?

With its prior substantial faculty investments in QISE, combined with its high-visibility national leadership with CQN, UArizona is exceptionally well positioned. Potential quantum systems applications include sensors systems for defense and scientific discovery and communications solutions beyond the scope and budget of CQN. This TRIF initiative will harness resources in the Colleges of Optical Sciences, Engineering, Science, and Medicine, and CQN has additionally broken new ground by funding societal impacts research in the Colleges of Law and Social and Behavioral Sciences.

Is there an Arizona Specific Benefit or Impact?

This TRIF initiative will produce more than a 10x ROI, including: • Growth in quantum research proposals, grants, and contracts • Intellectual property generation with an excellent record of licensing potential • Regional workforce development, producing increased BS, MS, PhD, postdoc, and research scientist talent with experience in applications-driven teams • QISE start-up companies and strengthened relationships with local tech companies

Investment Detail

	2022	2023	2024	Total
Infrastructure	$992,368	$992,368	$992,368	$2,977,104
Basic Research	$0	$0	$0	$0
Applied Research	$135,514	$135,514	$135,514	$406,542
Development	$0	$150,000	$150,000	$300,000
Total	$1,127,882	$1,277,882	$1,277,882	$3,683,646

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$800,000	$0	$600,000	$2,000,000
Postdocs Supported	3	8	12	75
Graduate Students	8	14	14	42
Undergraduate Students	0	0	0	0
Sponsored Project Funding	$600,000	$2,400,000	$3,500,000	$6,500,000
Publications in Academic Peer-Reviewed Journals	4	8	12	24
Startups	0	0	1	1

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	University of Arizona
TRIF Investment Area	Space Exploration and Optical Solutions
Program Name	Quantum Technology & Systems Engineering

Progress Summary

U of A leadership in Quantum Information Science and Engineering (QISE) is continuing to grow, based in part around the flagship Center for Quantum Networks (CQN), an NSF Engineering Research Center (ERC). CQN is now being established in the UASI supported Grand Challenges Research building. As in past years, TRIF-supported faculty have attracted additional funding from agencies including NSF, ONR, ARO, AFOSR, DARPA, NASA, and private sector partners. A TRIF-supported faculty member received the prestigious NSF Career Award for their work in QISE. In addition to information security and potential to network quantum computers for unprecedented computation resources, this technology shows promise for enhanced sensing with applications being explored for defense, medicine, and even long-baseline astronomical imaging.

How has the problem statement been addressed in the last year by this TRIF project?

Granted PhDs to two students funded through TRIF startup - Christian Pluchar and Aman Agrawal. Both described advances in quantum measurement and control of nanomechanical resonators. Dr. Pluchar is now a postdoc at U Washington and Dr. Agrawal is now a staff member at Lam Research, Corp. Published preprints describing a new theory of 'Imaging-based Quantum Optomechanics' (accepted at Physical Review Letters) and experimental demonstration of 'Quantum-limited Imaging of a Nanomechanical Resonator with a Spatial Mode Sorter' (provisionally accepted at Physical Review Research). Also published a paper on 'Ultralow loss torsion micropendula for chipscale gravimetry' (accepted at Physical Review Letters). These results are the intellectual offspring of TRIF startup funding received in 2021.

What, if anything, hasn't worked as well as was hoped?

Our original work focused on room temperature quantum experiments and was technically challenging. In hindsight, earlier investment in equipment for cryogenic experiments would have been helpful.

Describe the Arizona benefit or impact of this TRIF project for the last year.

Access to cleanroom facility at the Wyant College of Optical Sciences. Endowed professorship at the Wyant College of Optical Sciences (recently received; facilitating research through discretionary funds and student salary support). Access to seed funding from RII (currently supporting collaboration with NIST Gaithersburg) Major industrial affiliates program at the Wyant College of Optical Sciences. Through the high international reputation of the Wyant College of Optical Sciences.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$577,420	$354,119	$69,386	$0	$1,000,925
Basic Research	$0	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0	$327,852
Development	$0	$0	$0	$0	$0
Total	$577,420	$354,119	$69,386	$0	$1,000,925

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$577,420	$354,119	$69,386	$0	$1,000,925
Postdocs Supported	3	0	0	0	3
Graduate Students	10	3	8	5	26
Undergraduate Students	0	0	3	6	9
Sponsored Project Funding	$13,645,465	$11,307,856	$10,603,025	$1,468,330	$37,024,676
Publications in Peer-Reviewed Journals	36	0	8	4	48
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	Space Exploration and Optical Solutions
Program Name	University of Arizona Space Institute

Problem Statement

UArizona has an unparalleled history of involvement and leadership of major space science facilities and missions, both space-based and ground-based. Competition within academia, industry, and the federal government, however, has developed strong infrastructures for proposal development and project management, while UArizona has simply maintained its previously successful approach. The competitive landscape has changed, and UArizona must develop common infrastructure among space exploration and optical sciences to more effectively compete for research support in the future.

Program Description

The University of Arizona Space Institute (UASI) will provide a structure to aid in the development, proposal, and operation of large spacecraft missions and space- and ground-based instruments. By increasing both the number of operational projects and the support to develop them, UASI will help supply and retain the necessary workforce, providing the engineering and scientific expertise to develop, advance, propose, and operate the next generation of large projects funded by NASA, NSF, NOAA, and other government agencies. Successful proposal of such major missions and projects takes years of work, which is usually beyond the means of individual investigators or departments to support. The integrated UASI enables such long-term, higher-profile investments.

What is the University's Advantage and/or Anticipated Funding Opportunities?

UArizona was the first university to manage a planetary lander mission (Phoenix Mars Lander) and to lead a New Frontiers mission (OSIRIS-REx). Our scientists and engineers have developed, supplied, and operated a significant number of instruments to NASA planetary flagship missions (Pioneer 10, Voyager, Cassini, and numerous Mars missions) and NASA astrophysics flagship missions (NICMOS for the Hubble Space Telescope, MIPS for the Spitzer Space Telescope, and NIRCam for the James Webb Space Telescope), as well as ground-based telescopes that have significantly expanded our understanding of the universe (Multiple Mirror Telescope, the two 6.5m Magellan Telescopes, Large Binocular Telescope, the 24.5 Giant Magellan Telescope under construction, Spacewatch, and the Catalina Sky Survey).

Is there an Arizona Specific Benefit or Impact?

This TRIF initiative will produce more than a 20x ROI, including: • Growth in the number of multi-million dollar spacecraft mission and instrument contracts • Increased number of positions in a highly skilled workforce capable of designing, building, and operating spacecraft hardware and missions • Increased number of students involved in spacecraft missions and projects • Increased opportunities for Arizona companies to participate in spacecraft missions and projects

Investment Detail

	2022	2023	2024	Total
Infrastructure	$503,022	$503,022	$503,022	$1,509,066
Basic Research	$103,551	$103,551	$103,551	$310,653
Applied Research	$258,879	$258,879	$258,879	$776,637
Development	$362,430	$362,430	$362,430	$1,087,290
Total	$1,227,882	$1,227,882	$1,227,882	$3,683,646

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	75
Graduate Students	0	0	0	0
Undergraduate Students	0	0	0	0
Sponsored Project Funding	$2,000,000	$4,000,000	$6,000,000	$12,000,000
Publications in Academic Peer-Reviewed Journals	0	5	15	20
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	University of Arizona
TRIF Investment Area	Space Exploration and Optical Solutions
Program Name	University of Arizona Space Institute

Progress Summary

The University of Arizona Space Institute (UASI) provides the structural framework for the development, proposals and operation of large spacecraft missions and space and ground-based instruments. UASI is operating, or contributes to the development of, several world-class facilities that support such projects. TRIF support for UASI's mission is increasingly crucial, as the Strategic Implementation Funding that was a primary source of support to stand up UASI expired at the end of FY23. TRIF support is now the only source of seed grant funds for UASI. It continues to provide an excellent return on investment.

How has the problem statement been addressed in the last year by this TRIF project?

The UASI role is to support researchers on campus in the development of federal and private proposals. UASI assists with project budget development, project management planning and organizes and conducts proposal peer reviews. UASI manages the core infrastructure of Applied Research Building (ARB) and Mission Integration Lab (MIL) which provide unique testing services to the campus researchers as well as external customers. UASI also provides seeds grants to campus community researchers. UASI hosts a campus wide annual symposium that highlights research supported by the seed grants. UASI works with campus researchers to find industry collaborators in the conducting of research programs.

What, if anything, hasn't worked as well as was hoped?

Filling staff positions has been challenging, and our estimated staffing needs were too low. The cost of commissioning and certifying the large chambers are out-pacing available funds due to underestimating effort and time needed to bring the facility to operational status. Without additional funding to accelerate the process by adding staff, the process will take longer than expected before the services can be opened to outside customers.

Describe the Arizona benefit or impact of this TRIF project for the last year.

Assist in identifying the next generation of PIs, PMs, and engineers and in moving them into positions where they are working with U of A's current generation of experts. Work with the Office of Research and Partnerships (ORP) we identify high-level U of A representation to support sponsor negotiations involving U of A PIs. Maintain an on-going "Opportunities Outlook" listing of competitive, funded opportunities. Present the status of this listing to the U of A internal space community monthly. The UASI represents the U of A space community to the student population and outside world, including policy makers, funding agencies, industry partners and other universities and research institutes. Work with existing U of A organizations (e.g. Corporate Engagement and ORP), to establish new and expand/enhance existing arrangements with outside collaborators including relevant local businesses, NASA centers and other national laboratories, FFRDCs, UARCs, universities and aerospace companies. Enable the development of new, and expansion of existing skill sets possessed by the U of A space and technical faculty and staff through mentoring and formal training to both attract new talent and retain existing faculty/staff. UASI provides community outreach, lectures to local organizations about space exploration and the space related research conducted at the U of A. Host tours of ARB facility to local organizations, highlighting the research that is supported by UASI.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$0	$0	$47,986	$47,986
Basic Research	$0	$0	$0	$0	$0
Applied Research	$0	$0	$0	$212,891	$540,743
Development	$0	$0	$2,237,294	$1,400,944	$3,638,238
Total	$0	$0	$2,237,294	$1,661,821	$3,899,115

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$47,986	$47,986
Postdocs Supported	0	0	2	9	11
Graduate Students	0	0	3	15	18
Undergraduate Students	0	0	4	39	43
Sponsored Project Funding	$5,588,724	$957,657	$9,238,808	$17,782,118	$33,567,307
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	University of Arizona
TRIF Investment Area	Space Exploration and Optical Solutions
Program Name	World Leading Facilities for Astronomical Research

Problem Statement

Over 280 UArizona researchers (and additional students and faculty at ASU and NAU) depend on our world-renowned astronomical research facilities to produce transformative scholarship and return to Arizona, through external funding, 10x the currently provided state funding. We need $2.4M per year of additional funding to maintain our current level of observatory operations and protect and grow our external funding.

