

# TECHNOLOGY AND RESEARCH INITIATIVE FUND

SUMMARY REPORT

FISCAL YEAR 2023



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 three-year 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 link included at the end of the executive summary.

### 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, 2023



## 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 \$1.7 billion in TRIF funds. In FY 2023, the university system received over \$133.3 million in TRIF revenue. The university system carried over an additional \$9.6 million from FY 2022 to FY 2023 resulting in \$142.9 million in total TRIF revenues available for allocation in FY 2023.

Last year, the board allocated 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 – \$84.8 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 – \$ 900 thousand 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 – \$12 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**

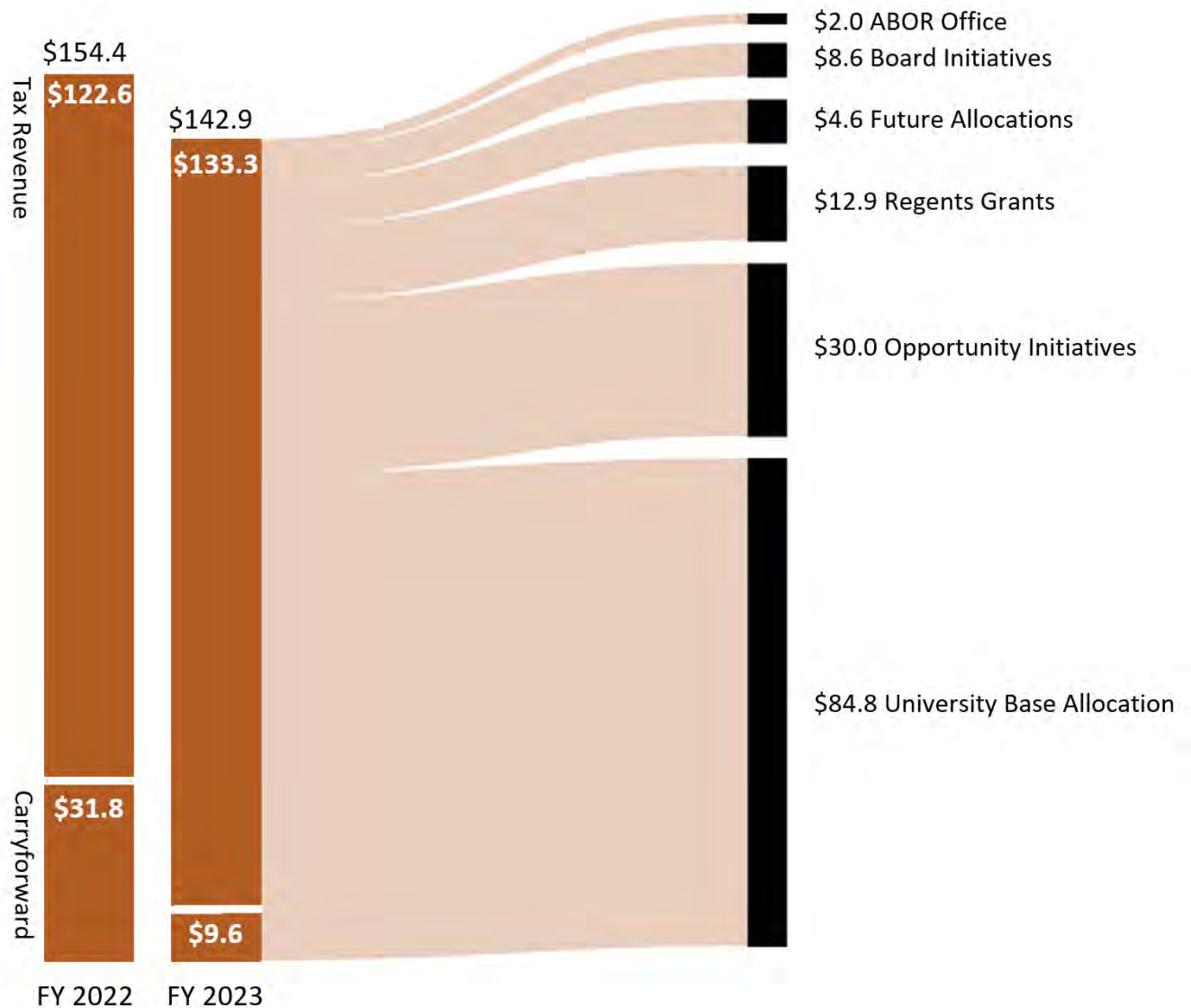
- Board approved initiatives, including:
  - Arizona Innovation Alliance – \$700,000 for the Arizona Innovation Alliance to support and improve access to higher education and student attainment.
  - General Education Assessment – \$300,000 to the board office and the universities to help design and administer the general education assessments to support and improve student and workforce outcomes.
  - Health Sciences and Workforce Analysis – \$3.5 million to analyze and identify factors that contribute to the success of the current structure/model and challenges that may limit its opportunities within Arizona's existing health care landscape and workforce.

- Phoenix Bioscience Core – \$1.0 million for the Phoenix Bioscience Core in support of its research, technology transfer and workforce development efforts.

### Regents' Opportunity Grants Awarded to the Universities

- Regents' Opportunity Initiatives Funds – \$30 million to the universities to support board priorities in research and to improve Arizona workforce and higher education access. The board divided this year's awards equally among the three Arizona public universities.
- Regents' Future Opportunity Initiative Funds – \$7.5 million in reserve for the board to allocate on a year-by-year and university-by-university basis to support board priorities in research and improving Arizona workforce and higher education access.

In FY 2023, the board and universities spent 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)

Each university's current three-year plan is available on the ABOR website [here](#).

Exhibit Enterprise.1: FY 2023 University Base Allocation Expenditure Summary

**\$79,551,484**

Proposal 2023

2023 Proposal vs Actual

● Proposal 2023 ● Actual 2023

**\$75,497,449**

Actual 2023



Proposal 2023 and Actual 2023 by Investment Area

● Actual 2023 ● Proposal 2023



Table Enterprise.1: FY 2023 TRIF Expenditures by Investment Area

InvestmentArea	Proposal 2023	Actual 2023	Budget Delta
Improving Health	\$23,286,197	<b>\$23,564,820</b>	(\$278,623)
National Security Systems	\$15,630,138	\$12,161,684	\$3,468,454
Space Exploration and Optical Solutions	\$7,369,969	\$5,349,972	\$2,019,997
Water, Environment and Energy Solutions	\$18,618,472	\$18,137,971	\$480,501
Workforce Development	\$14,646,708	<b>\$16,283,002</b>	(\$1,636,294)
<b>Total</b>	<b>\$79,551,484</b>	<b>\$75,497,449</b>	<b>\$4,054,035</b>

Exhibit Enterprise.1: FY 2023 Percent of Total TRIF Expenditures by Investment Area