Program Description

UArizona will continue to use our facilities to make further ground-breaking discoveries. We anticipate progress in the characterization of planets around other stars, including the search for signs of life in the atmospheres of these planets. The Event Horizon Telescope will perform further tests of Einstein's theory of gravity by studying the nearest massive black holes. Our well-equipped telescopes will identify the sources of gravity wave-producing events and provide new insights into the formation and evolution of stars and galaxies. We will use our facilities to train the next generation of astronomers and industry innovators.

What is the University's Advantage and/or Anticipated Funding Opportunities?

UArizona has been a leader in space sciences for over a century. Our five mountaintop observatories in the desert Southwest, under clear, dark skies, have brought the world's most talented students, engineers, and faculty to Arizona. These exceptional people have produced the innovations leading to our leadership in both space- and ground-based research facilities, not only in Arizona, but around the world. With our federal (e.g., NASA, Department of Energy (DOE), NSF) and foreign partners, we have developed the observatories and space missions that enable our past transformative discoveries, from proving the existence of dark matter to the first image of a massive black hole.

Is there an Arizona Specific Benefit or Impact?

• Greater than a 700 percent ROI, through external funding, on the funds provided to support and upgrade our facilities. • Completion of the next five observing campaigns of the Event Horizon Telescope (which uses our radio telescopes on Mount Graham and Kitt Peak) to complete our studies of the massive black holes in the nearest galaxies.

Investment Detail

	2022	2023	2024	Total
Infrastructure	$865,452	$865,452	$865,452	$2,596,356
Basic Research	$155,327	$155,327	$155,327	$465,981
Applied Research	$103,551	$103,551	$103,551	$310,653
Development	$103,551	$103,551	$103,551	$310,653
Total	$1,227,881	$1,227,881	$1,227,881	$3,683,643

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	20	20	20	75
Graduate Students	40	40	40	120
Undergraduate Students	0	0	0	0
Sponsored Project Funding	$14,000,000	$14,000,000	$14,000,000	$42,000,000
Publications in Academic Peer-Reviewed Journals	20	20	20	60
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	University of Arizona
TRIF Investment Area	Space Exploration and Optical Solutions
Program Name	World Leading Facilities for Astronomical Research

Progress Summary

The U of A continues to be a world leader in astronomical research, especially for ground-based facilities, which are unparalleled discovery centers. Our facilities provide groundbreaking discoveries and act as a draw for top talent. TRIF funding for each of these has resulted in good ROI across a range of metrics, including outside investment, research papers and support of students and postdocs.

How has the problem statement been addressed in the last year by this TRIF project?

TRIF supported the Aspera space mission, led at Steward Observatory. During the development and integration phases, 37 students contributed to flight software development, cleanroom hardware build activities, and design efforts. Aspera also contracts with Tucson company, Ascending Node Technologies, for software development support and operational support for the flight mission. Infrastructure support provided by Mt Graham International Observatory. Support for technical development provided by faculty in the Wyatt College of Optical Sciences. Support for engineering development provided through collaboration with Steward Observatory Engineering & Technical Services staff. Support for instrument materials fabrication provided by the U of A Machining & Welding Center.

What, if anything, hasn't worked as well as was hoped?

Major parts of our physical infrastructure are reaching end-of-life requiring adoption of a more robust multi-year planning effort for infrastructure renewal and associated budgeting. We are also adopting smart telemetry systems to allow us to monitor and extend the life of some components.

Describe the Arizona benefit or impact of this TRIF project for the last year.

Attracted $11M from collaborating institutions outside of Arizona for support of research operations, which includes salaries for 45 full-time employees in the Tucson and Safford regions. Supported 5 doctoral students and 13 postdoctoral trainees/fellows. Use of the LBT provides students and postdoctoral personnel with data for high visibility publications and facility in the use of cutting-edge instrumentation. Generated research discoveries across a wide span of astronomical topics of interest to professional scientists as well as the public.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$1,183,163	$1,237,685	$1,099,274	$1,365,213	$4,885,335
Basic Research	$0	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0	$327,852
Development	$0	$0	$0	$0	$0
Total	$1,183,163	$1,237,685	$1,099,274	$1,365,213	$4,885,335

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	14	5	3	18	40
Graduate Students	15	10	4	11	40
Undergraduate Students	0	5	100	33	138
Sponsored Project Funding	$21,107,894	$5,016,671	$4,437,293	$14,996,825	$45,558,683
Publications in Peer-Reviewed Journals	43	82	14	65	204
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Adaptable Desert Communities, Culture, and Ecosystems

Problem Statement

For humans to continue to live in arid lands, we must understand how we can be resilient to impacts associated with climate change and other stresses affecting the linked human and natural systems of the desert. Southern Arizona and northwest Mexico are in the crosshairs of global climate change. Many changes that will eventually affect the rest of the world are starting here in the arid Sonoran Desert; our experiences can inform communities across the globe. Integrated research, education, and outreach grounded in community needs is necessary to guide actions, policies, and decisions that preserve and enhance these linked cultural and ecological systems.

Program Description

With our history and living-laboratory location in the Sonoran Desert, we will draw upon our geographic heritage, experience, skills, expertise, and relationships with Southern Arizona communities to provide resilience solutions for arid lands in other parts of the world. Additionally, we will establish a program of science, culture, and art; form transdisciplinary university/stakeholder working groups to accelerate innovative solutions to the challenges of future life in the desert; and launch undergraduate, graduate, and community experiential courses that train the next generation of researchers in resilience thinking and science.

What is the University's Advantage and/or Anticipated Funding Opportunities?

In April 2020, the UArizona established the Arizona Institutes for Resilience (AIR) to aggregate its unique resources and programs under one administrative unit, which will strengthen this initiative. More than a century of research at the Desert Laboratory at Tumamoc Hill has revealed how life has adapted to an arid and unpredictable environment. Building on data from long-term plots, knowledge of ecosystem responses to prior climate changes, and an understanding of the persistence of humans in this region, we can transform how we address future ecological challenges. The potential and opportunities of the Desert Lab are significant and range from place-based research to field courses and programs for students and the community in culture, arts, and sciences. In addition to Tumamoc Hill, activities at Biosphere 2 likewise blend ecosystem science with arts and culture at a world-renowned, unique, controlled-environment research facility.

Is there an Arizona Specific Benefit or Impact?

• Production of science-based information products that use our unique research laboratories of Tumamoc Hill and Biosphere 2 to understand how life has adapted, and may adapt in the future, to the changing climate • Increased education of communities about the impacts of climate change and how to build resiliency to change through science, culture, and the arts by taking advantage of the public interest in Tumamoc Hill and Biopshere 2 • Recognition as a world leader in developing and implementing resilience solutions for arid lands elsewhere • Establishment of new university-community partnerships working together to develop new approaches to resiliency • Increased number of students learning about resilience science through hands-on experiences and experimental courses

Investment Detail

	2022	2023	2024	Total
Infrastructure	$462,333	$462,332	$634,920	$1,559,585
Basic Research	$43,146	$129,439	$129,439	$302,024
Applied Research	$302,025	$302,025	$302,025	$906,075
Development	$43,146	$129,439	$129,439	$302,024
Total	$850,650	$1,023,235	$1,195,823	$3,069,708

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$431,464	$0	$215,732	$862,928
Postdocs Supported	4	4	4	75
Graduate Students	20	20	20	60
Undergraduate Students	15	15	15	45
Sponsored Project Funding	$5,666,667	$5,666,667	$5,666,667	$17,000,001
Publications in Academic Peer-Reviewed Journals	14	14	14	42
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	University of Arizona
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Adaptable Desert Communities, Culture, and Ecosystems

Progress Summary

Solutions for thriving in a hotter, drier world integrate research, education, and community engagement to preserve Arizona's natural resources, make communities more resilient, and are case studies for solutions in other arid regions. These research projects included community partners in co-creating solutions and reached thousands of Arizona citizens through public engagements.

How has the problem statement been addressed in the last year by this TRIF project?

Teams advanced research projects that support resilient communities, ecosystems, and culture in the State of Arizona. Communities throughout Arizona face changing climate conditions that affect water, ecosystems and daily life. Research projects collaborated with communities to co-create solutions to environmental challenges including groundwater quality, water use, food security and improvement of public green spaces.

What, if anything, hasn't worked as well as was hoped?

Challenges included limits on time that faculty and graduate students can dedicate to TRIF-WEES projects while meeting other professional and academic responsibilities, logistical challenges coordinating large research projects, and changes in the federal funding landscape in 2025.

Describe the Arizona benefit or impact of this TRIF project for the last year.