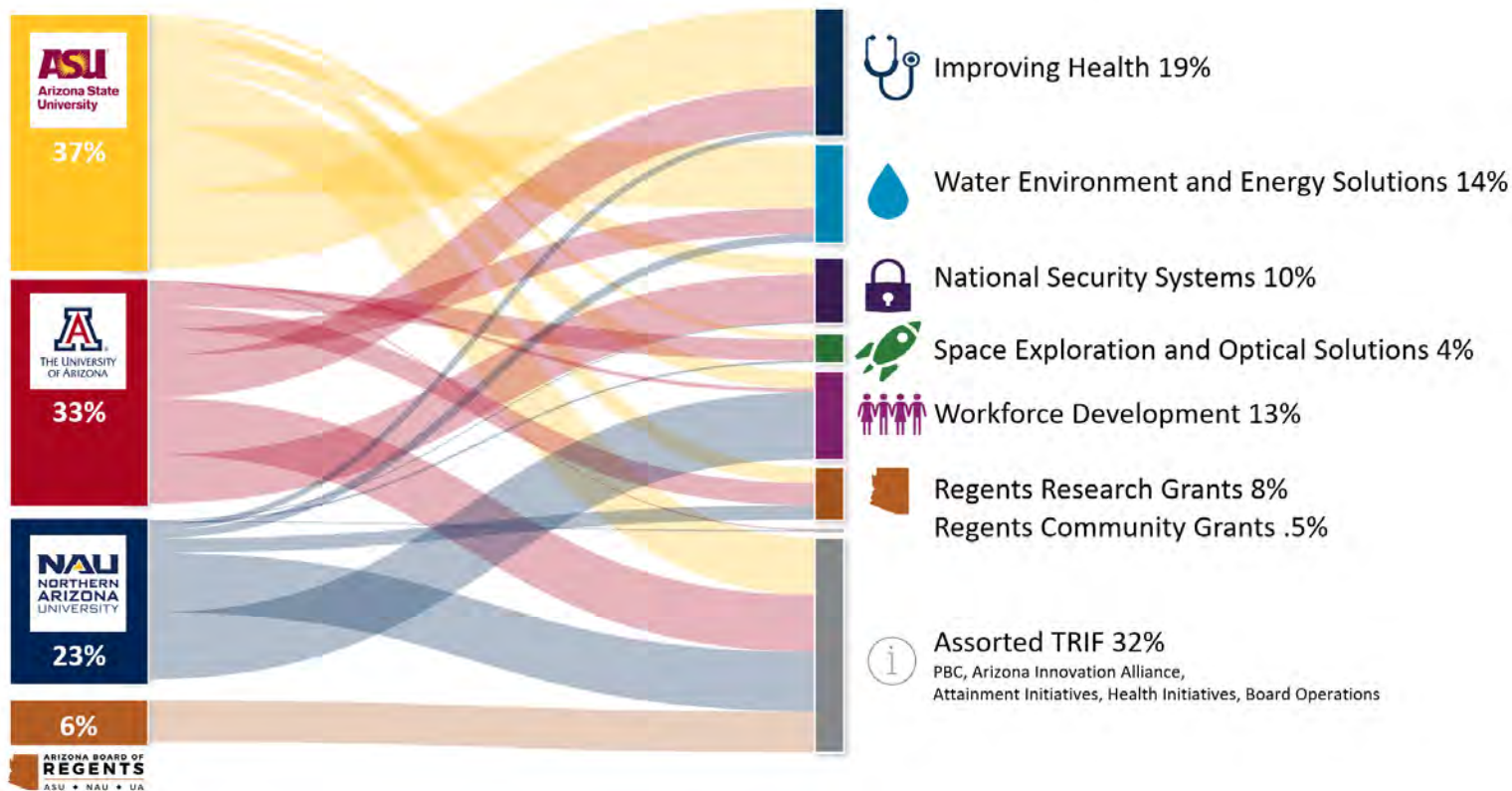
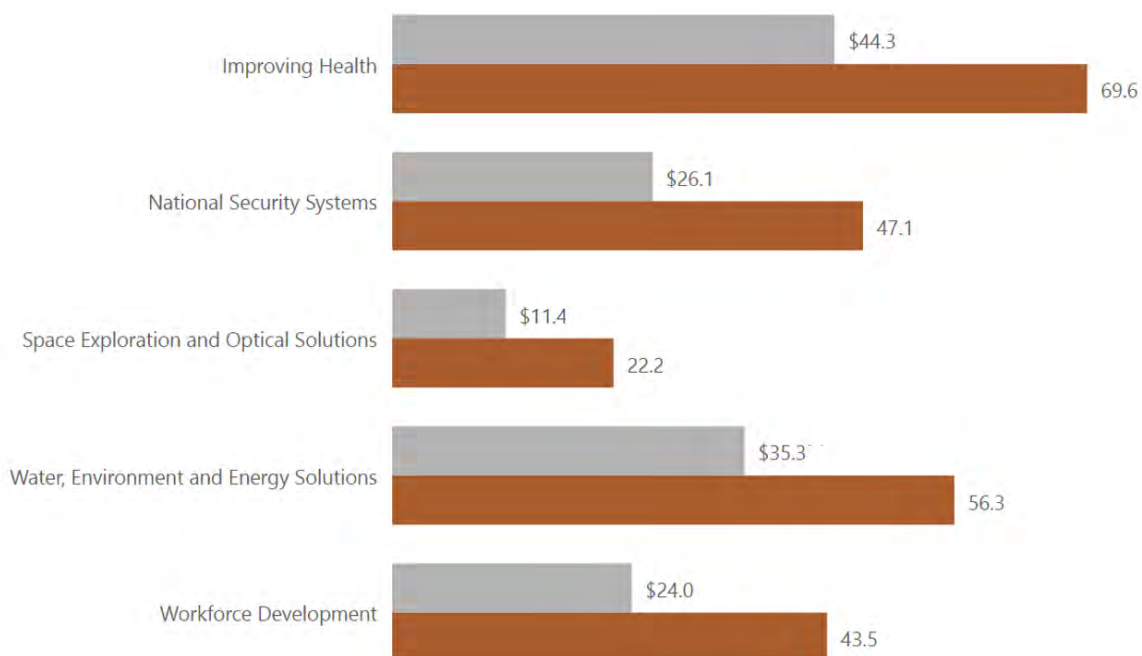


Exhibit Enterprise.3: FY 2023 – FY 2023 Cumulative Expenditures vs 3 Year Proposals

### 2023 Proposal vs Actual

● 2 Year Actual ● 3Yr Proposal



# TECHNOLOGY AND RESEARCH INITIATIVE FUND

ARIZONA STATE UNIVERSITY

FISCAL YEAR 2023





## EXECUTIVE SUMMARY

TRIF investment at Arizona State University has been fundamental to elevating ASU as a leading research and educational powerhouse. ASU leverages TRIF to advance programs and projects that are poised to bring the greatest return on investment to Arizona. Since TRIF began, ASU has more than quintupled its research expenditures, rising to #6 in the nation for research expenditures among institutions without a medical school. The university's solutions-focused approach to grand challenges led U.S. News & World Report to name ASU “#1 in innovation” for eight consecutive years. Currently, via TRIF, ASU is educating more than 14,000 students, providing the knowledge, skills and hands-on experience that 21st century employer's demand. During the current funding cycle, ASU is building on its foundation of TRIF-enabled expertise and infrastructure, developing novel solutions to challenges in our state and the skilled workforce needed to implement them.

Notable TRIF-enabled achievements in FY 2023 include:

- A \$90.8M award to build the world's first compact X-ray free electron laser. ASU's largest NSF award to date, the funds will support the construction of a room-sized instrument to explore the intricacies of complex matter at atomic length and ultrafast time.
- An expanded partnership between ASU and Applied Materials to create the Materials-to-Fab (MTF) Center. Representing a combined investment of \$270M, the MTF will provide researchers (including industry partners and students) access to state-of-the-art semiconductor tools.
- To address pressing energy concerns, the Center for an Arizona Carbon-Neutral Economy partnered on a multi-million-dollar NSF proposal to develop a regional clean hydrogen hub. Based at ASU with partnerships at the University of Arizona, Northern Arizona University and Arizona energy providers, the center will build on ASU's long-standing national expertise in hydrogen research.
- The launch of ASU's LunaH-Map CubeSat aboard NASA's inaugural Artemis I lunar flyby mission, where it successfully acquired lunar data and achieved the highest designation for technology readiness from NASA.
- Skysong Innovations secured 60 licensing deals and 160 new patents based on ASU innovations.
- ASU's recently launched supercomputer, Sol, was recognized by the Top500, ranking higher than esteemed academic institutions such as Harvard, NYU and Johns Hopkins.

TRIF investment creates an ecosystem that empowers businesses to succeed in our state Arizona's long-term commitment to research attracts and generates companies that advance new technologies and helps them stay ahead of disruptive trends. Our universities provide the talent, knowledge and infrastructure companies need to be competitive. In turn, they create stable, high-wage jobs and invest in their communities — a virtuous cycle of economic growth and human well-being for generations to come.





ASU invested 78.4% of its FY 2023 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 \$897.8 million in outside related sponsored project funding, resulted in 26 startups and supported 4,279 graduate and undergraduate students.

Exhibit ASU.1: FY 2023 ASU Base Allocation Expenditure Summary



Proposal 2023 and Actual 2023 by Investment Area



Table ASU.1: FY 2023 TRIF Expenditures by Investment Area

InvestmentArea	Proposal 2023	Actual 2023	Budget Delta
Improving Health	\$14,091,805	\$14,510,651	(\$418,846)
National Security Systems	\$2,953,895	\$3,074,948	(\$121,053)
Space Exploration and Optical Solutions	\$868,967	\$1,012,136	(\$143,169)
Water, Environment and Energy Solutions	\$10,898,498	\$11,761,735	(\$863,237)
Workforce Development	\$2,819,315	\$3,135,043	(\$315,728)
<b>Total</b>	<b>\$31,632,480</b>	<b>\$33,494,513</b>	<b>(\$1,862,033)</b>

Exhibit ASU.1: FY 2023 TRIF Revenue and Expenditures by Investment Area and Initiative (\$ Millions)

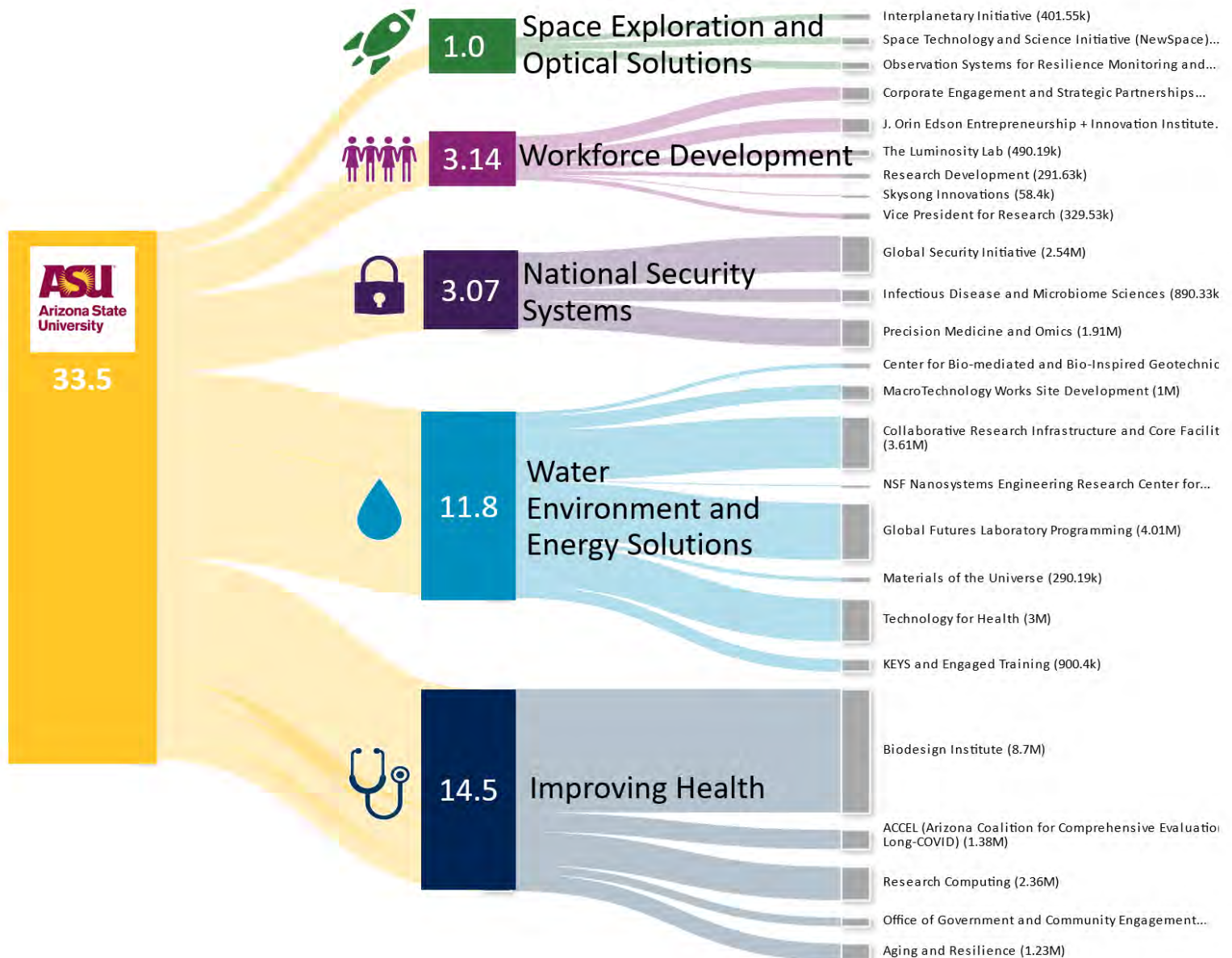


Table ASU.2: FY 2023 Performance Measures

Performance Measures	2023 Projections	2023 Actuals
Faculty Startup Package Expenses	0	0
Postdocs Supported	548	503
Graduate Students	2,814	2,911
Undergraduate Students	1,435	1,368
Sponsored Project Funding	\$468,285,900	\$897,766,937
Publications in Academic Peer-Reviewed Journals	1	1
Startups	48	26

Exhibit ASU.2: FY 2023 TRIF Expenditure by Research Category (in millions)

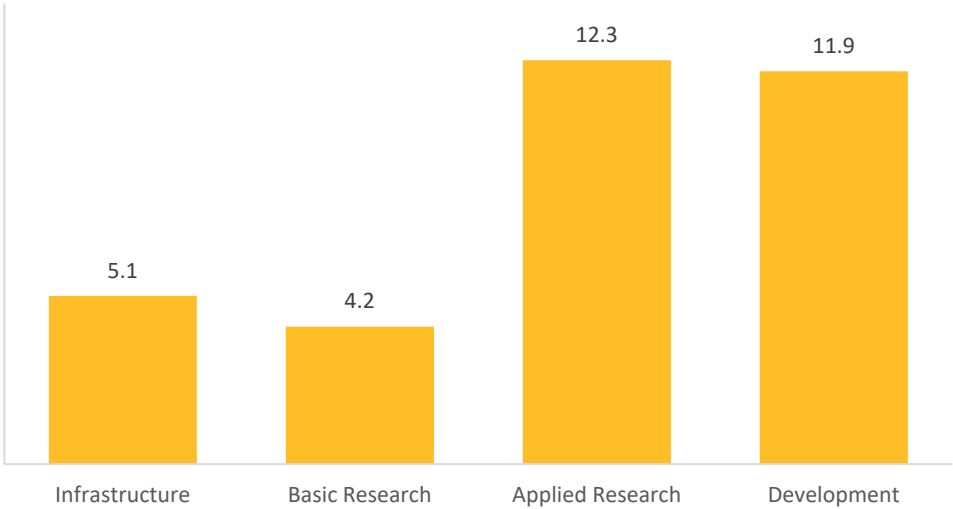
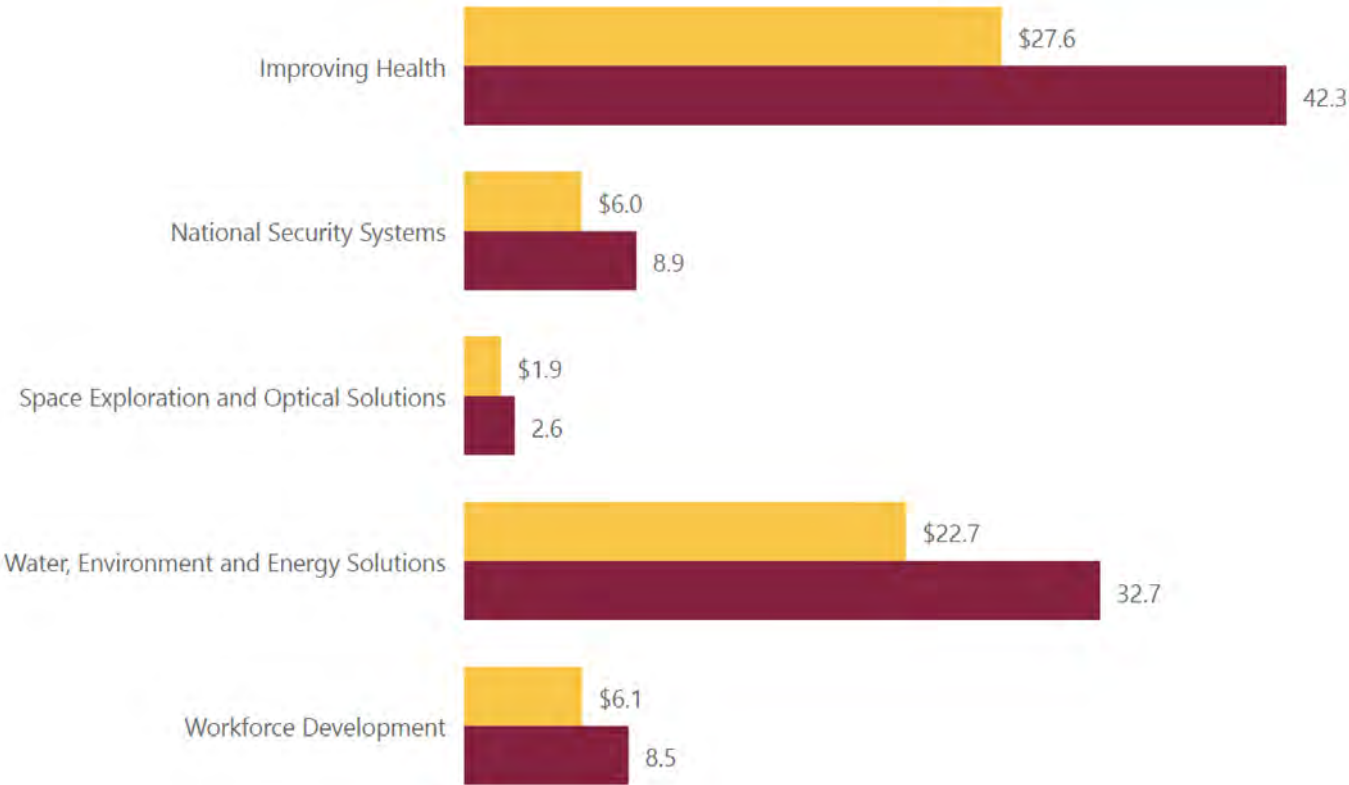