Transdisciplinary and community-engaged research methods were taught to 18 U of A staff, student, and faculty researchers. These new skills will help participants work more effectively with colleagues and community partners to address real-world problems in Arizona. Researchers documented patterns of groundwater contamination in a rural Arizona community so that community members can make informed decisions about water usage and how to water their cattle. Nineteen high school, community, and university musical ensembles engaged 900 musicians to provide 25 concerts for 19,000 audience members. These performances engaged the public on themes of water stewardship and restoration of the Santa Cruz Watershed. Researchers documented the health benefits that public parks provide for Tucson communities and developed design and planning strategies to enhance 120 parks in Tucson's public park system. Several projects focused on food availability and food sovereignty for Arizona communities, including Tribal nations. These projects generated actionable insights that empower communities to make choices that enhance food security and health.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$482,430	$237,536	$760,059	$735,924	$2,215,949
Basic Research	$11,009	$19,324	$71,034	$0	$101,367
Applied Research	$81,732	$503,797	$419,564	$206,246	$615,830
Development	$63,928	$816	$33,048	$448,522	$546,314
Total	$639,099	$761,473	$1,283,705	$1,390,692	$4,074,969

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$428,167	$40,505	$410,172	$337,398	$1,216,242
Postdocs Supported	5	12	2	19	38
Graduate Students	11	125	75	124	335
Undergraduate Students	17	88	297	460	862
Sponsored Project Funding	$1,306,029	$7,012,389	$20,267,238	$20,434,063	$49,019,719
Publications in Peer-Reviewed Journals	1	12	13	35	61
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Building Resilience from Environmental to Human Health

Problem Statement

Arizona's changing climate, population, demographics, and land use patterns, as well as sudden shocks to the system from pandemics, heat waves, wildfires, and other natural phenomena, bring a continuous stream of health challenges to our communities. People are moving closer to the urban/wild interface, and changing climate brings new or more intense natural hazards and new vectors for disease transmission into our region. Communities need reliable information about the nature and extent of threats, the economic costs of threats and possible counter actions, where the greatest vulnerabilities lie, and scenarios for building resiliency to their effects. Resource use and extraction industries are critical to the Arizona economy but have an impact to our environment that needs to be addressed.

Program Description

New research will advance our understanding of the impacts of heat, drought, and other climate impacts as well as of sources of contaminants to water, air, and food systems in order to help develop early warning systems that preempt environment-human crises. Researchers will collaborate with communities to develop mitigation strategies, produce scenario evaluation tools, and build community education programs. New approaches to mining and reclamation will enable these industries to prosper while preserving our environment.

What is the University's Advantage and/or Anticipated Funding Opportunities?

UArizona researchers study major public health issues such as those due to vector-, air-, and water-borne diseases; heat waves; and water and food contamination as they relate to a changing climate. In addition, UArizona is helping to develop a worldwide early warning system for monitoring other emerging zoonotic mutations with human crossover potential. A newly formed collaborative for global adaptive pandemic solutions led by UArizona places us at the forefront of research dedicated to identifying and filling knowledge gaps to better prepare for pandemic impacts by dedicating attention to prophylactics and treatments that are ready for deployment when needed.

Is there an Arizona Specific Benefit or Impact?

• Establishment of new partnerships with Arizona communities, governments, and tribes to help them prepare for heat, drought, and disease-related impacts associated with climate change and to build resilience to future threats • Development of new threat-warning and evaluation tools for resource managers, utilities, and industry • Creatation of solutions aimed at combating pandemics and addressing their social and economic impacts • Support for the sustainability of the Arizona mining industry through new partnerships and approaches

Investment Detail

	2022	2023	2024	Total
Infrastructure	$462,333	$462,333	$634,920	$1,559,586
Basic Research	$43,146	$129,439	$129,439	$302,024
Applied Research	$302,025	$302,025	$302,025	$906,075
Development	$43,146	$129,439	$129,439	$302,024
Total	$850,650	$1,023,236	$1,195,823	$3,069,709

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$431,465	$1	$215,732	$862,929
Postdocs Supported	4	4	4	75
Graduate Students	20	20	20	60
Undergraduate Students	15	15	15	45
Sponsored Project Funding	$5,666,667	$5,666,667	$5,666,667	$17,000,001
Publications in Academic Peer-Reviewed Journals	14	14	14	42
Startups	0	1	0	1

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Building Resilience from Environmental to Human Health

Progress Summary

Changing climate conditions and extreme weather impact public health in Arizona in many ways. Research projects advanced new disciplines, models, and methods that increase responsiveness to and readiness for climate events, pandemics, and other environmental hazards. Together, these projects enhance the health of Arizonans and their ability to respond to floods and their after-effects, extreme heat, mosquito-borne and other illnesses, and health impacts from industrial waste streams.

How has the problem statement been addressed in the last year by this TRIF project?

Advancements in research improved health resilience to extreme climate events, enhanced models that can predict outbreaks of diseases like West Nile virus, improved management of mining waste streams and low-grade ores, and increased community resilience to extreme heat. All these projects advanced public health in the State of Arizona. Communities participated in co-producing solutions, leading to better outcomes and increased public buy-in.

What, if anything, hasn't worked as well as was hoped?

Researchers' challenges included balancing research and other professional responsibilities, finding programmers with expertise in AI, and recruiting undergraduates to participate in research projects. Other challenges included changes in research plans and staff due to shifts in the federal funding landscape.

Describe the Arizona benefit or impact of this TRIF project for the last year.

Researchers continued to develop the field of Resilience Informatics, a new discipline that studies how informatics can improve health resilience to climate events, pandemics and other stressors. Collection of additional field data improved models that predict outbreaks of West Nile Virus within the State of Arizona and in other areas of the United States. New collaborations were established between the University of Arizona and regional industry partners Hydrogeosense and BHP to create innovative strategies for management of groundwater and critical metals extraction from low-grade ores and waste streams. The Heat Resilience Initiative in the Arizona Institute for Resilience launched. The initiative co-organized the second annual Southern Arizona Heat Summit and led a working group on extreme heat and public safety for coordinated state-wide response, communication, and research. Research highlighted the potential of thermophilic composting to degrade conventional and biodegradable plastics. Graduate fellows worked with local communities on decision making in flood-prone areas, environmental restoration and wetland projects, and understanding the impact of regional mining on water quality. The Lovejoy Center for Bridging Biodiversity, Conservation Science, and Policy led a delegation to the inaugural DC Climate Week and presented a panel about environmental market solutions. Conservation leaders from around the world gathered to celebrate the launch of the center, which was attended by 120 people.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$123,391	$229,513	$239,886	$0	$592,790
Basic Research	$280,941	$0	$0	$0	$280,941
Applied Research	$318,539	$242,942	$819,555	$104,874	$751,265
Development	$95,328	$200,778	$19,697	$243,379	$559,182
Total	$818,199	$673,233	$1,079,138	$348,253	$2,918,823

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$115,452	$214,938	$239,886	$0	$570,276
Postdocs Supported	5	1	12	5	23
Graduate Students	44	39	83	96	262
Undergraduate Students	39	7	69	27	142
Sponsored Project Funding	$21,221,868	$11,243,743	$20,444,193	$10,470,803	$63,380,607
Publications in Peer-Reviewed Journals	32	11	41	24	108
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	University of Arizona
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Fostering Leaders in Resilience

Problem Statement

Arizona is home to a diverse population with varying strengths, interests, and vulnerabilities. Preparing for a resilient future requires our next generation of leaders and decision makers to reflect that diversity and be able to communicate across sectors and disciplines. STEM training is necessary, particularly for the initiatives described in this planning document, but with fluency that goes beyond just STEM. New cross-disciplinary fields are emerging that mix science with technology or policy, for example, and we need to draw students into them. Students, in turn, seek opportunities to make a difference in their communities even before they graduate.

Program Description

To prepare the next generation for the future workplace and guide students on a career path related to resilience, we will increase diversity in existing scholarship and internship programs; design and implement experiential learning curricula; expand internship programs to include more opportunities, especially with underserved populations and for less advantaged students; offer more leadership training and mentoring for junior faculty via TRIF-funded programs; grow programs to reach K-12 students in STEM and attract them to the university; and create and offer new environment-focused courses that allow high school students to gain UArizona credit.

What is the University's Advantage and/or Anticipated Funding Opportunities?

The university has established programs in science communications training for graduate students and faculty, experiential learning, and cross-disciplinary collaboration, with strong ties and programs supporting Hispanic and Indigenous communities. This program will be expanded and adapted to undergraduate students. New internship programs will place students in paid positions in the community where they can test potential careers while providing valuable service to local organizations. UArizona also supports several programs that train teachers to bring STEM into K-12 classrooms and is developing a series of environment-focused dual enrollment classes that will allow high school students to gain UArizona credit and familiarity with the many paths an environmental degree can follow.

Is there an Arizona Specific Benefit or Impact?

● Provide increased opportunities for resilience-focused experiential learning through courses and internships ● Increase the number of students engaging in resilience-related training ● Increase the number of students from underserved populations engaged in environmental and resilience-focused programs ● Increase involvement by junior faculty in applied resilience-focused research that engages with communities, strengthening ties between the university and Arizona communities ● Increase the scientific and technical knowledge of Arizona communities through greater engagement with university students and faculty

Investment Detail

	2022	2023	2024	Total
Infrastructure	$462,333	$462,332	$634,920	$1,559,585
Basic Research	$43,146	$129,439	$129,439	$302,024
Applied Research	$302,025	$302,025	$302,025	$906,075
Development	$43,146	$129,439	$129,439	$302,024
Total	$850,650	$1,023,235	$1,195,823	$3,069,708

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$431,464	$0	$215,732	$862,928
Postdocs Supported	5	5	5	75
Graduate Students	30	30	30	90
Undergraduate Students	25	25	25	75
Sponsored Project Funding	$5,666,667	$5,666,667	$5,666,667	$17,000,001
Publications in Academic Peer-Reviewed Journals	5	5	5	15
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	University of Arizona
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Fostering Leaders in Resilience

Progress Summary

Resilience education and experiential learning help students progress beyond STEM competency to understand the value of interdisciplinary approaches to solving environmental challenges. Research opportunities for undergraduate and graduate students, including internship placements with community partners, provide students with real-world experience before graduating and equip them to better enter the workforce as effective leaders in resilience after graduation.

How has the problem statement been addressed in the last year by this TRIF project?

Across the U of A campus, more than 1,000 undergraduates and hundreds of graduate students were supported by this project in internships, research projects, and other experiential learning opportunities. By learning about resilience and environmental solutions, developing hands-on skillsets, participating in research, and working with community partners to create solutions to environmental challenges, these students are better equipped to continue work in environmental and resilience-related fields once they graduate from the university.

What, if anything, hasn't worked as well as was hoped?

Shifts in the funding landscape for experiential learning opportunities are challenges for continued funding of many of these programs. Many students cannot afford to take underpaid or unpaid internships, so continued funding is essential for the continued success of these programs.

Describe the Arizona benefit or impact of this TRIF project for the last year.

A Udall Center Fellow developed a smartphone app that can provide monitoring tools to Arizona farmers so they can assess crop damage for insurance purposes. This app can also be used in other arid regions. The Arizona Institute for Resilience (AIR) Education program provided approximately 300 undergraduate and graduate students from 15 different colleges with paid internships with community and campus partners, mentored research experiences, cohort-based learning, and community- and service-based learning experiences. These experiences improve student retention, graduation rates, and employment outcomes for students of all backgrounds. The Find Your Research Environment program hosted 100 southern Arizona high school students who would be first-generation college students for small-group field trips to explore college majors. Current U of A students who are alumni of this program participated in student panels and helped lead the field trips. More than 200 students participated in Find Your Environment events organized by the Find Your Environment advisor in the A Center. The advisor provided one-on-one guidance to 150 students as they navigated college and chose majors. The Roots for Resilience program provided training in open science, data science, data and project management, advanced computation and AI tools, and professional development skills to 13 graduate students from 12 different departments. Students presented what they learned to their department and will serve as ambassadors for the skillsets and program in their department. Postdoctoral researchers in the Bridging Biodiversity and Conservation Sciences program in the Lovejoy Center for Bridging Biodiversity, Conservation Science, and Policy focused their research on urban wildlife and urban heat islands in the southwest and spatial modeling of risks of vector-borne diseases in Arizona.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$0	$8,740	$879,698	$251,662	$1,140,100
Basic Research	$0	$0	$0	$0	$0
Applied Research	$135,024	$222,185	$817,550	$537,250	$1,000,126
Development	$133,019	$156,798	$228,186	$880,534	$1,398,537
Total	$268,043	$387,723	$1,925,434	$1,669,446	$4,250,646

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	3	3	2	7	15
Graduate Students	55	32	107	298	492
Undergraduate Students	15	94	2173	1356	3638
Sponsored Project Funding	$2,973,345	$830,100	$990,480	$841,910	$5,635,835
Publications in Peer-Reviewed Journals	15	0	8	46	69
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Observation Systems for Resilience Monitoring and Modeling

Problem Statement

We can better prepare for change if we are able to monitor it in real time. Data related to weather, water resources, soil and vegetation conditions, air quality, greenhouse gases, wind and solar energy, and other conditions allow us to predict what we might expect in the future and plan accordingly. Monitoring parameters on the ground, while critically important, is time and labor intensive, and each monitoring point has only a limited radius of relevance. Monitoring from above ground using instruments on airplanes, balloons, and satellites permits greater spatial coverage and sampling frequency. Combined, these methods produce higher-resolution results and improved predictions.

Program Description

Leveraging our existing strengths and programs, we will launch a regional-scale climate forecasting center and produce energy forecasting products codeveloped with utilities. We will contribute to science, policy, economic, and technology solutions to help monitor and manage greenhouse gas emissions and develop more refined local and regional-scale climate, weather, and other models. We also will grow partnerships with communities to codevelop data and information products that allow them to make decisions based on greater understanding of probable conditions.

What is the University's Advantage and/or Anticipated Funding Opportunities?

UArizona has long-established expertise in space exploration and remote sensing, the study of Earth processes, and climate-related modeling, which, when combined, yield the potential for powerful new observation-based products and physical and economic forecasts. While efforts are distributed in colleges and institutes across the university, the globally recognized Arizona Remote Sensing Center aggregates experts and programs specifically dedicated to supporting decisions informed by its products and services. New programs are designed for identifying ways for communities to identify large methane emitters and other major carbon producers, anticipate growing conditions, help the military prepare for changing conditions and mitigate hazards, and evaluate the economic costs of environmental impacts.

Is there an Arizona Specific Benefit or Impact?

• New partnerships with Arizona and other industries and communities • Development of new water and energy management and forecasting tools for Arizona resource managers, industry, and utilities • Establishment of new regional-scale climate forecasting center • Development of new means to monitor and help manage greenhouse gas emissions • Creatation of new energy forecasting products codeveloped with utilities

Investment Detail

	2022	2023	2024	Total
Infrastructure	$634,919	$462,333	$462,333	$1,559,585
Basic Research	$43,146	$129,439	$129,439	$302,024
Applied Research	$302,025	$302,025	$302,025	$906,075
Development	$43,146	$129,439	$129,439	$302,024
Total	$1,023,236	$1,023,236	$1,023,236	$3,069,708

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$431,465	$1	$215,732	$862,929
Postdocs Supported	4	4	4	12
Graduate Students	20	20	20	60
Undergraduate Students	15	15	15	45
Sponsored Project Funding	$5,666,667	$5,666,667	$5,666,667	$17,000,001
Publications in Academic Peer-Reviewed Journals	14	14	14	42
Startups	0	0	1	1

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Observation Systems for Resilience Monitoring and Modeling

Progress Summary

To prepare for and respond to environmental challenges, researchers, agencies and community organizations need access to reliable, timely data. Improved monitoring capabilities and predictive models allow scientists to better anticipate environmental events and share that information with industry and community partners. These projects provided vital information to industry partners and community agencies who are working to improve climate resilience and environmental restoration in Arizona.

How has the problem statement been addressed in the last year by this TRIF project?

Researchers revealed new discoveries about the relationships between El Niño events and hydroclimate extremes, continued research on how slopes that have been burned twice are impacted by erosion, provided climate reports to an international mining corporation, and worked with the mining industry in Arizona to revegetate mine tailing sites.

What, if anything, hasn't worked as well as was hoped?

Changes in the funding landscape, including termination of several federal grants, were a challenge. Other challenges included coordinating timelines with industry partners.

Describe the Arizona benefit or impact of this TRIF project for the last year.

The Clouds to Core Research Experience for Undergraduates brought students from Arizona Tribal and community colleges into geoscience research. More than half of the students who participated in this program intend to transfer to Geosciences at the University of Arizona. Major publications in Nature and Nature Geoscience revealed new discoveries about the relationship between El Niño events and hydroclimate extremes as well as the role that monsoon extremes in the Indian Ocean Monsoon play in marine productivity. New funding was secured to continue research for the Water Erosion Prediction Project, a model for hillslopes that have been burned twice. This is a growing concern for watersheds in Arizona and throughout the western US. Climate research summaries were provided to executive members of the Consortium for Environmentally Resilient Businesses, including key utility representatives in Arizona and California. A new research initiative on a mine tailing facility focused on revegetation success and how woody plants can sequester carbon and support climate-change mitigation. The mining corporation that owns this land is considering funding the continuation of this work. A climate assessment tool was developed in collaboration with Fresnillo mining and delivery of climate reports for 12 key mining locations throughout Mexico.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$329,666	$373,645	$419,586	$583,556	$1,706,453
Basic Research	$0	$0	$0	$0	$0
Applied Research	$58,047	$71,019	$210,507	$436,121	$775,694
Development	$11,355	$94,032	$47,351	$0	$152,738
Total	$399,068	$538,696	$677,444	$1,019,677	$2,634,885

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$189,317	$94,305	$152,055	$514,609	$950,286
Postdocs Supported	4	4	5	6	19
Graduate Students	10	12	32	34	88
Undergraduate Students	63	19	43	32	157
Sponsored Project Funding	$12,085,759	$6,337,940	$6,735,311	$6,749,709	$31,908,719
Publications in Peer-Reviewed Journals	68	13	16	10	107
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Resilient Systems Integration

Problem Statement

Transformational changes in our production of secure and sustainable energy, food, and water sources, and in the efficient use of energy, are among the most significant global challenges of the 21st century. As energy demands, food scarcity, and climate variability increase, the means to create and maintain reliable and resilient energy delivery systems, food production systems, and water supplies sufficient to sustain and enhance our society, our economy, and our ecosystems are of paramount importance, especially in regions like Arizona and the Southwest. An integrated and aggressive approach that incorporates economic considerations is required to solve these problems, especially as these regions are home to many communities that are particularly vulnerable to such changes.

Program Description

We will develop new materials, technologies, and operations targeted to energy-efficient water reuse and purification for all sectors as well as smarter data and decision-making platforms with robust links to policy and decision-making processes for water and energy production and use. We also will integrate new science and technology with policy development, decision making, support, and education; produce new designs of the future for a more resilient and efficient urban and rural environment; and create regional test beds and new public-private partnerships.

What is the University's Advantage and/or Anticipated Funding Opportunities?

UArizona researchers are at the forefront of the food-energy-water nexus, exploring ways to address our scientific, technological, economic, and societal challenges. UArizona partnerships with Indigenous communities, particularly the Navajo Nation, are developing technical solutions to build reliable, affordable access to energy, water, and food while training the next generation of food-energy-water systems professionals to tackle these challenges. The university has been a pioneer in the development of agrivoltaics, with the flagship project at Biosphere 2 named a 2018 World Changing Idea, subsequent experiments initiated at local area schools, and discussions expanded to large-scale Arizona growers. UArizona researchers work closely with government officials in Yuma to enhance agriculture in the region, where food, energy, and water are of great socioeconomic importance, but would be scarce if not for thoughtful, informed resource management. Further, UArizona's new RESTRUCT program harnesses expertise from across the university to address the complex design, engineering, social, economic, and environmental challenge of envisioning, defining, and advancing the future built infrastructure. Various organizations such as the British Standards Institution, the Marriott Corporation, and the Campbell Gray Hotel group, as well as universities across the US, acknowledge our expertise and leadership.

Is there an Arizona Specific Benefit or Impact?