Exhibit ASU.3: FY 2023 – FY 2023 Cumulative Expenditures vs 3 Year Proposals

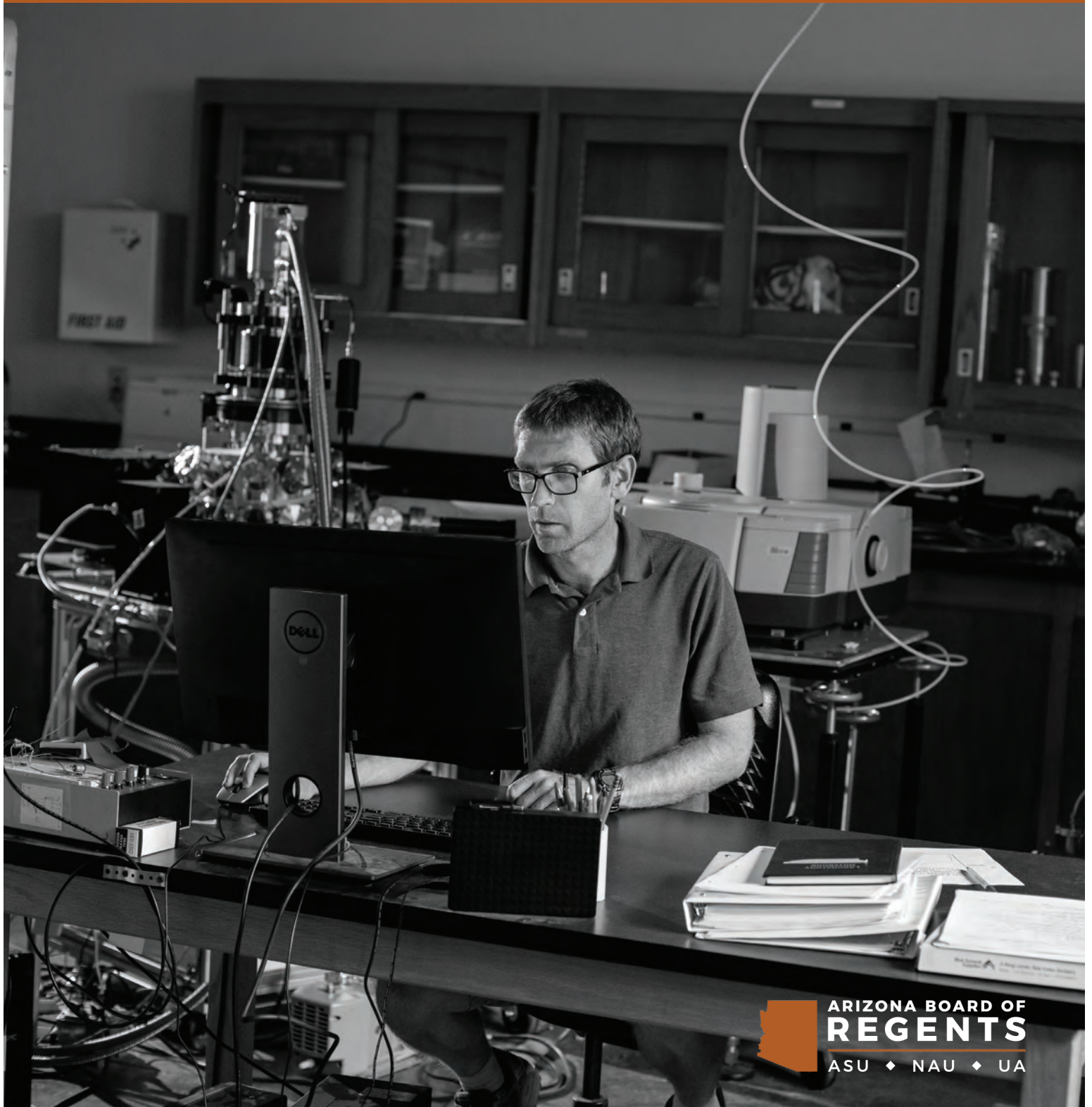
● 2 Year Actual ● 3Yr Proposal



# TECHNOLOGY AND RESEARCH INITIATIVE FUND

NORTHERN ARIZONA UNIVERSITY

FISCAL YEAR 2023



ARIZONA BOARD OF  
**REGENTS**  
ASU ♦ NAU ♦ UA



## EXECUTIVE SUMMARY

Northern Arizona University has used TRIF to produce economic benefits through scientific advancements, workforce training and enabling access to higher education for all Arizonans. TRIF funding has provided the foundation for NAU to strategically invest in workforce development opportunities, attract new external research programs, and enable high impact experiential opportunities for students to conduct both basic and applied research. NAU's accomplishments in research enhance the reputation of the state while addressing critical issues facing the world today.

Through competitive externally funded grants, research remains a significant growth engine for NAU that supports the university's mission. At the same time, faculty-led research projects continue to offer a pathway for intellectual growth of students, provide learning opportunities that enable students to secure better jobs, generate economic growth for communities and improve the lives of Arizona's citizens.

TRIF has also enhanced NAU's educational programming and ability to prepare its students to be complex problem solvers, addressing the workforce needs of today and an increasingly diversified workforce for the future. NAU is dedicated to impactful research that expands opportunities for undergraduate learning.

Researchers in the Pathogen Genomics program joined with statewide partners to form the Arizona Valley Fever consortium and coordinated their research to understand, prevent, and treat this disease of concern, as well as mentoring over sixty undergraduates over the past year. Investigators in our Solar System Science and Exoplanets program conducted a student-led program which delivered a camera that was designed and built by undergraduates for inclusion on a future spaceflight to Mars.

Additionally, researchers in our Community Health Research program were awarded two center proposals (the Center for Native American Health Equity and renewal of the Southwest Health Equity Research Collaborative or SHERC), which together represent more than \$25M in new sponsored research funding to NAU and similarly provide experiential learning opportunities for many students. Investment into NAU's TRIF has consistently generated a positive impact for the state.

- The iHealth initiative has empowered NAU to make discoveries in the lab, in the clinic, and the public health arena that has elevated our translational research capabilities, enabling NAU researchers to better understand and be prepared for outbreaks of pathogens facing the world.
- The NSS initiative has established NAU as a leader in the critical areas of cybersecurity and cyber solutions, developing new technologies to protect Arizona's businesses and consumers.
- The AWD initiative supports online and in-person statewide programs and services, workforce training, and lifelong learning, with the aim of fostering students' economic mobility. It resulted in the identification, development, and in some cases delivery of degree

and certificate programs and workforce development programming, informed by regional business and industry needs and occupational outlook analyses. These high-quality programs are intentionally designed with learning outcomes responsive to the workforce needs of communities across Arizona.

- The WEES initiative leverages regional resources in Northern Arizona and historical strengths of the institution to pursue research of the environment and sustainability and has enhanced NAU's leadership position in forestry, land management, and climate science.
- The SPACE initiative leverages the wealth of astronomical resources in Northern Arizona and throughout the state at partner institutions to prepare a workforce that will strengthen Arizona's stature as a worldwide leader in this burgeoning area of research.





NAU invested 80% of its FY 2023 TRIF funds to access and workforce development projects. NAU also invested 17% of its TRIF funds in targeted research toward improving health and finding solutions in water, environment, and energy. The research dollars were used mainly (14 million) to support research infrastructure.

These investments generated \$50.6 million in outside related sponsored project funding, and supported 8,559 graduate and undergraduate students.

Exhibit NAU.1: FY 2023 NAU Base Allocation Expenditure Summary

**\$15,973,002**

Proposal 2023

### 2023 Proposal vs Actual

● Proposal 2023 ● Actual 2023

**\$15,570,341**

Actual 2023

Northern Arizona University



### Proposal 2023 and Actual 2023 by Investment Area

● Actual 2023 ● Proposal 2023



Table NAU.1: FY 2023 TRIF Expenditures by Investment Area

InvestmentArea	Proposal 2023	Actual 2023	Budget Delta
Improving Health	\$1,836,923	\$1,128,021	\$708,902
National Security Systems	\$381,978	\$79,486	\$302,492
Space Exploration and Optical Solutions	\$715,467	\$416,060	\$299,407
Water, Environment and Energy Solutions	\$1,934,434	\$1,538,929	\$395,505
Workforce Development	\$11,104,200	\$12,407,845	(\$1,303,645)
<b>Total</b>	<b>\$15,973,002</b>	<b>\$15,570,341</b>	<b>\$402,661</b>

Exhibit NAU.1: FY 2023 TRIF Revenue and Expenditures by Investment Area and Initiative (\$ Millions)

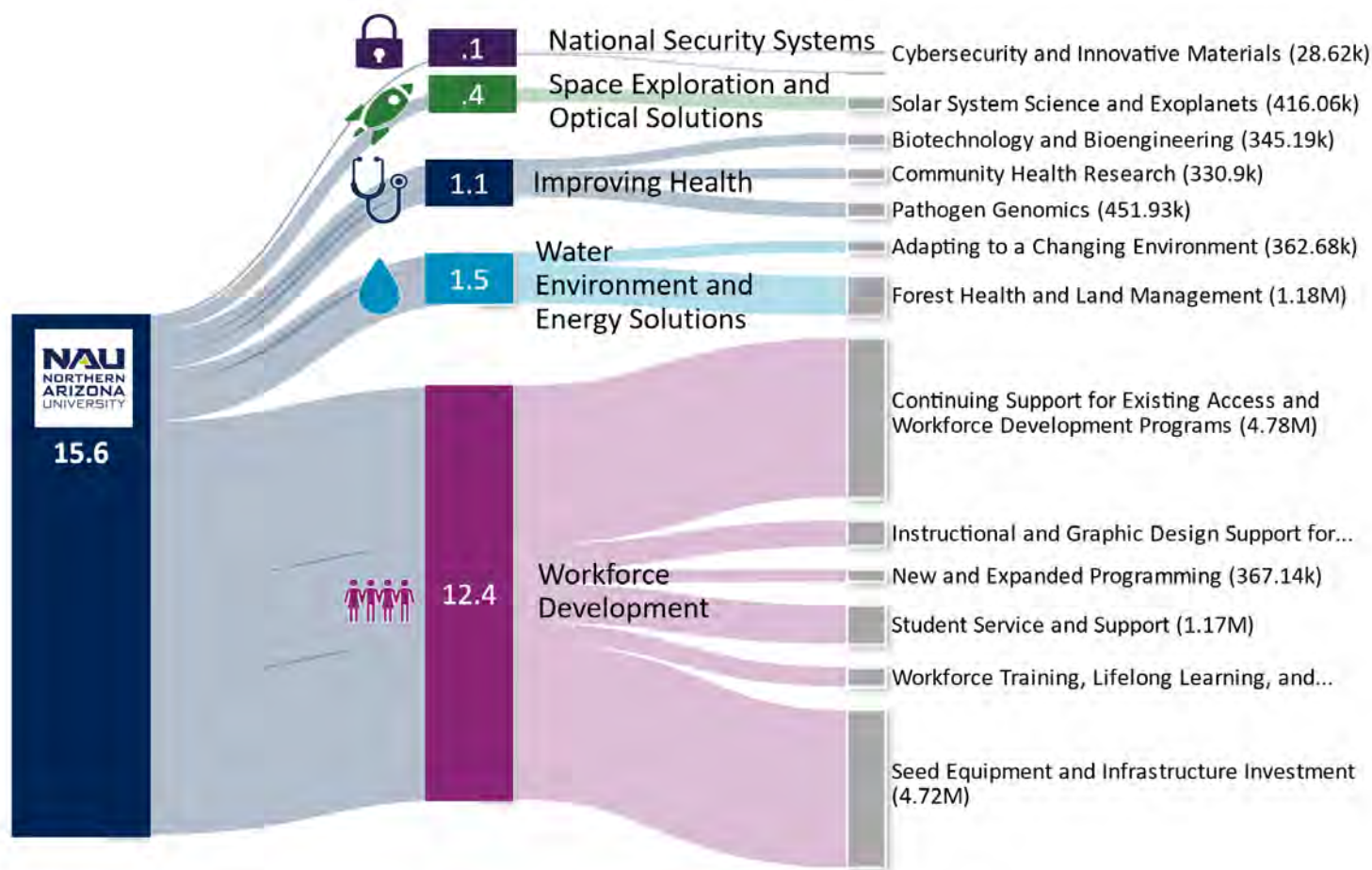


Table NAU.2: FY 2023 Performance Measures

Measures	2023 Projections	2023 Actuals
Faculty Startup Package Expenses	1,032,500	771,579
Postdocs Supported	38	32
Graduate Students	2,573	2,076
Undergraduate Students	5,367	6,483
Sponsored Project Funding	\$27,014,081	\$50,572,385
Publications in Academic Peer-Reviewed Journals	343	442
Startups	0	0

Exhibit NAU.2: FY 2023 TRIF Expenditure by Research Category (in millions)

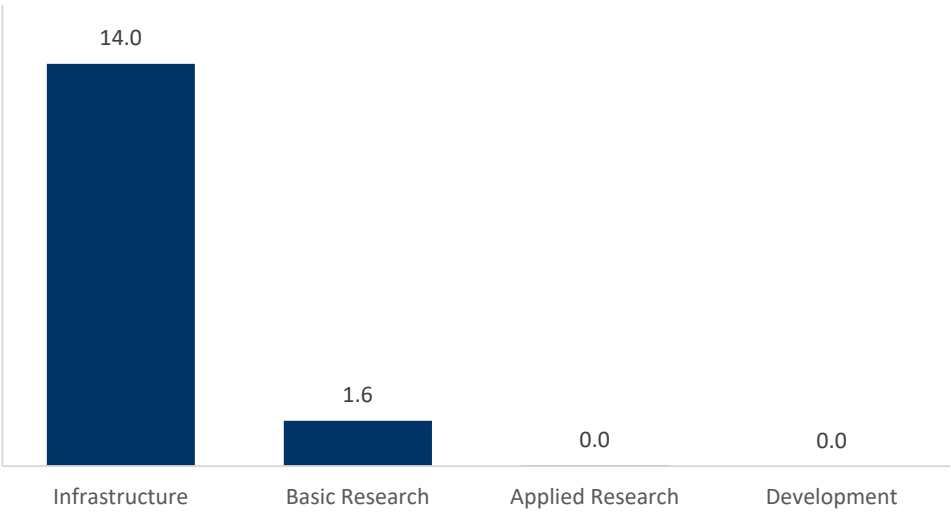
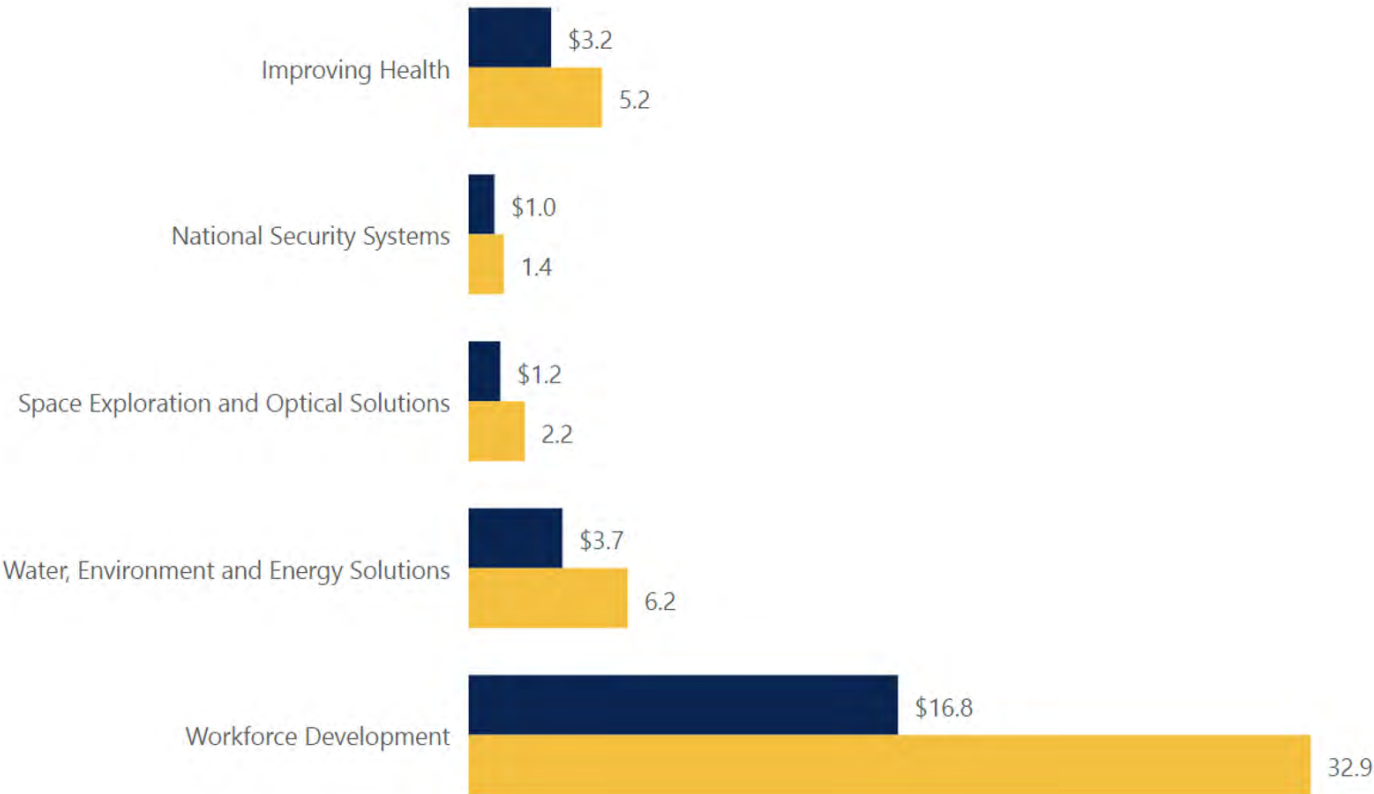