• New partnerships with Arizona industry and government • Creatation of better data and decision-making platforms for resource managers, utilities, and others users • Creatation of knowledge for policy- and decision-makers arising from university-community partnerships • Development of new materials, technologies, and operations targeted to energy-efficient water reuse and purification • Integrattion of new science and technology with policy development, decision making, and education

Investment Detail

	2022	2023	2024	Total
Infrastructure	$462,333	$462,333	$634,919	$1,559,585
Basic Research	$43,146	$129,439	$129,439	$302,024
Applied Research	$302,025	$302,025	$302,025	$906,075
Development	$43,146	$129,439	$129,439	$302,024
Total	$850,650	$1,023,236	$1,195,822	$3,069,708

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$431,465	$1	$215,732	$862,929
Postdocs Supported	4	4	4	75
Graduate Students	20	20	20	60
Undergraduate Students	15	15	15	45
Sponsored Project Funding	$5,666,667	$5,666,667	$5,666,667	$17,000,001
Publications in Academic Peer-Reviewed Journals	14	14	14	42
Startups	0	0	1	1

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Resilient Systems Integration

Progress Summary

Sustainable production of energy, food, and water is essential for the environmental and economic well-being of Arizona. Researchers advanced solutions for improved quality, sustainability, efficiency and safety of energy, food, water and waste streams. These solutions incorporate economic considerations to maintain the success of Arizona's industries while protecting Arizona's economy and ecosystems.

How has the problem statement been addressed in the last year by this TRIF project?

Projects addressed and advanced sustainable solar energy technology, food safety and security, off-grid water purification systems, methods to recover metals from waste streams and green dust suppressants that improve air quality. These projects include industry partnerships.

What, if anything, hasn't worked as well as was hoped?

Drought conditions made field work challenging. Difficulties automating some production processes are gradually being applied but remain a challenge. Delays and changes in the funding landscape, including federal funding cuts, were a significant challenge for teams.

Describe the Arizona benefit or impact of this TRIF project for the last year.

Researchers published design concepts that can be used to produce low-cost, high-efficiency printable photovoltaics, which could be disruptive to the silicon-dominated photovoltaics market. Three working groups were established to work on research and advocacy in Pima County's local food system by focusing on safe and healthy foods, policy and advocacy, and water rates. Two demonstration solar UV water treatment systems were installed in the Navajo Nation and a patent application for materials and processes that can remove PFCs (perfluorinated compounds) from water was filed. The National Institute of Environmental Health Sciences published a health impact story and video featuring the Center for Environmentally Sustainable Mining's (CESM) development of "aqueous mining" to recover rare earth metals from US water sources from lab to commercialization. CESM also improved Arizona air quality with green dust suppressants. A U of A team funded by WEES and the Resilient and Efficient Code Implementation partnership (DOE) is developing a regionally appropriate resilience building code to fit the unique needs of the American Southwest. Researchers identified the most effective type of silicon to apply to plants to enhance their uptake of this element. This project identified the utility of using silicon products in the greenhouse to deter herbivores from eating plants intended to be used for restoration projects. Researchers investigated precipitation and dust over Arizona and other vulnerable areas to understand how they interact with monsoons. The Comfort at the Extremes conference, a well-established international conference focused on thermal comfort in extreme environments, was attended by WEES recipients in preparation for hosting the conference at the U of A in June 2026. The people and state stand to benefit from increased international awareness of Arizona's leadership in this field, as well as the new knowledge and connections this conference will bring to the state.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$742,132	$321,224	$253,772	$152	$1,317,280
Basic Research	$28,031	$27,520	$0	$13,307	$68,858
Applied Research	$251,572	$783,078	$631,141	$540,074	$1,119,498
Development	$109,151	$42,092	$0	$0	$151,243
Total	$1,130,886	$1,173,914	$884,913	$553,533	$3,743,246

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$452,239	$231,274	$217,873	$152	$901,538
Postdocs Supported	6	11	16	12	45
Graduate Students	35	62	92	34	223
Undergraduate Students	106	60	88	69	323
Sponsored Project Funding	$12,650,611	$13,345,573	$14,430,096	$6,433,713	$46,859,993
Publications in Peer-Reviewed Journals	37	8	38	18	101
Startups	0	0	0	1	1

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	University of Arizona
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Future-Proofing Arizona Water

Problem Statement

From farmers and ranchers to tourists, developers, miners, and legislators, Arizonans are concerned about the state's water supply. We seek reliable supplies of clean water for our municipalities, industries, and ecosystems. We seek new technologies to treat contaminated water and new means to use it more efficiently and distribute it equitably. The science and technology of clean and reliable water is extremely important, as is having people understand the options and trade-offs associated with alternative paths forward and encouraging the exploration of creative new ways to manage water in the state.

Program Description

Water resources are arguably among the most—if not the most—pressing environmental issue facing Arizona. To ensure a reliable and safe water supply for all Arizonans, we will form new types of partnerships between scientists, engineers, and policymakers; produce concept papers that connect science to policy and bring science to bear on addressing and resolving water management challenges; commercialize new water treatment technologies; promote a greater diversity of voices influencing water resources management; and engage in innovative partnerships with the private sector.

What is the University's Advantage and/or Anticipated Funding Opportunities?

Ranked No. 1 in the nation in water resources, the UArizona has more than 280 faculty and researchers in 48 departments and programs that specialize in topics related to water. Expertise ranges from the physical and social sciences, economics, and public policy to civil engineering, biology, and environmental chemistry, addressing drought and climate, environmental systems, management and policy, society and culture, and technology and industry. UArizona works with numerous stakeholder communities at federal, tribal, regional, state, and local scales to develop water management plans and policies, and runs the Arizona Laboratory for Emerging Contaminants. Additionally, the Water and Energy Sustainable Technology (WEST) Center develops new methods to detect, quantify, and treat contaminants in water.

Is there an Arizona Specific Benefit or Impact?

• Establishment of new partnerships with water managers and policymakers in Arizona and the Southwest, ranging from small communities to large municipalities and state/regional scale • New water policies and management decisions informed with science • Creatation of new water quality and water management tools and technologies co-developed with users

Investment Detail

	2022	2023	2024	Total
Infrastructure	$462,333	$462,333	$634,920	$1,559,586
Basic Research	$43,146	$129,439	$129,439	$302,024
Applied Research	$302,025	$302,025	$302,025	$906,075
Development	$43,146	$129,439	$129,439	$302,024
Total	$850,650	$1,023,236	$1,195,823	$3,069,709

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$431,465	$0	$215,732	$862,929
Postdocs Supported	4	4	4	12
Graduate Students	20	20	20	60
Undergraduate Students	15	15	15	45
Sponsored Project Funding	$5,666,667	$5,666,667	$5,666,667	$17,000,001
Publications in Academic Peer-Reviewed Journals	14	14	14	42
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	University of Arizona
TRIF Investment Area	Water, Environment and Energy Solutions
Program Name	Future-Proofing Arizona Water

Progress Summary

As the second-dryest state in the United States, Arizona must carefully manage water resources, including water quality, safe water re-use, and sustainable water use for agriculture and industry. Research in this project advanced water quality, sustainable and efficient water use and public engagement and education on water issues. This research benefited all Arizonans, helping to ensure that they continue to have access to safe, sustainable water supplies.

How has the problem statement been addressed in the last year by this TRIF project?

Researchers developed and improved techniques to detect and remove a group of contaminants known as per- and polyfluoroalkyl substances (PFAS) from groundwater. New industrial partnerships advanced sustainable use of water for agriculture in Arizona. Improved detection of waterborne viruses and enhanced water treatment technology supported both water re-use and public health. Public engagements, webinars, and conferences educated Arizonans about water in the state.

What, if anything, hasn't worked as well as was hoped?

While improving, the U of A's analytical capability to detect PFAS is still limited and would benefit from continued investments. Some teams encountered delays hiring personnel for projects and challenges with publication timelines.

Describe the Arizona benefit or impact of this TRIF project for the last year.

Researchers developed methods to assess "hidden" per- and polyfluoroalkyl substances (PFAS) in groundwater and evaluated methods to remove them via conventional and novel adsorbent materials. Support for the Arizona Laboratory of Emerging Contaminants (ALEC), a core analytical facility, enabled faculty, staff, and students in multiple colleges at the U of A to conduct research that requires analytical chemistry capabilities to identify PFAS, organic, and inorganic contaminants. A new industrial partnership focused on water sustainability was created with Limoneira, the largest producer of citrus in Arizona. New methods of enhanced detection of waterborne viruses and advanced water treatment technologies was developed to support water reuse in the State and region and help ensure public health. The Water Whys Program designed and installed a sign for the Tucson Airport advising visitors on how to stay safe in the heat. The sign will be seen by roughly 4 million visitors who travel through the airport each year. The Water Resources Research Center convened 11 well-attended Water Webinars, two hybrid book signings, and their annual conference. These events reached more than 1,000 attendees.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$389,943	$389,015	$166,486	$116,809	$1,062,253
Basic Research	$0	$0	$0	$0	$0
Applied Research	$413,832	$908,278	$687,810	$383,264	$2,393,184
Development	$0	$4,975	$65,592	$43,846	$114,413
Total	$803,775	$1,302,268	$919,888	$543,919	$3,569,850

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$389,943	$165,390	$79,356	$44,156	$678,845
Postdocs Supported	4	11	17	11	43
Graduate Students	21	35	48	59	163
Undergraduate Students	43	33	50	41	167
Sponsored Project Funding	$6,133,282	$4,483,466	$1,979,379	$4,638,319	$17,234,446
Publications in Peer-Reviewed Journals	27	12	32	56	127
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	Workforce Development
Program Name	Building Pre-College Interest in Research and Technical Careers

Problem Statement

One of the pre-college barriers to early development of Arizona's technically skilled workforce is an overall lack of awareness and interest among K-12 students about the requirements for the desirable Arizona jobs they ultimately will want to pursue. This is particularly true within communities with less access to research and fewer technically skilled role models with whom to engage. Early exposure to research and technology, and the career possibilities that go with those skillsets, through a variety of targeted outreach activities, will help inspire the future workforce.