Exhibit NAU.3: FY 2023 – FY 2023 Cumulative Expenditures vs 3 Year Proposals

2023 Proposal vs Actual

2 Year Actual 3Yr Proposal



# TECHNOLOGY AND RESEARCH INITIATIVE FUND

UNIVERSITY OF ARIZONA

FISCAL YEAR 2023





## EXECUTIVE SUMMARY

UArizona achieved \$824 million in research expenditures last year, and TRIF continues to drive advancement of initiatives that align with areas of state and national need, and where we have faculty expertise and specialized facilities, infrastructure, and enabling technologies.

We leverage TRIF investment to attract new funding to the state; provide unique student training programs to prepare a diversified, modern workforce; jump-start innovation that creates economic and societal impact; support a robust entrepreneurial ecosystem; and move inventions stemming from university research into the marketplace.

### INITIATIVES

Improving Health; National Security Systems; Space Exploration and Optical Sciences; Water, Environment and Energy Solutions; and Workforce Development.

### HIGHLIGHTS

- We leveraged TRIF investment to attract \$266 million in new sponsored projects funding. For example, TRIF investments in the Micro Nano Fabrication Center helped secure a transformational investment from the Arizona Commerce Authority that will allow us to build not only a state-of-the-art physical facility to support semiconductor manufacturing, but digital and virtual reality platforms that will allow us to deploy workforce training across the state.
- TRIF-supported research programs engaged 2,740 undergraduates, 741 graduate students, and 138 post-doctoral appointees. For example, the TIMESTEP Summer Internship allowed undergraduates in the physical sciences and mathematics to connect with small to mid-sized businesses/industry based in Southern Arizona, creating paths to employment and connecting businesses with university resources. Additionally, as the leading cyber program for undergraduates in the U.S, we taught 1,500+ students this year and produced 268 additional graduates, delivering a large cadre of talent to improve cyber resilience in Arizona and beyond.
- 28 patents were issued, and 3 new startup companies were launched based on technology from TRIF-supported research. For example, researchers developed a drug that has been licensed to the Tucson-based start-up, Proneurogen, and has begun first-in-human trials for the treatment of vascular dementia, the most common form of Alzheimer's disease. With an emphasis on moving inventions into the marketplace, UArizona ranks No. 30 among universities worldwide for U.S. patents issued.





UArizona invested 64% of its FY 2023 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. The research dollars were used mainly (77%) to support research infrastructure and applied research.

These investments generated \$265.8 million in outside related sponsored project funding, resulted in 4 startups, and supported 4,047 graduate and undergraduate students.

Exhibit UA.1: FY 2023 UArizona Base Allocation Expenditure Summary

**\$31,946,002**

Proposal 2023

### 2023 Proposal vs Actual

● Proposal 2023 ● Actual 2023

**\$26,432,595**

Actual 2023

University of Arizona



### Proposal 2023 and Actual 2023 by Investment Area

● Actual 2023 ● Proposal 2023

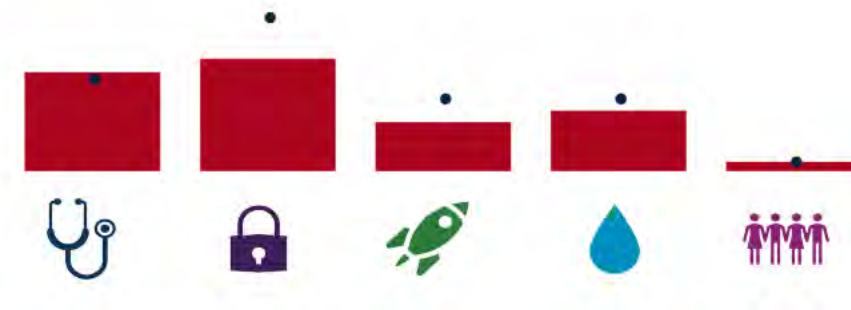


Table UA.1: FY 2023 TRIF Expenditures by Investment Area

InvestmentArea	Proposal 2023	Actual 2023	Budget Delta
Improving Health	\$7,357,469	\$7,926,148	(\$568,679)
National Security Systems	\$12,294,265	\$9,007,250	\$3,287,015
Space Exploration and Optical Solutions	\$5,785,535	\$3,921,776	\$1,863,759
Water, Environment and Energy Solutions	\$5,785,540	\$4,837,307	\$948,233
Workforce Development	\$723,193	\$740,114	(\$16,921)
<b>Total</b>	<b>\$31,946,002</b>	<b>\$26,432,595</b>	<b>\$5,513,407</b>

Exhibit UA.1: FY 2023 TRIF Revenue and Expenditures by Investment Area and Initiative (\$ Millions)

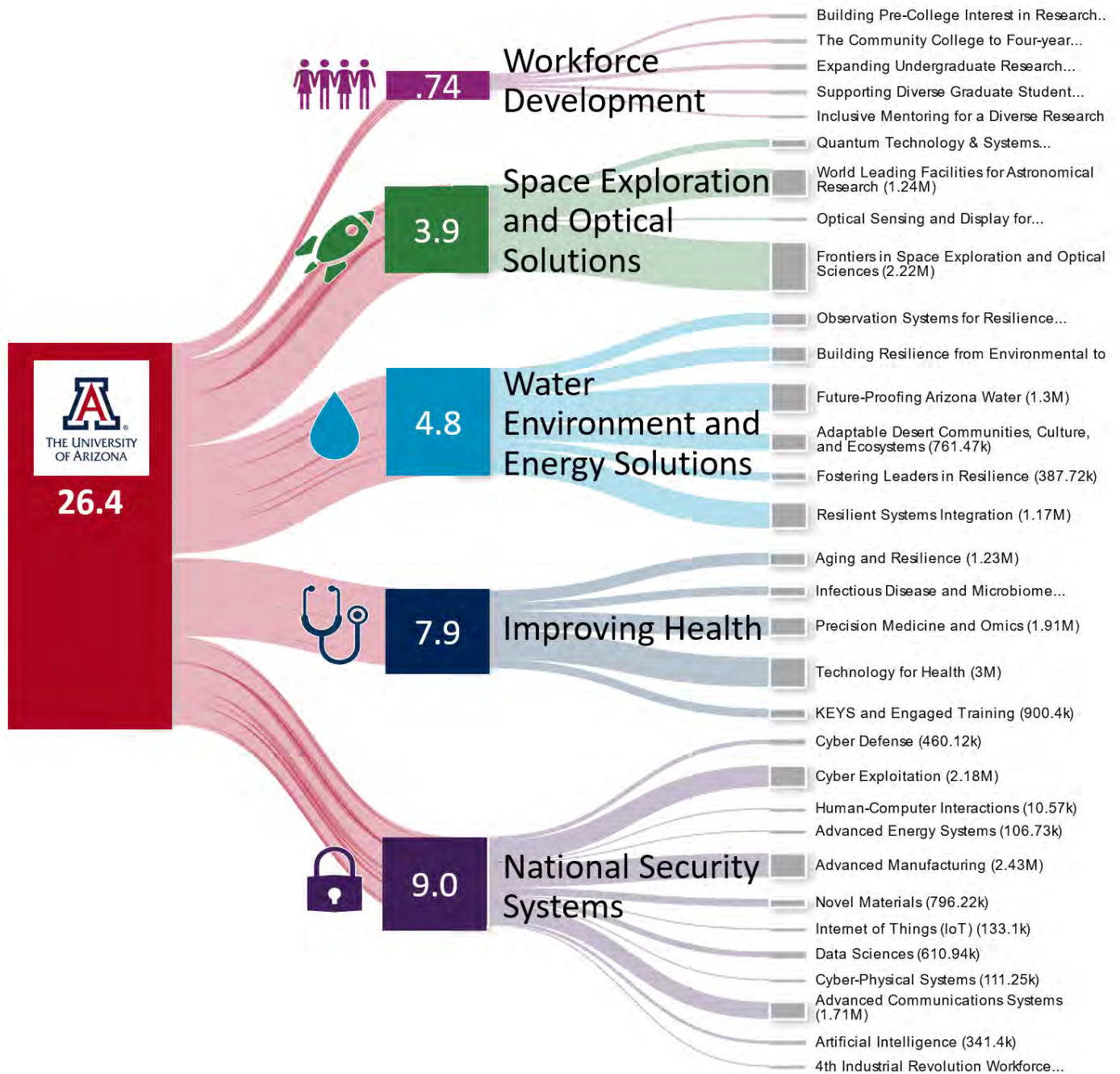


Table UA.2: FY 2023 Performance Measures

Measures	2023 Projections	2023 Actuals
Faculty Startup Package Expenses	6,655,704	9,636,915
Postdocs Supported	176	138
Graduate Students	500	741
Undergraduate Students	464	3,306
Sponsored Project Funding	\$159,400,003	\$265,787,443
Publications in Academic Peer-Reviewed Journals	699	455
Startups	15	4

Exhibit UA.2: FY 2023 TRIF Expenditure by Research Category (in millions)

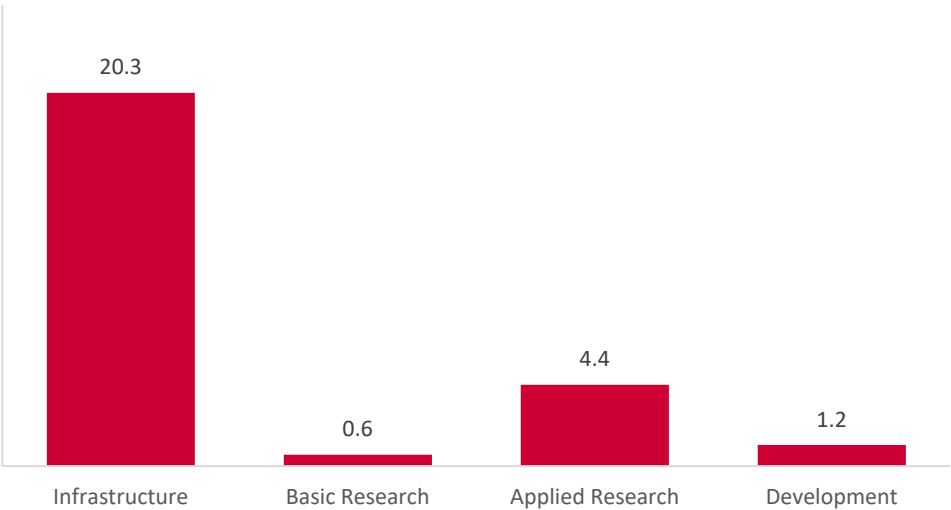
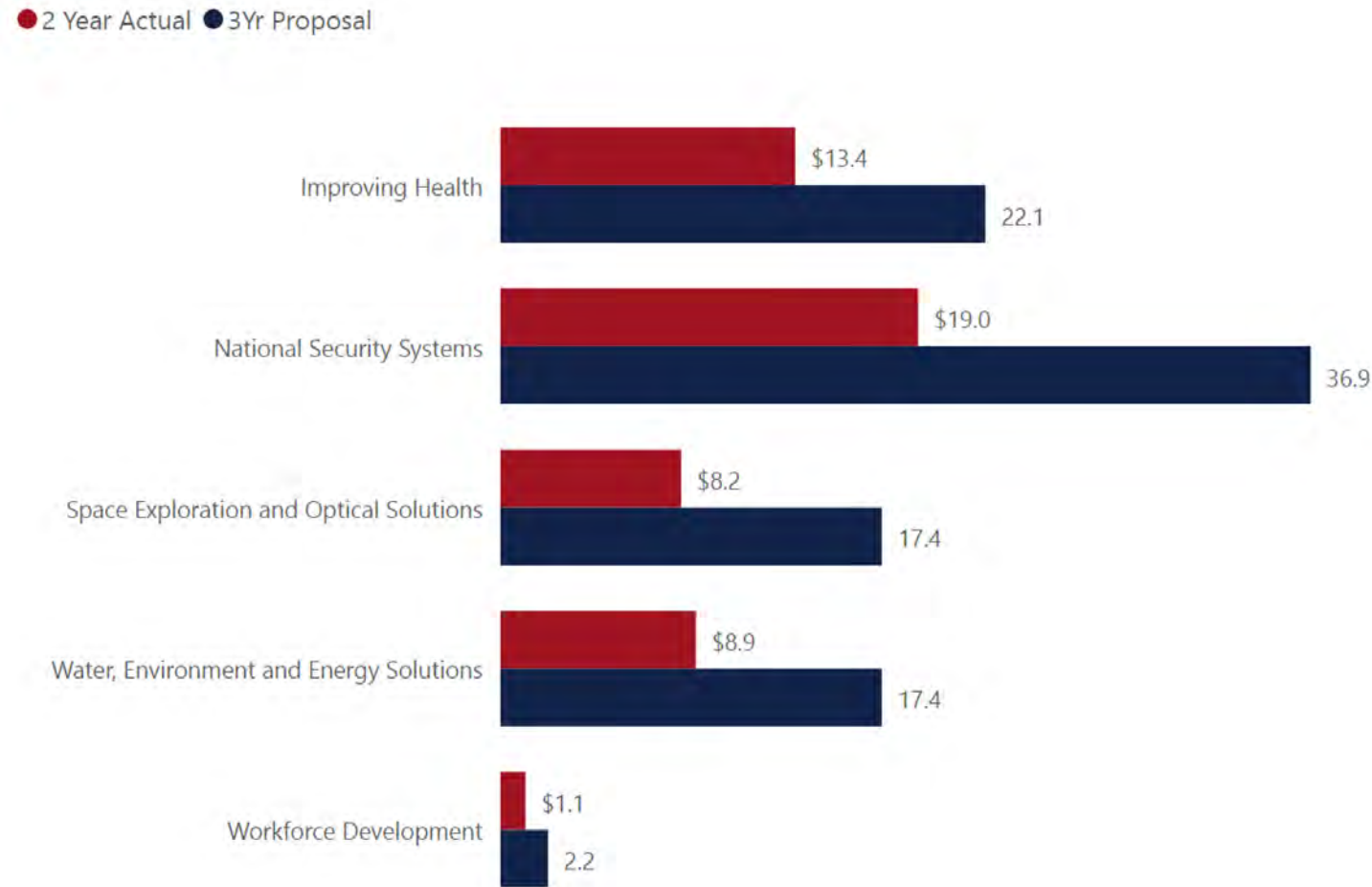


Exhibit UA.3: FY 2023 – FY 2023 Cumulative Expenditures vs 3 Year Proposals



# TECHNOLOGY AND RESEARCH INITIATIVE FUND

ABOR INITIATIVES, GRANTS AND OPERATIONS

FISCAL YEAR 2023



ARIZONA BOARD OF  
**REGENTS**

ASU ♦ NAU ♦ UA



## ARIZONA BOARD OF REGENTS TRIF EXECUTIVE SUMMARY

The Arizona Board of Regents is responsible for the coordination, administration, and verification of the appropriate use of TRIF funds. The board ensures that taxpayer dollars are guided by the objectives established by voters and result in outcomes that benefit Arizona. The board also uses TRIF grants to leverage university expertise to help solve community issues and allocates funds for special projects and initiatives designed to be catalysts to improving and strengthening Arizona.

In June of this year, the board dedicated \$30 million in TRIF funds to address the critical health care workforce shortage and improve Arizona's health care outcomes. The universities will use the funds to create and expand new and existing academic programs to meet Arizona's health care workforce and research needs.

Special projects and initiatives include:

- Providing small awards to the Arizona SciTech Festival, an annual statewide celebration of science, technology, engineering, math, and the arts featuring over 1,000 expos, workshops, conversations, exhibitions, and tours designed to inform Arizonans about how these industries will drive our state forward.
- Supporting the ASU Innovation Open competition for university students developing hard tech ventures. The program provides venture mentorships and funding for student competitors on the cutting-edge of tech.
- Publishing K-20 attainment outcomes through a partnership with the National Student Clearinghouse and the Arizona Department of Education.
- Connecting Arizona researchers with university collaborators across the world through the Elsevier Pure Portal, an online solution to increase the impact and visibility of Arizona research.