Program Description

By building and supporting broader pre-college awareness of, and interest in, research opportunities and highly skilled careers among Arizona's students, UArizona can help influence the next generation of diverse leaders taking Arizona's industries to new heights of productivity and growth. These future leaders will develop new perspectives on the variety of research and technical careers available to them, how those career paths will positively impact their communities and the state, and the skills needed to join the workforce. As UArizona works to overcome the barriers that historically have limited participation in such careers, we will develop more meaningful partnerships with community stakeholders, engaging them to participate in building these talent pipelines for the betterment of our state.

What is the University's Advantage and/or Anticipated Funding Opportunities?

UArizona has a long history of supporting pre-college students through a multitude of programs and structures designed for K-12 audiences to advance Arizona's future workforce. Many of our programs provide expertise in skill building and mentoring in key areas that are typically barriers to STEM and technical career preparation readiness. TRIF funds can leverage these existing programs and structures, which have resulted in trusted relationships with Southern Arizona's young learners, their teachers, and their families. While not a comprehensive list, examples of programs that work directly with youth include the Upward Bound program, Early Academic Outreach, Engineering 102, Native Student Outreach and Resiliency (Native SOAR), Mentoring and Education for SCIence in Tucson (MESCIT), Keep Engaging Youth in Science (KEYS, discussed in the Improving Health section of this plan), Girls Who Code, and Imagine Your STEM Future.

Is there an Arizona Specific Benefit or Impact?

• Increased awareness of and interest in research and technical careers among Arizona pre-college students and their larger community, particularly among populations who have historically had less access to such careers • Increased opportunities for exposure to state-of-the-art scientific and technical infrastructure and research faculty • Knowledge of or participation in research projects that are co-created between researchers and community stakeholders • Increased awareness of important Arizona economic development and research initiatives, and the associated future career opportunities • Development of formal and informal educators that have the skills to support student research and technical career-related experiences

Investment Detail

	2022	2023	2024	Total
Infrastructure	$90,844	$90,844	$90,844	$272,532
Basic Research	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0
Development	$24,270	$24,270	$24,270	$72,810
Total	$115,114	$115,114	$115,114	$345,342

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	75
Graduate Students	0	0	0	0
Undergraduate Students	0	0	0	0
Sponsored Project Funding	$0	$0	$0	$0
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	University of Arizona
TRIF Investment Area	Workforce Development
Program Name	Building Pre-College Interest in Research and Technical Careers

Progress Summary

TRIF AWD has enabled UA to deepen the commitment to our strategic priority of engagement with our communities. Initiatives made substantial progress in building early awareness of and engagement in STEM and research careers among Arizona's K–12 students. Through strategic programs, community partnerships, immersive research experiences, and mentorship initiatives, UA has supported the development of a diverse and technically informed pipeline for the state's future workforce. K–12 engagement was notably strengthened through programs like Young Women of Impact, which connected 47 Southern Arizona high school students from 13 schools with Women of Impact awardees to foster mentoring relationships and leadership development. The Black Men in White Coats Summit engaged more than 700 K–12 students, families and community members in hands-on healthcare career exploration. The PRISM and the STAR Lab high school research internships, each developed in partnership with SARSEF, matched rural and Title I high school students with graduate student and faculty mentors to conduct meaningful scientific research, reinforcing college readiness and STEM identity. The Quantum Quest camp, in partnership with Girl Scouts of Southern Arizona and Qbit by Qbit, introduced high school girls to quantum physics, both demystifying the science and preparing students for further education in the field.

How has the problem statement been addressed in the last year by this TRIF project?

The original problem identified a lack of awareness and access to STEM and research careers among Arizona's K–12 students, particularly in underserved communities. Over the past year, initiatives directly addressed this by offering early exposure to scientific research, structured mentorship and direct interaction with university faculty and industry professionals. By creating localized K–12 programs, the project made significant strides in increasing students' knowledge of technical careers and reducing barriers to participation in STEM pathways. Programs like PRISM and STAR Lab exemplify how authentic research experiences can reshape students' understanding of their potential and influence career decisions. Programs like Quantum Quest and Young Women of Impact introduce youth to technical concepts and mentors to support their education pathways and opportunities.

What, if anything, hasn't worked as well as was hoped?

Scaling mentorship programs and research experiences equitably across Arizona, especially in rural and remote regions, continues to be a complex task. Ensuring sustained engagement beyond one-time events or summer programs can be difficult without consistent access to mentors, internet connectivity, and academic support at the local level. And, building long-term pathways from K–12 through graduate STEM programs requires ongoing collaboration with school systems and community partners—work that is meaningful but time- and resource-intensive.

Describe the Arizona benefit or impact of this TRIF project for the last year.

These initiatives continue to deliver statewide benefits, particularly by advancing educational equity and workforce readiness. More students from tribal, rural and historically underserved communities are engaging with STEM opportunities, exploring opportunities at U of A, and pursuing STEM education and careers within Arizona. The emphasis on authentic research, mentoring and outreach events builds not only individual capacity but also stronger university-community relationships. Programs like the Black Men in White Coats Summit and Young Women of Impact deepen local trust in higher education and health/STEM careers, while also cultivating a new generation of diverse professionals ready to contribute to Arizona's economic and societal needs.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$47,750	$146,289	$59,788	$102,862	$356,689
Basic Research	$0	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0	$327,852
Development	$0	$0	$0	$0	$0
Total	$47,750	$146,289	$59,788	$102,862	$356,689

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	0	0	0
Graduate Students	7	13	0	10	30
Undergraduate Students	58	53	140	13	264
Sponsored Project Funding	$373,185	$0	$3,339,079	$3,190,978	$6,903,242
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	University of Arizona
TRIF Investment Area	Workforce Development
Program Name	Expanding Undergraduate Research Opportunities

Problem Statement

Undergraduate research is well known as a high-impact educational practice that leads to increased retention and a stronger workforce. An early undergraduate research experience (URE) in social sciences and humanities leads to significant gains in analytical and critical thinking skills for first- and second-year students, especially for first-generation students. UREs, particularly during the academic year, lead to increased interest and persistence in STEM, especially for underrepresented minorities. However, the traditional one-on-one apprenticeship model prevalent at UArizona limits the number of students with these experiences to a select few.

Program Description

TRIF funds will support the expansion of undergraduate research opportunities to provide equitable access to research experiences for students who historically have had less access to research early in their academic careers. The funds will also be used to support student's direct participation in TRIF-funded research projects and the dissemination of best practices in the various models of undergraduate research engagement.

What is the University's Advantage and/or Anticipated Funding Opportunities?

UArizona offers numerous long-running undergraduate research programs supported by the institution that address societal needs. As a Hispanic-Serving Institution and an American Indian and Alaska Native-Serving Institution, the university is now more intently focused on the "servingness" aspect of these designations. The culture within science departments has been shifting to recognize the value of offering research opportunities to a wide majority of students and not to just the top, most academically talented.

Is there an Arizona Specific Benefit or Impact?

• A more expansive distribution of research opportunities • Increased diversity and representation among UArizona students who have access to research experiences and research-rich curriculum • Increased number of research-rich courses and other research opportunities targeted to first- and second-year students • Increased number of VIPs • Increased number of awarded proposals that incorporate scaled-up research experiences in their education plans • Overall increased retention in STEM of underserved and underrepresented students • Overall increased enrollment in graduate research programs among historically underserved and underrepresented students necessary to realize Arizona's workforce challenges

Investment Detail

	2022	2023	2024	Total
Infrastructure	$97,034	$97,034	$97,034	$291,102
Basic Research	$49,862	$49,862	$49,862	$149,586
Applied Research	$49,862	$49,862	$49,862	$149,586
Development	$39,890	$39,890	$39,890	$119,670
Total	$236,648	$236,648	$236,648	$709,944

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	75
Graduate Students	0	0	0	0
Undergraduate Students	0	0	0	0
Sponsored Project Funding	$0	$0	$0	$0
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	University of Arizona
TRIF Investment Area	Workforce Development
Program Name	Expanding Undergraduate Research Opportunities

Progress Summary

Stemming from a 2020 mandate from the Vice President for Research to prioritize undergraduate research (UR), over the FY21-FY25 TRIF cycles we have leveraged AWD funding to build the infrastructure needed to expand access to UR, a high-impact practice with proven positive effects. The more students we can engage in research, the better we prepare Arizona graduates with experiential learning experiences and critical thinking skills necessary for the research workforce. We have done this in collaboration with units across campus, embedding sustainable resources and opportunities. We offer professional development for faculty on incorporating authentic research experiences into courses through the CURE Training Institute. We have funded the staff necessary to coordinate programs that scale awareness and access to research experiences including the Undergraduate Research Ambassadors (URAs), Vertically Integrated Projects (VIP), the UR interdisciplinary journal, industry internships, STEM research skills workshops, and research writing/presentation skills courses. We have improved and consolidated resources such as a centralized UR website, a UR database, and informational materials for faculty, staff and graduate student mentors.

How has the problem statement been addressed in the last year by this TRIF project?

Undergraduate Research Ambassadors (URAs) inform and educate Arizona students about the availability of UREs, then teach them the skills to get involved. In its fourth year, the URA team continues to expand its outreach and education efforts. The URAs saw an 82% increase in their peer-to-student interactions over the previous year, from 1650 in AY24 to 3004 in AY25. These included 246 one-on-one student consultations, 804 connections at 14 tabling events, 639 attendees at 24 presentations, and 467 requests for information fulfilled via email. Over 38% of the students we supported were first- or second- year students who have the most to gain from engaging in UR. We continued our nationally recognized model for the infrastructure we provide to support course-based undergraduate research experiences, leading to a growing number of CUREs offered across a wide spectrum of disciplines. Between FY21-25, a total of 34 CUREs have been developed at UA, plus two at Pima Community College. There have been 77 total offerings, serving 4,303 students. The VIP program offers students the opportunity to participate in research projects for multiple semesters. Faculty, graduate students, and experienced team members mentor the newer students for credit-based or paid research experiences. With each semester, returning students move into leadership roles as prior leaders graduate. Over the past four years, VIPs have grown from two teams (14 students) to 55 teams (313 students). UR programs help to connect students with real world projects in industry. The TIMESTEP program places undergraduates in the physical sciences in internships with small to mid-sized businesses based in Southern Arizona, creating paths to employment and exposing businesses to university talent. In FY25, TRIF supported 24 summer intern positions (from 62 applicants), at 16 employers. Across 2018-2024, 99% of participating student Interns would recommend this program to other students; 100% of employers reported that students provided a meaningful contribution to the company.

What, if anything, hasn't worked as well as was hoped?

Describe the Arizona benefit or impact of this TRIF project for the last year.

In FY25, TRIF supported UR skills development for 7700 students, a 306% increase from FY24. To provide a more personalized context, these quotes demonstrate the impact: It gave me a better understanding of what is expected from a scientific researcher, which has given me more confidence in my ability to conduct research. And: It significantly changed my desire to pursue a Master's or PhD degree. And: It's easy to picture myself doing research now, and exciting to consider.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$178,912	$202,653	$453,923	$440,665	$1,276,153
Basic Research	$0	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0	$327,852
Development	$0	$0	$0	$0	$0
Total	$178,912	$202,653	$453,923	$440,665	$1,276,153

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	0	18	18
Graduate Students	1	1	93	141	236
Undergraduate Students	196	1111	1926	4086	7319
Sponsored Project Funding	$800,743	$658,453	$745,917	$231,066	$2,436,179
Publications in Peer-Reviewed Journals	0	0	8	4	12
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	University of Arizona
TRIF Investment Area	Workforce Development
Program Name	Inclusive Mentoring for a Diverse Research Workforce

Problem Statement

Many of us need the support of high-quality mentors to succeed and advance in our professions. This is especially true for those who are pursuing careers in research and high-tech fields. Mentoring often is most impactful when the mentor and mentee share the same gender, cultural background, or life experience. UArizona must be able to ensure that future and early-career researchers receive high quality, culturally inclusive mentoring through a robust training landscape and increase the pool of diverse mentors to serve the needs of our students and our future workforce.

Program Description

Through TRIF funding, we will leverage these efforts and provide support to establish a mentoring community focused on innovating, increasing awareness, and disseminating best practices; develop higher-quality mentoring across TRIF-funded research projects and participants; create a centralized infrastructure to support culturally responsive and asset-based mentoring workshops; and implement a system for follow-up support to research mentors, particularly those participating in TRIF-funded research initiatives and projects. Additionally, we anticipate supporting an increased campus-wide understanding of how to overcome insensitivities in the mentor-mentee relationship; a series of events convening research thought leaders from community colleges and UArizona to identify barriers and solutions to mentoring challenges; and increased rewards and recognition for faculty who engage in high-quality mentoring practices and who carry higher-than-normal mentoring loads to provide mentoring to students who are from similar backgrounds.

What is the University's Advantage and/or Anticipated Funding Opportunities?

A number of early-stage efforts exist on campus around research mentor training, mentoring in STEM and health science, peer mentoring, and inclusive mentoring. The Office of Societal Impact has developed workshops for faculty, staff, and peer mentors on culturally responsive and asset-based, inclusive mentoring. An interactive training series is under development, supported by the Provost's Office of Diversity & Inclusion, in which Black, Indigenous, and People of Color (BIPOC) faculty will mentor other faculty as they undergo training to mentor BIPOC students. The UAHS Office of Diversity & Inclusion offers a series of training and support for mentoring students specifically in the health sciences.

Is there an Arizona Specific Benefit or Impact?

• Development of a comprehensive database of training opportunities and mechanisms to track trainings offered and taken • Among TRIF-funded research projects, an increased number of faculty and staff who have completed research mentor trainings • Among TRIF-funded research projects, an increased number of students with high-quality, inclusive research mentors

Investment Detail

	2022	2023	2024	Total
Infrastructure	$56,732	$56,732	$56,732	$170,196
Basic Research	$35,067	$35,067	$35,067	$105,201
Applied Research	$35,067	$35,067	$35,067	$105,201
Development	$11,689	$11,689	$11,689	$35,067
Total	$138,555	$138,555	$138,555	$415,665

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	75
Graduate Students	0	0	0	0
Undergraduate Students	0	0	0	0
Sponsored Project Funding	$0	$0	$0	$0
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

THE UNIVERSITY OF ARIZONA

University	University of Arizona
TRIF Investment Area	Workforce Development
Program Name	Inclusive Mentoring for a Diverse Research Workforce

Progress Summary

Funding has significantly advanced U of A's efforts to build a more inclusive, supportive and diverse research workforce via support for programs and campus-wide mentoring infrastructure that emphasizes inclusive, asset-based practices. The Graduate CAFE (Community, Advocacy, Fellowship, and Empowerment) program continued its high-impact work, receiving a $1M, 5-year NSF Innovations in Graduate Education grant, underscoring its national significance. To expand its reach, a new pilot—Grad SPACE (Graduate Scholars Protecting Academic Communities for Engagement)—was launched to support students not previously served by Grad CAFE, particularly those who identify as underrepresented or marginalized in academia. The TIMESTEP project connects undergraduate students in astronomy and geophysical sciences with local apprenticeship and internship opportunities and provides mentoring and professional development to support student success. In FY25 the program grew to include 16 additional industry employers in the space and technology sectors in Southern Arizona as internship sites. TIMESTEP expanded to include a new Astronomical Software Engineering Internship Program to build the talent pipeline for this growing industry. Previously funded programming to develop culturally inclusive and responsive mentor training saw the training institutionalized through the EDGE Learning platform and reached additional mentors through U of A research internship projects such as the SARSEF-UA "STAR Lab" and "PRISM" programs–both host high school students from rural and title one schools to undertake authentic research projects with mentors. Training is also provided to faculty and graduate students engaged in Course-based Undergraduate Research Experience (CURE) courses and Vertically Integrated Projects (VIP), which serve thousands of undergraduates annually. U of A mentoring infrastructure includes the Student Services "undergraduate research ambassadors" (URA) program. Trained URAs in FY25 saw an 82% increase in peer-to-peer mentoring interactions. Undergraduate research is a high impact practice proven to enhance retention and post-graduation career success; mentoring is a critical component in preparing an innovative technical workforce.

How has the problem statement been addressed in the last year by this TRIF project?

These efforts reflect U of A's investment in Research That Shapes the Future—ensuring students and early-career researchers receive the mentorship and institutional guidance needed to contribute to scientific innovation and interdisciplinary discovery. Workshops and training have increased mentoring capacity across U of A research projects and supported the development of culturally competent research teams, particularly within the health sciences and STEM disciplines.

What, if anything, hasn't worked as well as was hoped?

Describe the Arizona benefit or impact of this TRIF project for the last year.

Projects provide statewide and institutional benefits aligned with U of A's land-grant mission and commitment to community impact. By fostering greater inclusion and retention of diverse graduate scholars, U of A is helping to shape a future Arizona research workforce that is more representative, resilient and community connected. Participants are more likely to persist in their programs and enter academic, industry or policy careers with confidence and skill—strengthening both local talent pipelines and national competitiveness. These mentoring programs support place-based excellence by helping scholars from across Arizona—including those from rural, Indigenous and historically marginalized communities—connect to a university system that values their identities, voices and contributions. The initiative directly increases the number of students receiving high-quality, inclusive mentorship, supports faculty engagement in mentoring best practices and builds long-term capacity for equity-driven research and workforce development.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$68,299	$93,372	$0	$56,201	$217,872
Basic Research	$0	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0	$327,852
Development	$0	$0	$0	$0	$0
Total	$68,299	$93,372	$0	$56,201	$217,872

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	0	0	0
Graduate Students	2	0	14	0	16
Undergraduate Students	0	0	8	0	8
Sponsored Project Funding	$108,696	$499,730	$0	$0	$608,426
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	University of Arizona
TRIF Investment Area	Workforce Development
Program Name	Supporting Diverse Graduate Student Researchers

Problem Statement

Graduate students are the backbone of the research workforce at UArizona and frequently transition to high-tech industries in their careers. They generally outnumber other staff researchers, and prospective students are actively recruited by research-intensive graduate programs. Upon graduation, they are highly sought by industry. However, diverse graduate students pursuing these programs often face barriers, at both the recruitment and acceptance stages. Even if accepted into a program, they can face a lonely and unwelcoming environment. UArizona seeks a highly representative group of passionate graduate students who have the training to succeed in research-intensive careers after they leave graduate school.

Program Description

TRIF funding will prioritize research projects that include graduate student researchers from across Arizona's complex demographics; connect research efforts and lived experiences to address issues of importance to Arizona's communities; are open to recruiting graduate students from within UArizona's existing undergraduate community; require inclusive mentor training for their research teams; and provide professional development opportunities so students can master technical skills and those that promote collaboration, creativity, and critical thinking. These are exactly the skills that Arizona's high-tech industries are seeking.

What is the University's Advantage and/or Anticipated Funding Opportunities?

With TRIF investment, UArizona can leverage and support a number of existing programs and structures to address the challenges described above. The Graduate College oversees the McNair Program, funded by the U.S. Department of Education, and the Undergraduate Research Opportunities Consortium, both of which serve diverse undergraduates and prepare them for graduate school. A number of graduate training programs and Graduate Interdisciplinary Degree Programs exist on campus in disciplinary areas that TRIF funds, and we will work with these programs to advance efforts towards growing Arizona's research and technical workforce and a vibrant economy.

Is there an Arizona Specific Benefit or Impact?