Regents' Research and Community Grants pair Arizona's public university researchers with government agencies and community organizations to address longstanding challenges in Arizona.

This past year, the board awarded Regents' Research Grants to universities help reduce Arizona firefighter cancer and cardiovascular risks and prevent wildfires by using sound to detect bark beetle tree infestations that are destroying Arizona forests.

The board awarded Regents' Community Grants to university experts that can solve challenging problems for Arizona's local communities. Lack of attainable housing in rural Arizona is a critical challenge for rural fire departments and communities. One community grant partners NAU researchers with rural firefighting agencies and statewide government associations to develop a series of strategies and implementable programs for firefighters to access attainable housing in Prescott and other rural areas.

Through its oversight, administration, grant awards and direct initiatives, the board is committed to actions that expand research to directly benefit Arizona, increases Arizona's educational attainment and prepare Arizona's workforce for the high technology jobs needed in the 21st century economy.

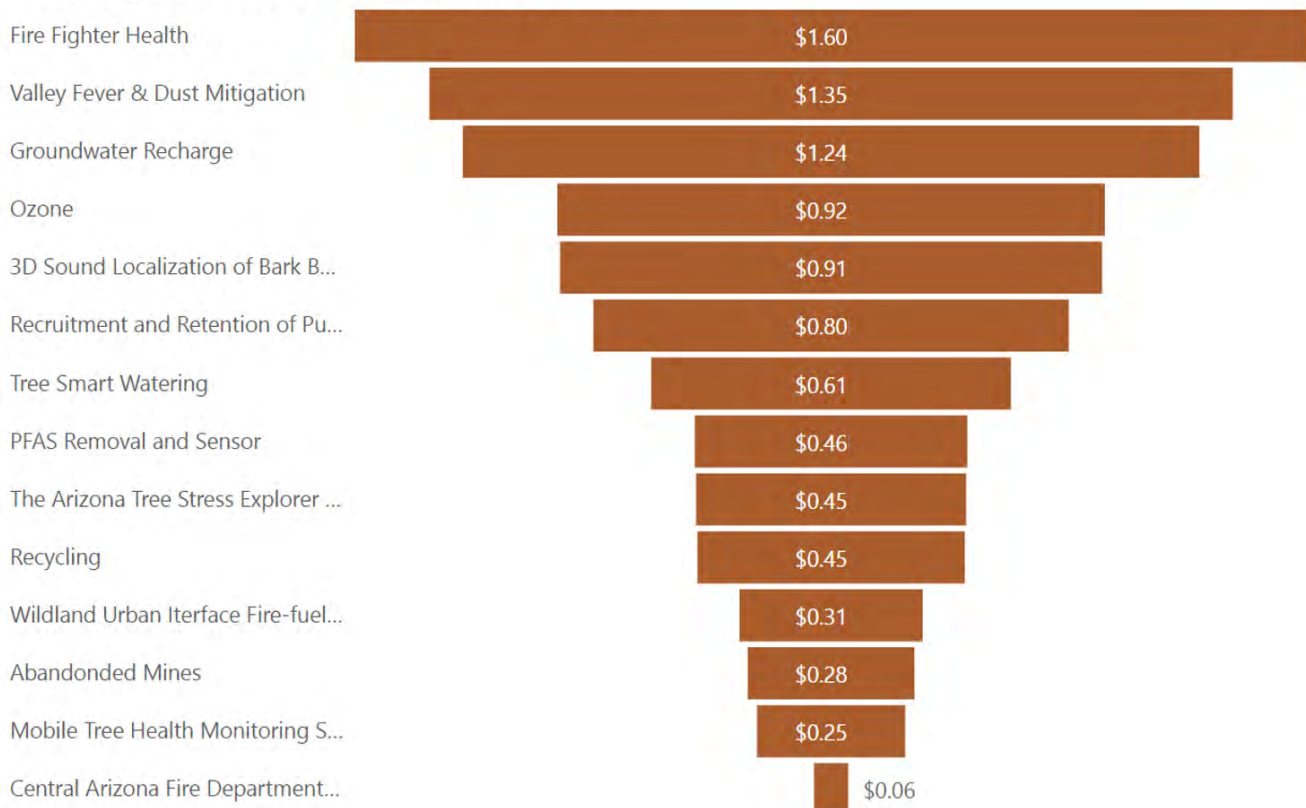


Table 1: FY 2023 Board Approved Initiatives

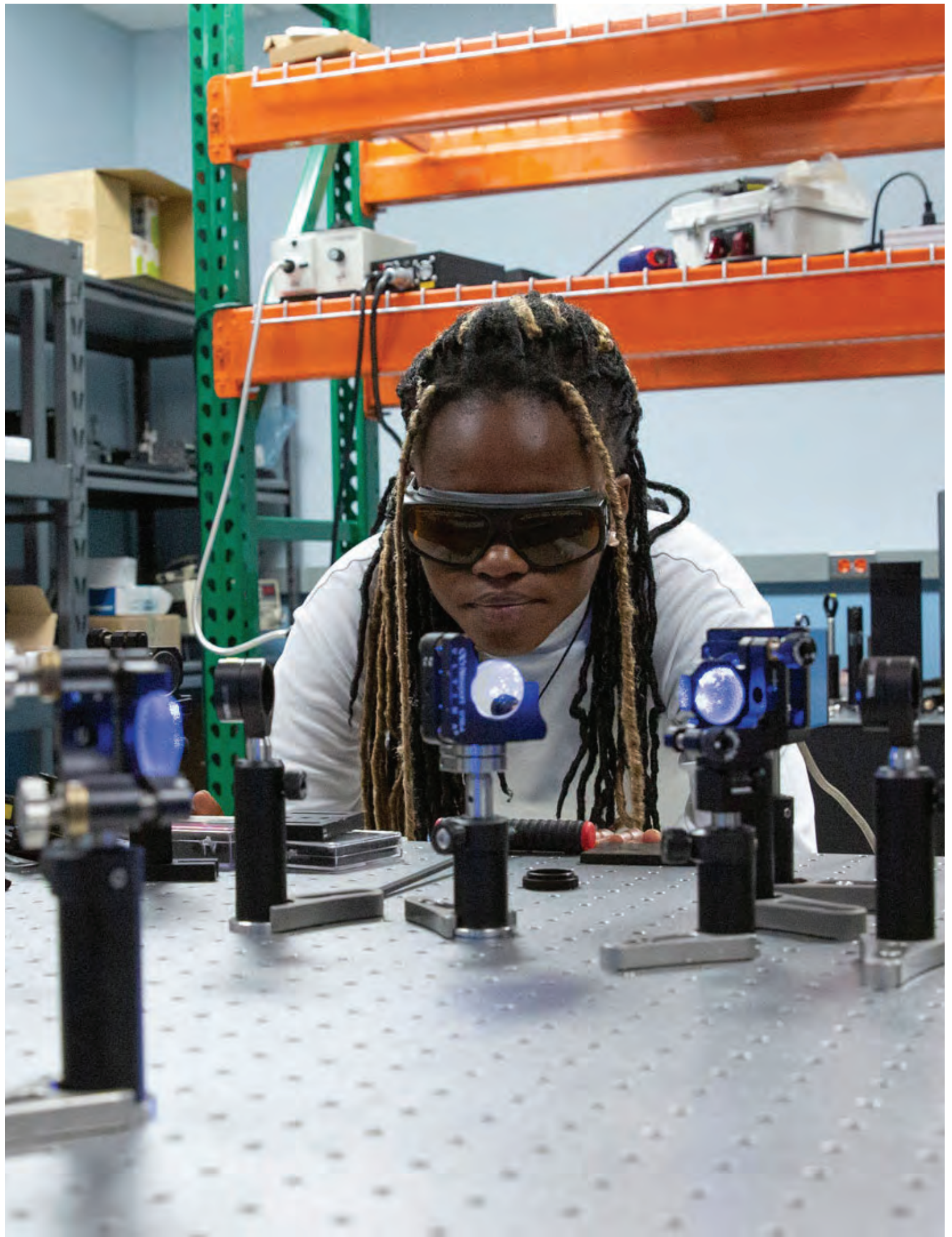
<b>Arizona Innovation Alliance</b>	\$700,000
<b>Board Attainment and Workforce Initiatives</b>	\$5,000,000
<b>Board Office Operations</b>	\$2,000,000
<b>General Education Assessment</b>	\$300,000
<b>Health Sciences and Workforce Analysis</b>	\$320,329
<b>Opportunity Initiatives</b>	\$30,000,000
<b>Phoenix Bioscience Core</b>	\$5,000,000
<b>Total</b>	<b>\$43,320,329</b>

Exhibit 1: FY 2023 Board Approved Regents and Community Grants (\$ Millions)

### 2023 Regents Research & Community Grants









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