• TRIF-funded research teams representing the breadth of Arizona society • TRIF-funded research teams are more likely to tackle Arizona's grand challenges that directly impact Arizona's communities and industries • Among TRIF-funded research projects, higher numbers of underrepresented students persist year-to-year in research-intensive fields, developing the skills to succeed in the high-tech workforce • Among TRIF-funded research projects, graduate students report feeling welcome in their research-intensive environment

Investment Detail

	2022	2023	2024	Total
Infrastructure	$72,452	$72,452	$72,452	$217,356
Basic Research	$44,775	$44,775	$44,775	$134,325
Applied Research	$44,775	$44,775	$44,775	$134,325
Development	$14,925	$14,925	$14,925	$44,775
Total	$176,927	$176,927	$176,927	$530,781

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	75
Graduate Students	0	0	0	0
Undergraduate Students	0	0	0	0
Sponsored Project Funding	$0	$0	$0	$0
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	University of Arizona
TRIF Investment Area	Workforce Development
Program Name	Supporting Diverse Graduate Student Researchers

Progress Summary

Projects made measurable progress supporting diverse graduate student researchers by expanding programming, strengthening research and building community. The initial Grad CAFE program, which received $1M over 5 years from the NSF's Innovations in Graduate Education program, laid the foundation for holistic support structures. This year, U of A piloted Grad SPACE, a new initiative aimed at reaching students underserved by existing programs. Two U of A-SARSEF collaborations, STAR Lab and PRISM (Partnership for Research Inspiration in STEM Mentorship), trained 30+ grad students in culturally responsive mentoring practices and created a community of practice for students to support each other's professional development. Projects advanced U of A's strategic imperatives: Success for Every Student - Weekly Student Success Classes and Study Halls, along with monthly community-building events, helped reduce feelings of isolation, increased retention, and nurtured academic identities among underrepresented graduate students. Research That Shapes the Future - Research assistantships enabled studies on STEM education and workforce development, leading to presentations at national conferences, publications in peer-reviewed journals, and a successful NSF collaborative grant totaling over $2.48 million. Engagement with Our Communities to Create Opportunity - Students participated in national diversity-focused STEM conferences (SACNAS, AISES), representing U of A and forming professional networks. Institutional memberships (AAAS, CUR, ARIS) and community-driven programming ensured access to broader impact resources and sustained outreach and networking opportunities. Partnering with SARSEF provided mentored research experiences for 100+ rural and title one high school students, many of whom were recruited into U of A STEM programs.

How has the problem statement been addressed in the last year by this TRIF project?

Projects directly addressed recruitment barriers, isolation and lack of inclusive training for diverse graduate students and in so doing, advanced U of A's strategic priorities. Grad CAFE and Grad SPACE offer tailored resources for students from diverse backgrounds, helping them form an academic identity, reduce feelings of tokenism and build peer networks. The expansion to include master's students this fall responds directly to demand and feedback. Workshops, mentor training, and technical skill development ensured students and faculty are prepared to foster inclusive, effective research environments and engagement in high-impact research projects prepared students for Arizona's high-tech workforce. Programs connect graduate education to real-world, community-rooted issues. Students and researchers collaborated with community partners to design more inclusive STEM training pathways that reflect Arizona's cultural and economic diversity. The SARSEF partnership connects graduate students with high schoolers from rural and Title One schools.

What, if anything, hasn't worked as well as was hoped?

Due to the limited budget, fewer graduate student focused awards were made in FY25.

Describe the Arizona benefit or impact of this TRIF project for the last year.

Through inclusive graduate training and conference participation (e.g., SACNAS, AISES, APS), underrepresented students gain exposure, networks, and persistence toward STEM degrees and careers. By connecting undergraduate research opportunities with graduate mentorship and community engagement, U of A is better preparing students for research-intensive careers in Arizona's industries. U of A's memberships in national organizations (AAAS, SACNAS, CUR, ARIS) provide faculty and students with opportunities for professional development, networking, and expanding research impact.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$88,112	$148,302	$111,343	$67,338	$415,095
Basic Research	$0	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0	$327,852
Development	$0	$0	$0	$0	$0
Total	$88,112	$148,302	$111,343	$67,338	$415,095

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	1	6	4	11
Graduate Students	0	8	94	48	150
Undergraduate Students	0	9	128	60	197
Sponsored Project Funding	$454,335	$1,250,671	$1,179,055	$1,209,382	$4,093,443
Publications in Peer-Reviewed Journals	0	0	8	3	11
Startups	0	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program Proposal

University	University of Arizona
TRIF Investment Area	Workforce Development
Program Name	The Community College to Four-year University Transition

Problem Statement

Many Arizona students begin their postsecondary study at a two-year community college, due to financial resources or because they lack the academic qualifications and competitiveness to begin at one of the state's four-year universities. Students who seek to transfer to UArizona and have an interest in STEM majors often face several barriers. Research opportunities and other experiential learning experiences are scarce at community colleges, so transfer students struggle to compete for such experiences when they arrive at UArizona. Additionally, a difference exists in the academic cultures between community colleges and four-year universities, especially in the research-intensive STEM and pre-health fields.

Program Description

TRIF funding will support UArizona programs that assist students through the transfer process into technical and research-intensive majors, provide paid research opportunities to transfer students to work on TRIF-funded research initiatives, and involve foundational research that will help us understand and overcome barriers for community college transfer students into research-rich degree programs and careers.

What is the University's Advantage and/or Anticipated Funding Opportunities?

UArizona houses the nationally known Center for the Study of Higher Education, with leading scholars whose research on the following topics can inform initiatives relevant to strengthening workforce development programs with community colleges: • The challenges Latinx, African American, and low socioeconomic status (SES) students face transitioning into four-year college, research-intensive degree programs • College planning strategies and trajectories of diverse community college transfer students • Recruitment and access issues for community college students into research-rich majors and careers

Is there an Arizona Specific Benefit or Impact?

• Increased number of students accessing communication tools or events • Increased transfer overall from Arizona community colleges into research-intensive majors at UArizona • Increased number of students selecting STEM or other research-rich majors upon transferring • Increased faculty partnerships between community colleges and UArizona researchers • Increased indicators for participation in undergraduate research before transferring • Increased retention of community college transfer students in STEM to graduation

Investment Detail

	2022	2023	2024	Total
Infrastructure	$57,919	$57,919	$57,919	$173,757
Basic Research	$8,453	$8,453	$8,453	$25,359
Applied Research	$12,679	$12,679	$12,679	$38,037
Development	$21,132	$21,132	$21,132	$63,396
Total	$100,183	$100,183	$100,183	$300,549

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	$0	$0	$0	$0
Postdocs Supported	0	0	0	75
Graduate Students	0	0	0	0
Undergraduate Students	0	0	0	0
Sponsored Project Funding	$0	$0	$0	$0
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0

Arizona Board of Regents
Technology and Research Innovation Fund (TRIF) Program 2024 Report

University	University of Arizona
TRIF Investment Area	Workforce Development
Program Name	The Community College to Four-year University Transition

Progress Summary

TRIF funding advanced U of A's commitment to building a student-centered, research-rich and community-connected environment by expanding access to undergraduate research for potential community college transfer students. Through course-based undergraduate research experiences (CUREs), tribal and community college partnerships and faculty development, the project has supported smoother transitions into STEM majors, increased research participation, and fostered greater institutional collaboration. These efforts reflect U of A strategic priorities and directly address barriers faced by community college transfer students, especially those entering research-intensive STEM fields.

How has the problem statement been addressed in the last year by this TRIF project?

TRIF funding supported the creation of six new CUREs which were offered to students in 2024-25, including the conversion of Biology II at Pima Community College (PCC) into a CURE. With both Biology I and II now inquiry-based at PCC, students experience research-based learning from their first year. This ensures that transfer students arrive at U of A academically aligned and confident in research skills, supporting retention, sense of belonging and equitable access to research opportunities—key indicators of undergraduate success. The TRIF-supported USDA-NIFA "Bridge to STEAM" and "Come Back Home Summer Research Immersion" programs, in partnership with Diné College, provide tribal undergraduates with immersive, community-relevant STEAM (A for Agriculture) research internships. From 2021–25, 30 students participated, leading to strong outcome. Six began STEM graduate degrees at Diné College, two entered U of A graduate programs, one began a STEM career in Arizona and 4 transferred to UA to complete a B.S. in a STEAM field. These place-based, culturally relevant programs reflect U of A's land-grant commitment to tribal nations. The newly developed CUREs span diverse, interdisciplinary research topics—from plant virology and equine biomechanics to education research and computational biochemistry—providing undergraduates early exposure to cutting-edge science. This approach builds a scalable model of inclusive research training and aligns with U of A's mission to foster research that addresses real-world challenges and prepares students for future innovation.

What, if anything, hasn't worked as well as was hoped?

Despite meaningful progress, challenges exist, including scaling beyond Pima Community College, ongoing mentoring and support post-transfer, and inclusivity of summer research programs.

Describe the Arizona benefit or impact of this TRIF project for the last year.

Community college students now participate in early research through CUREs, promoting academic equity and better preparation for upper-division STEM coursework at U of A. The number of students transferring with research experience is growing. Preliminary data suggests improved retention and engagement in STEM majors among these students, many of whom are first-generation, Latinx, Native American, or low-income which is aligned with the demographic data for Arizona. Nearly 1,000 students transferred to U of A in Fall 2024 from Arizona community and tribal colleges—over half from PCC alone. The partnership between U of A and PCC has improved curriculum design and alignment, enhancing faculty development and research culture across institutions. Programs like Come Back Home are preparing tribal students not just for degree completion, but for graduate education and professional STEM careers in Arizona, meeting workforce needs and supporting tribal sovereignty and development.

Investment Detail

	2022	2023	2024	2025	Total
Infrastructure	$16,568	$149,498	$217,485	$44,846	$428,397
Basic Research	$0	$0	$0	$0	$0
Applied Research	$0	$0	$0	$0	$327,852
Development	$0	$0	$0	$0	$0
Total	$16,568	$149,498	$217,485	$44,846	$428,397

Performance Measures

	2022	2023	2024	2025	Total
Faculty Startup Package Expenses	$0	$0	$0	$0	$0
Postdocs Supported	0	0	1	0	1
Graduate Students	1	10	3	0	14
Undergraduate Students	0	3	11	0	14
Sponsored Project Funding	$75,000	$1,010,178	$1,185,483	$1,015,940	$3,286,601
Publications in Peer-Reviewed Journals	0	0	0	0	0
Startups	0	0	0	0	0

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